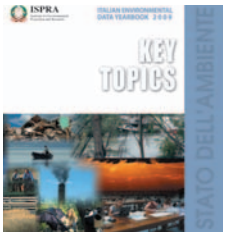
ISPRA
Institute for Environmental
Protection and Research

# KEY TOPICS

## Italian Environmental Data Yearbook

## 2009

ENVIRONMENTAL PROTECTION AGENCIES OF THE REGIONS
AND AUTONOMOUS PROVINCES



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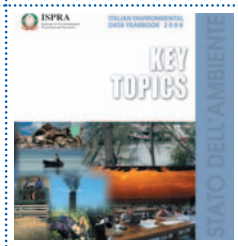
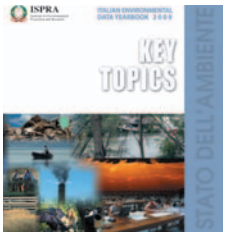



*"…namque alid ex alio clarescet nec tibi*
*caeca nox iter eripiet, quin ultima naturai*
*pervideas: ita res accendent lumina rebus …".*[1]

*Titi Lucretii Cari – De rerum natura*
*(Liber I,* 1115-1117*)*

[1] "…for one thing after other will grow clear, nor shall the blind night rob thee of the road, to hinder thy gaze on Nature's farthest forth. Thus things for shall kindle torches new …" (Translated by William Ellery Leonard)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# Foreword

I would like to express my great satisfaction for the 2009 edition of ISPRA Environmental Data Yearbook. It represents an important endeavour for disseminating environmental information which is a key mission of ISPRA.

There is also no doubt on the high expectations by decision-makers, operators, citizens and all those who consider environmental information as a fundamental tool of knowledge and participation.

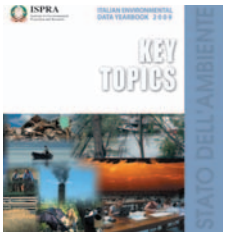
For some time now, all planning and legislative initiatives of the European Union acknowledge the strategic role of information, both as a fundamental element of knowledge and as a tool for communication.

A solid and complete knowledge base is also being created to accompany decision making for one of the greatest European and global challenges: climate change and adaptation. As anticipated in the EU White Paper on this topic, a Clearing House Mechanism to improve information and knowledge sharing is being created on the impact of climate change, on vulnerability and on successful practices of adaptation.

ISPRA's Yearbook also works in this direction, as underlined by our institution during the hearing held by the 8th Environmental Commission of the Italian Chamber of Deputies on the issue of adaptation to climate change.

I wish to thank all the experts who made this publication possible and I shall take it upon myself to ensure that the resources needed to carry out this important endeavour will be always available.

*Prefect Vincenzo Grimaldi*
ISPRA's Commissioner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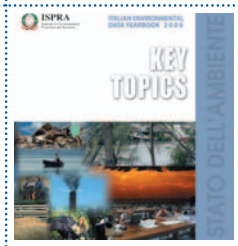



## Introduction to the Environmental Data Yearbook

The Environmental Data Yearbook represents Italy's most complete collection of environmental data and information.

Born out of the environmental reporting experience of the former APAT, the Yearbook has expanded its information base through the valuable contributions of ICRAM and INFS merged with APAT into ISPRA since 2008.

As always, a key factor in the successful preparation of the work was the sharing of environmental information between ISPRA and the other components of the national environment agencies system, i.e the environmental protection agencies of the Italian regions and of the autonomous provinces.

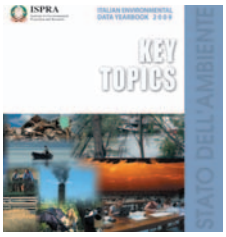
This year, ISPRA was once again aided by numerous technical-scientific institutions in drafting the various sections, as well as in data validation and information processing.

The important activity of revising the core-set of indicators, initiated in the last edition, was continued this year through the following procedures: validation of each indicator, based on the objectives set by national, European and international laws and regulations and by the corresponding reporting obligations and/or guidelines; assessment of the indicator's ability to represent the phenomenon being investigated; verification of the availability of the data needed to populate the indicator; evaluation of the scientific relevance and solidity of the indicator.

The indicator fact-sheets of the full version of the Yearbook provide a widely analytical and detailed information on the environmental topics addressed.

The overview that introduces the fact-sheets contains information on the indicators and on how they are represented in tables and figures. Starting from this year, the overview also provides information on the frequency of updates.
The structure of the fact-sheets (meta-data section), as compared to the format used in the Yearbook Database, was simplified by selecting the key information on the indicator.

This led to the exclusion of the following fields: Source of the Data, Frequency of Updates, Aim and Limits.




The Yearbook is structured in four sections: Introductory Elements, Production Sectors, Environmental Conditions and Responses.

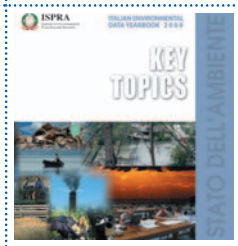
The chapter on the socio-economic framework, first included in the 2008 edition, was updated and expanded, in order to provide a scenario as reliable as possible for interpreting the environmental information provided.

Under the section Production Sectors, the chapters Agriculture, Energy and Transportation were further rationalised , thanks also to the revision of the core-set of indicators.
A number of modifications were also made in the Environmental Conditions section. In particular, the contents of the chapters on the Biosphere and Hydrosphere were supplemented. Finally, the set of indicators for the Atmosphere chapter was expanded by including indicators on adaptation.
As for the chapter on Monitoring and Control, the activities of the ad hoc working group set up to to draw up adequate indicators are continuing.

In keeping with ISPRA's publishing strategy, the full version of the 2009 edition is produced in both paper and electronic formats (PDF available on CD-ROM and at the sites www.isprambiente.it and http://annuario.apat.it ).

In addition to the full version of the Yearbook, the basic information is provided in the following four products:
- Key Topics – A version containing supplementary information on priority environmental issues, subject to specific prevention and reclamation;
- Vademecum – A short version (pocket) of the assessments contained in the preceding volume;
- Database – A tool for on-line consultation of the indicator fact-sheets and the production of reports;
- Multimedia – A tool for communicating the Yearbook data and information in a quick and easily understandable way through film sequences and web applications.

In the volume Key Topics (also available in English), the information base of the Yearbook is used to evaluate a number of situations related to key environmental policy concerns. Their choice was inspired by topics addressed by the EU's 6th Environmental Action Plan and by key 2009 events , such as the earthquake in L'Aquila, the landslide in Messina (Environmental Risk), the problems of algae (Coastal Environment) and waste. Particular consideration was given to Climate Change and Biodiversity,




both central to the 2009 Environment G8 in Siracusa and continuing to remain at the forefront of international policy debate as for 2009. Copenhagen Summit and the 2010 Year of Biodiversity.

The same key topics are dealt in a summarised form in the Vademecum (also available in English),

The Database of the Yearbook, together with the Full Version, allow for a deeper examination of the topics.
A new release of the database has been created, in order to improve the operating performance, rationalising the processing of the indicators and facilitating the consultation of the information collected. Of particular note are the improvements made to the report editing phase, through a smoother management of the xls files, plus a much more extensive, well stocked section of .pdf files.

The information base of ISPRA's Environmental Data Yearbook also constitutes the backbone for other important publications. These include the document "Le sfide ambientali" ("Environmental Challenges"), issued by the Ministry of the Environment, Land and Sea, and the European Environment State and Outlook Report 2010 (SOER 2010), drawn up by the European Environment Agency.

It is hoped that the different publications originating from the information base provided by ISPRA will make a tangible contribution to the dissemination of environmental information and to the raising of environmental awareness among an ever broader group of users, policy-makers, researchers and citizens alike. Progress towards more sustainable forms of human development on our planet is possible only through informed decisions by all citizens, based on their full understanding of the environmental consequences of consumption and production patterns.
ISPRA's intense activity on environmental information contributes to the technical and -scientific groundwork needed to develop such understanding.

*Mr. Roberto CARACCIOLO*
Director of ISPRA's State of the
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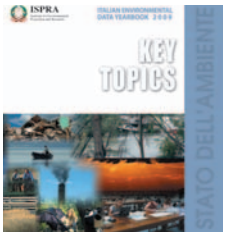
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# Contributors and Thanks

## *General considerations*

In carrying out one of its most important institutional functions, namely the coordination, collection and distribution of environmental information and reporting, ISPRA constantly procures and maintains a significant supply of top-quality knowledge, translating it into thematic and inter-thematic reports, such as the Environmental Data Yearbook, which, now in its eighth edition, is drawn on by a vast range of users.

Compared to the other publications, the Yearbook, give the thoroughness of the treatment of the environmental topics, stands as the best example of the final outcome of the complex synergies involving almost all the Institute's structures in the different disciplines.

New features include an expansion of the information contents, beyond the topics already dealt with, through the addition of the valuable contributions of the former ICRAM and INFS institutes, which have become a part of ISPRA.

To an even greater extent than in years past, the mass of information generated, together with the complexity of the analyses required to prepare this edition of the Yearbook, called for the efforts of a noteworthy number of experts on the different topics, together with analysts responsible for the reporting.

In citing the main contributions to the publication, special mention must go to the following departments:

- *State of the Environment and Environmental Metrology; Marine and Inland Waters Protection; Land Resources and Soil Protection; Nature Protection*; *Nuclear, Technological and Industrial Risk; Library, Documentation and Information;* as well as to the Inter-Departmental Services: *Environmental Emergencies, Environmental Information; Guidance, Coordination and Control of Inspection Activities* and *Environmental Certification,* carried out in the past by the former APAT;
- *Monitoring of Environmental Quality, Prevention and Mitigation of Impact, Defence of Habitats and Biodiversity,* formerly carried out by ICRAM and INFS.

Equally important were the contributions of the ARPA/APPA agencies, plus the numerous technical-scientific bodies.

The planning and coordination of the overall production of the work are handled by the State of the Environment and Environmental Metrology Department, through the Environmental Statistics and Yearbook Project Service, both units that were formerly part of the APAT.

## *Specific contributions to the document Key Topics*

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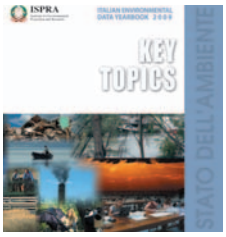


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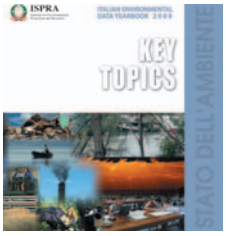


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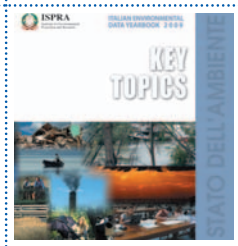


## Editing

The phases of the editing of the Yearbook products were handled by a workgroup coordinated by Mariaconcetta GIUNTA and consisting of: Giovanni FINOCCHIARO (processing and statistical validation of the data), Cristina FRIZZA (processing and statistical validation of the data), Alessandra GALOSI (processing and statistical validation of the data), Silvia IACCARINO (coordination of the fact-sheets and technical revision), Alessandra MUCCI (revision and editing of texts), Matteo SALOMONE (processing and statistical validation of data, plus multimedia processing), Luca SEGAZZI (technical revision and processing and statistical validation of data), Paola SESTILI (contact for the processing and statistical validation of data). The Databank of the Yearbook Indicators was managed by Raffaele MORELLI. The Group has also handled the preparation of specific techniques, together with the related guidelines, for compilation of the indicator fact-sheet and the Yearbook Indicators Database, as well as the integration of the contents of the work, the processing and statistical control of the data published and the overall technical review of both the information contents and the methodological/editing techniques used on those contents.

## Information Contents – Reference Units

The work involved in the preparation of the information contents of the "Environmental Data Yearbook" was carried out by a Task Force coordinated by Mariaconcetta GIUNTA. In the interests of updating the indicators found in the Yearbook Indicators Database for each environmental topic, the following contacts were identified within the Institute:

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| Spatial coverage of the indicators | Mariaconcetta GIUNTA | AMB-ASA | |
| Socio Economic framework | Mariaconcetta GIUNTA | AMB-ASA | |
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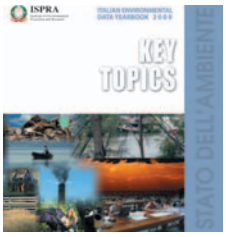
| TRANSPORT | Mario CONTALDI (Emissions and Technology)<br>Roberta PIGNATELLI (Socioeconomics and the Environment) | AMB-MPA<br>AMB-RAS | Paola SESTILI |

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| Environmental Topics | Topic Coordinator | Department Service/Sector | Statistical Coordinator |
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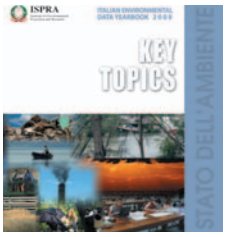
| ENVIRONMENTAL PLANNING INSTRUMENTS | Patrizia FIORLETTI (SEA)<br>Patrizia BONANNI (Air)<br>Angela BARBANO (Coasts)<br>Ardiana DONATI (Waters)<br>Salvatore CURCURUTO (Noise)<br>Eutizio VITTORI (Natural Risk)<br>Claudio PICCINI (Biosphere) | AMB-VAL<br>AMB-MPA<br>ACQ-COS<br>ACQ-MON<br>AMB-AGF<br>SUO-RIS<br>NAT-BIO | Cristina FRIZZA |
| ENVIRONMENT and HEALTH | Luciana SINISI | AMB-VAL | Cristina FRIZZA |




## Former ICRAM

Department II, "Prevention and Mitigation of Impacts", provided additional information on contaminated sites and on the topic of the hydrosphere (Coasts). Elena ROMANO (Contaminated Sites) and Luisa NICOLETTI (Coasts) worked with the topic coordinators.
Department III, "Defence of Habitats and Biodiversity", provided further information on Protected Marine Areas and Protected Species (marine). The Department Director, assisted by Sabrina AGNESI, Taira DI NORA and Giulia MO, worked with the coordinator of the biosphere topic.

## Former INFS

Piero GENOVESI served as the liaison with the other members of the task force, focussing attention on providing further information on the Biosphere environmental topic.

Contacts were also identified for the phases of implementation not directly connected with the information contents of the Yearbook, as shown below:

| Connected Activities | Topic Coordinator | Department Service/Sector | Statistical Coordinator |
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| SINAnet databases | Michele MUNAFÒ | AMB-NET | |
| Printing | Renata MONTESANTI<br>Daria MAZZELLA | DIR-COM | Matteo SALOMONE |
| Graphics/Photography | Franco IOZZOLI<br>Paolo ORLANDI | DIR-COM DIR | Matteo SALOMONE |

The full meanings of the symbols for the departments, inter-departmental services, services and sectors are spelled out below:

| Departments/Inter-Departmental Services of the former APAT | SYMBOL |
|---|---|
| Commissioner's Office | DIR |
| Communications Service | DIR/COM |
| Inter-Departmental Service for Guidance, Coordination and Control of Inspection Activities | ISP |
| Inter-Departmental Service for Environmental Emergencies | EME |
| Inter-Departmental Service for Environmental Certification | CER |
| Department for Land Resources and Soil Protection | SUO/DIR |
| Service of Background Investigations, Basin Plans and Data Collection | SUO/IST |
| Natural Risks Service | SUO/RIS |
| Department for Marine and Inland Waters Protection | ACQ/DIR |


| Departments/Inter-Departmental Services of the former APAT | SYMBOL |
|---|---|
| Coastal Protection Service | ACQ/COS |
| Data Collection and Management Service | ACQ/DAT |
| Service for the Monitoring and Hydrology of Inland Waters | ACQ/MON |
| Service for the Lagoon of Venice | ACQ/VEN |
| Department for the State of Environment and Environmental Metrology | AMB/DIR |
| Special Yearbook Project and Environmental Statistics Service | AMB/ASA |
| Special Environmental Observatory Project | AMB/OAM |
| Service for the Monitoring and Prevention of Atmospheric Impact | AMB/MPA |
| Physical Agents Service | AMB/AGF |
| Environmental Metrology Service | AMB/LAB |
| SINANET Service | AMB/NET |
| Environmental Assessment Service | AMB/VAL |
| Environmental Reporting and Instruments of Sustainability Service | AMB/RAS |
| Waste Service | AMB/RIF |
| Department of Nuclear, Technological and Industrial Risk | RIS/DIR |
| Radiation Protection Service | RIS/RDP |
| Industrial Risk Service | RIS/IND |
| Radiometric Measurement Service | RIS/LAB |
| Department of the Protection of Nature | NAT/DIR |
| Service for the Sustainable Use of Natural Resources | NAT/SOS |
| Service for the Protection of Biodiversity | NAT/BIO |
| Department of Library, Documentation and Information Activities | BIB/DIR |
| Environmental Education and Training Service | BIB/FOR |
| Library Service | BIB/DOC |
| Web Portal Service | BIB/WEB |

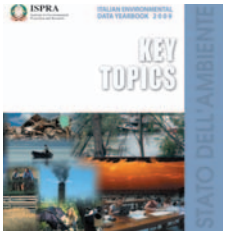
## *Authors of information contents*

A detailed listing of specific contributors (authors and collaborators for the specific topics) is included at the start of each chapter of the full version.

## *Contributions of the Environmental Agency System*

Initially, the contribution of the System involved the formulation of methodologies and the collection of data; later, it took the form of invaluable refereeing activities that made it possible to detect and, when necessary, resolve discrepancies inevitably produced by such an elaborately structured, complex process of information management.

The role of liaison between the ISPRA and the individual ARPAs was carried out by: Giovanni AGNESOD (ARPA Aosta Valley), Rossella AZZONI (ARPA Lombardy), Fabio BADALAMENTI (ARPA Sicily), Milena BRANDINELLI (ARPA Marche), Antonio Nicolò CORRAINE (ARPA Sardinia), Chiara DEFRANCESCO (APPA Trent), Luciana DI CROCE (ARTA Abruzzo), Alessandro Di GIOSA (ARPA Lazio), Giuseppe DI NUZZO (ARPA




Basilicata), Ferruccio FORLATI (ARPA Piedmont), Marco GANI (ARPA Friuli Venezia Giulia), Donatella GRIMALDI (ARPA Liguria), Armando LOMBARDI (ARTA Abruzzo), Roberto MALLEGNI (ARPA Emilia Romagna), Anna Maria MATRONE (ARPA Campania), Luca MENINI (ARPA Veneto), Luigi MINACH (APPA Bolzano), Pina NAPPI (ARPA Piedmont), Paolo Michele RICCI (ARPA Molise), Stefano ROSSI (ARPA Tuscany), Vincenzo SORRENTI (ARPA Calabria), Stefano SPAGNOLO (ARPA Apulia), Paolo STRANIERI (ARPA Umbria).

## *Other contributions from the ISPRA technical units*

Other specific *technical contributions* were made by units of the former APAT, including:

- on topics regarding the *Atmosphere, Waste, Noise, Non-Ionising Radiation, Environment and Health, Monitoring (Metrology), Environmental Impact Assessment, Dissemination of Environmental Information* and the production sectors of *Energy*, *Industry*, *Tourism* and *Transport*, from the State of the Environment and Environmental Metrology Department;
- on topics regarding *Water Resources* and *Coastal Defence*, from the Marine and Inland Waters Department;
- on topics regarding the *Soil and Natural Risk*, the Land Resources and Soil Protection Department;
- on topics involving the *Biosphere* and the *Agriculture* production sector, from the Nature Protection Department;
- on topics regarding *Ionising Radiation* and *Anthropogenic Risk,* from the Nuclear, Technological and Industrial Risk Department;
- on topics regarding the *Promotion and Dissemination of Environmental Culture*, from the Library, Documentation and Information Activities Department;
- on the topic of *Control*, from the Inter-Departmental Service for Guidance, Coordination and Control of Inspections Activities;
- on considerations regarding the *Environmental Quality of Organisations, Businesses and Products*, from the Inter-Departmental Service for Environmental Certification.

Further specific *technical contributions* were provide by the former ICRAM, including:

- for topics regarding the *Biosphere*, from Department III, "Defence of Habitats and Biodiversity";
- for topics regarding the *Hydrosphere*, from Department II, "Prevention and Mitigation of Impacts", and from Department I, "Monitoring of Environmental Quality"

Specific *technical contributions* were also provided by the former INFS, especially with regard to topics involving the *Biosphere.*

Specific contributions *on considerations of methodology and liaison* were supplied by:

- SISTAN interface, through the Statistics Office of the former APAT: Mariaconcetta GIUNTA;


- coordination of the *EIONET* network (formerly handled by the APAT): Claudio MARICCHIOLO, as the *National Focal Point* for Italy;
- chapter on the *Promotion and Dissemination of Environmental Culture*: Inter-Agency Workgroup for Education Geared towards Sustainability (EOS), the network of libraries and contacts for environmental instruction of the Agency System.

### *Other contributions by units of the former APAT*

The following contributions were made on operating considerations:

- procedural and administrative considerations: Vincenzo PEZZILLO, Elisabetta GIOVANNINI;
- administrative considerations: the Department of General Services and Personnel Management and the Inter-Departmental Service for the Administration and Planning of Activities. With regard to the activities involved in carrying out tenders, the Tender and Contracting Sector;
- the functional support was overseen by Elisabetta GIOVANNINI.

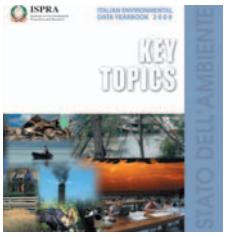
### *Contributions by subjects outside of the Agency System*

Numerous contributions from central and local government bodies have also been drawn on, as well as from technical-scientific structures and individual experts in different sectors.

Of the government bodies, specific mention should be made of: the departments of the Ministry of the Environment, Land and Sea, the Ministry of Economic Development, the Ministry of Cultural Resources and Activities, the Ministry of Infrastructures and Transportation, the Ministry of Agricultural, Food and Forestry Policies, the Ministry of Labour, Health and Social Policies, the Carabinieri Police Command for the Protection of the Environment, the Italian National Forestry Corps, the Manager of the National Transmission Network, the Marine Environmental Unit of the Harbourmasters' Corps, the National Fire-Fighters' Corps, the Regional and Provincial Waste Observatories, the Commissioners for the Waste Emergencies in the Regions of Campania, Calabria, Apulia and Sicily, the regional, provincial and municipal governments, the PMP and local government bodies. Of the technical-scientific authorities and organisations, both public and private, the following should be acknowledged: the ISTAT, the ISS, the basin authorities, the magistrates of bodies of water, the CNR, the ACI, the ENEA, the Italian Glaciological Committee, the Italian Meteorological Society, the ENEL, the European Soil Bureau of the Common Research Centre of the European Commission in Ispra (VA), EUROSTAT, Agecontrol S.p.A., Biobank, the National Register of the Organisations EMAS, ISTIL, ODYSSEE, TELEATLAS, TERNA and IREPA.

### *Referees*

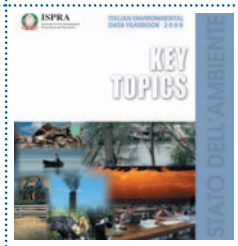
As was done with previous editions, in addition to the numerous contributions received from subjects (individual experts and organisations) outside of the Agency System



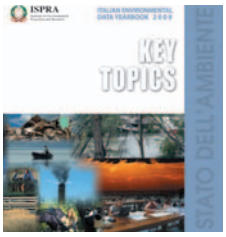

during the phases involving the formulation and production of the Yearbook, it was held best to request an additional and independent assessment of the final product from experts on the individual topics addressed in the publication.
It was not always possible to utilise all or a part of these contributions. In certain cases, the key factor was a lack of time. Other contributions that could not immediately be put to use regard proposed additions to the Indicators Database. In such cases, the proposals were not enacted because the data needed to populate the indicators were lacking.
We shall be sure, however, to return to these proposals in subsequent editions of the Yearbook.
The following individuals were consulted and offered observations and proposals for additions:
Renzo BARBERIS (ARPA Piedmont), Guido BENASSAI (University of Naples), Gianfranco BOLOGNA (WWF Italy), Giovanni BRAMBILLA (IA CNR), Fabrizio BULGARINI (WWF Italy), Anna Maria DE MARTINO (Ministry of Labour, Health and Social Policies), Vincenzo FERRARA (ENEA), Alessandro Maria MICHETTI (University of Insubria - Como), Romano PAGNOTTA (IRSA CNR), Alessandro POLICHETTI (ISS), Sabina PORFIDO (IAMC CNR), Giuseppe RANDAZZO (University of Messina), Rachele SCHETTINI (Chairwoman EUROPA 2010), Anna Maria SIANI (University of Rome, La Sapienza Campus), Paolo VECCHIA (ISS), Giuseppe VIVIANO (ISS).

## *Thanks*

Heartfelt thanks are once again expressed to those whose contributions have made publication of the 2009 edition of the Yearbook possible.
The listing of those who have contributed in one way or another, an exercise that may prove tedious but is definitely deserved, further demonstrates, were there any need for such evidence, the complexity of the work behind this volume, which constitutes an indispensable reference for those who use environmental data and information in the course of their own activities or in order to keep themselves up-to-date on our country's environmental status. There is also no mistaking the fact that, in pursuing these objectives, ongoing efforts must be made to enlarge the network of cooperation with other organisations and institutions, without which it would prove impossible to provide a body of knowledge adequate to current demands.
These thanks go to everyone, including those who, though they contributed, are not explicitly mentioned. A few names may have been left out by mistake. We ask these people to accept our most sincere apology.
As was done for the previous editions, we again ask that readers send us any observations or suggestions for modifications they might have, so that, on the strength of such contributions, we can continue our ongoing improvements in the development of the Yearbook.




# CONTENTS




# I. Purposes and Structure of the Document

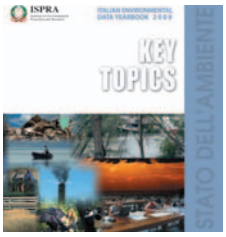
## Purposes

This document is meant to provide a sufficiently thorough description of the underlying context for the environmental topics currently given priority in the formulation of environmental policy, especially as regards the topics held by the European Union to be “priority areas for policy initiatives”.

Unlike the complete edition of the Yearbook, which provides detailed descriptions by means of the indicator fact-sheets, this work offers the reader the environmental data structured according to the information base of the Yearbook, which follows the underlying logic of the DPSIR model.

To ensure that the contents are suited to the widest possible audience, the latest reporting techniques have been employed, together with a style of language both clear and precise.

Special care has been taken with the graphic illustration of the information, in order to streamline the communication of the contents. The images included in the text are always accompanied by comments on what is being shown.




## Structure of the Document

The document is structured in 11 chapters: each of the first 10 focuses on a different environmental topic, while the eleventh is devoted to instruments of environmental knowledge.

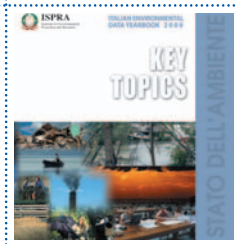
Among the topics examined, special attention is placed on: *climate change, natural risk* (earthquakes, landslides and floods), *the marine coastal environment* (dune, banks of Posidonia, water quality for swimming and marine algae) and *biodiversity*, seeing that these were the issues focussed on by public opinion, together with national and international institutions, in the year 2009.

Each environmental topic has been described according to the following logical sequence: first the current environmental conditions are presented, following by an analysis of the underlying causes of these conditions and, finally, a presentation of the solutions currently implemented or that will hopefully be put in place in the future. Special boxes have been included in this edition, where judged to be appropriate, for in-depth examination of certain topics, such as the application of the new regulations for monitoring internal waters and marine coastal waters.

There are three different ways of reading the various chapters: the text provides the reader with a complete and exhaustive analysis of the topics; the “focuses” in the margins make easier the rapid identification of the topics addressed before deciding whether to examine them in depth; by consulting the graphs and the figures, the reader can obtain information that is sufficiently complete, though limited to the individual aspect illustrated.

The information elements found in the document are the end result of a painstaking selection process carried out on the far more extensive stock of information contained in fact-charts of the Yearbook Indicators Database.

An appendix provides a description of the structure and function of the Yearbook Database, a computerised instrument for managing the indicator fact-sheets that contain the Institute’s store of environmental information.




# II. Socio Economic Framework

## Characteristics of Italy

Italy is a peninsula located in southern Europe, with a territory that includes the Alpine mountain chain and numerous islands, the largest of which are Sicily and Sardinia, while the smaller islands are about 70.

*Italian territory consists of hilly and mountainous zones, plus a lengthy coastline, ensuring a wide variety of landscapes.*

The environmental features of Italian territory, and the Mediterranean climate in particular (dry and seasonably hot) are similar to those of other Mediterranean countries, such as Spain, Portugal and Greece. Italy has a total territorial surface of 301,336 km$^2$. The territory consists primarily of hilly and mountainous zones (accounting for 41.6% and 35.2% of the total respectively), plus a lengthy coastline (8,353 km). These features ensure a territory with a wide variety of landscapes.

Climate conditions are generally temperate, with regional variations. In summer, the northern regions are hot, with occasional rain, the central regions are humid, and the south scorches under the dry heat. In winter the northern cities undergo cold temperatures, noteworthy humidity and fog, while temperatures in the south are more comfortable (10-20°C).

*The climate in Italy is generally temperate, with regional variations.*

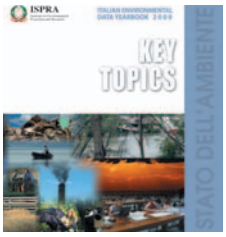
The specific location of Italian territory within the Mediterranean geodynamic context (convergence of the European and African plates, interposition of the Adriatic micro-plate, opening of the Tyrrhenian basin) makes Italy one of the countries at greatest risk for earthquakes and volcanoes.

The areas at greatest risk for earthquakes are the Friuli sector, the central-southern Apennine mountain chain, and especially the sectors of the intra-Apennine basin, as well as along the Tyrrhenian coast of Calabria and in southeast Sicily. The highest volcanic risk is naturally tied to the presence of Italy's active volcanoes, meaning in the Vesuvius and Phlegrean area, on the Island of Ischia, in and around Etna volcano, on the Aeolian Islands and, in part, in the Alban Hills.

*Due to its position, Italy is one of the countries at greatest risk for earthquakes and volcanoes in the Mediterranean area.*

Italy is one of Europe's countries, in terms of biodiversity, essentially on account of its favourable geographic position as well as its extensive geo-morphological, microclimatic features and vegetative variety, plus the additional influence of factors of history and culture factors. Italy contains one half of all the plants species and a third of the animal species currently found in European territory.

*Italy is one of the European countries with the richest supply of biodiversity.*




At the end of 2008, Italy's population numbered more than 60 million. As has been the case for a number of years now, any growth is due almost exclusively to the arrival of immigrants.
The average population density in Italy is approximately 200 inhabitants per square kilometre.

*Italy is one of the most densely populated countries in Europe.*

Levels of population density higher than the national average tend to be registered by smaller towns, especially in the southern regions and on Italy's islands, where peaks of more than 900 inhabitants per square kilometre can be found.
Seen within the context of the European Union, Italy is one of the most densely populated states. The majority of the Italian population lives in lowland areas.
Thanks to its lengthy history of urban development, Italy is one of the countries with the greatest wealth of cultural resources and monuments (42 Italian cultural sites are included on the UNESCO World Heritage list).

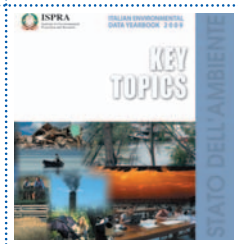
*Compared to the rest of Europe, Italy's enterprises are more geared towards manufacturing activities, creating what is referred to as the "made in Italy" sector.*

Looking at Italy's production structure, service enterprises are prevalent in the central regions, while the micro-enterprises are predominant in the South , and medium-size enterprises are the most widespread in the northeast regions. In the northwest, on the other hand, large-scale industry plays the leading role.
Compared to the rest of Europe, a higher percentage of our companies are involved in manufacturing activities (despite a late-arriving but rapid development of service industries), with a relative specialisation in the sub-sectors that can be referred to under the category of "*Made in Italy*" products.

## II.1 Key developments in Italian society

*The last 60 years have been characterised by a sharp drop in the birth rate and a gradual ageing of the population, together with increased immigration.*

During the last 60 years, major socioeconomic transformations have occurred in Italy: from a poor society based on agriculture, it has become an advanced post-industrial society.
In accordance with the reference framework, the structure of the Italian population has also changed, in terms of inhabitants and forms of behaviour, going from 47 million inhabitants in the 50's to 60 million at present.
This period was characterised by a sharp drop in the birth rate



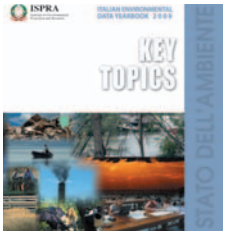

and by the gradual ageing of the population, along with increased immigration.

After a period of relatively stable growth of the Italian economy in the years following the Second World War (1945-1950), the population rose at an astonishing pace, reaching annual growth rates of 1%, especially in urban and suburban areas.
The years between 1958 and 1963 came to be known as those of "Italy's Economic Miracle", though it should be noted that economic development noteworthy regional differences, especially between the Centre-North and the South.
Potentially better job prospects in urban areas were the primary cause of the intensive exodus from countryside to the cities, drawing flows of internal immigrants from the Alpine hinterland and the Apennine hills, as well as Sicily and Calabria, in the direction of Rome, Milan, Turin and Genoa. This exodus towards industrial areas still exists, though it has slowed, due to the current depressed state of the economy.

*The years of the "Italian Economic Miracle" widened the gap between the Central-North regions and the South.*

In 1970, the Italian population numbered approximately 54 million inhabitants, of whom approximately 4 million worked in agriculture (20.1% of the total workforce), while more than 8 million were employed in the service industries (41.5%) and approximately 7.6 million in the industrial sector (38.4%), making for a total active workforce of roughly 20 million. Between 1970 and 2008, the population grew by approximately 6 million inhabitants (+11%), with an equally significant change in the distribution of the workforce among the various categories of employment: the total number of actively employed inhabitants rose by slightly more than 5.5 million (+27%); there was a drop of 992,000 in the number employed in agriculture (-75%), while the number in the service industries rose above the 17 million mark (+107.7%), and the number in the industrial sector fell slightly below 7 million (-7.1%).

*Between 1970 and 2008 the Italian population grew by 11% and the structure of the country's workforce changed significantly, with the emphasis on farming and industry shifting in favour of the service industries.*




*Between 1970 and the present, the structure of the Italian workforce changed significantly, with the emphasis on farming and industry shifting in favour of the service industries.*

**Table II.1: Total employed[1]**

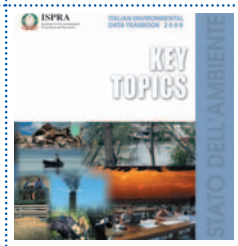
| Economic activities | 1970 | 1980 | 1990 | 2000 | 2008 |
|---|---|---|---|---|---|
| | figures in the 1,000's | | | | |
| Agriculture, forestry and fishing | 4,008.2 | 2,856.6 | 1,689.9 | 1,102.9 | 991.7 |
| Industry in the strict sense | 5,689.7 | 6,429.1 | 5,820.1 | 5,189.5 | 5,179.1 |
| Construction | 1,970.4 | 1,709.9 | 1,511.4 | 1,553.9 | 1,938.1 |
| Trade repairs, hotels and hotels and restaurants, transport and communications | 3,932.4 | 4,742.8 | 5,561.2 | 5,631.7 | 6,175.0 |
| Monetary and financial intermediation; real estate and business activities | 707.7 | 1,068.8 | 2,091.8 | 2,949.8 | 3,783.7 |
| Other service activities | 3,623.0 | 4,565.8 | 5,935.1 | 6,502.3 | 7,195.3 |
| **TOTAL** | **19,931.4** | **21,373.0** | **22,609.5** | **22,930,1** | **25,262.9** |

| Economic activities | 1970 | 1980 | 1990 | 2000 | 2008 |
|---|---|---|---|---|---|
| | % | | | | |
| Agriculture, forestry and fishing | 20.1 | 13.4 | 7.5 | 4.8 | 3.9 |
| Industry in the strict sense | 28.5 | 30.1 | 25.7 | 22.6 | 20.5 |
| Construction | 9.9 | 8.0 | 6.7 | 6.8 | 7.7 |
| Trade repairs, hotels and hotels and restaurants, transport and communications | 19.7 | 22.2 | 24.6 | 24.6 | 24.4 |
| Monetary and financial intermediation; real estate and business activities | 3.6 | 5.0 | 9.3 | 12.9 | 15.0 |
| Other service activities | 18.2 | 21.4 | 26.3 | 28.4 | 28.5 |
| **TOTAL** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** |

## II.2 The main driving forces and the resulting environmental pressures and impacts

The distinguishing characteristics of the country's territorial and socio-economic framework, and especially the demographic dynamics and the models of behaviour of economic subjects (families and businesses), are closely connected with the anthropogenic pressures that threaten the national environment (air pollution, water, soil and nature, waste generation, consumption and deterioration of natural resources).

[1] Source: ISTAT data processed by ISPRA




## Socio-demographic considerations

*The individuals found in a given territory are one of the main sources of pressure on the environment.*

The question of the environment is closely tied to production activities and to the individuals found in a given territory. These two factors are the main causes of pressures on the environment in terms of consumption, waste generation, emissions etc.. It follows that any analysis of the environmental situation must also take into account the demographic factor, which has noteworthy repercussions from a socio-economic point of view.

During 2008, Italy's resident population rose above the threshold of 60 million inhabitants. As of 31 December 2008, the total was 60,045,068[2] inhabitants, for an increase of 425,778 over the same date in 2007, determined exclusively by the arrival of immigrants from abroad. The population increase presents regional differences, as a result of contrasting dynamics that channel the majority of the migratory, both internal and from abroad, towards the regions of northern and central Italy, while the balance of natural population growth is positive in Southern Italy (including islands). In terms of the territorial make-up, therefore, noteworthy differences can be observed not only between the surface areas of the different regions but as regards their demographic profiles as well.

*During 2008 Italy's resident population rose above the threshold of 60 million inhabitants.*

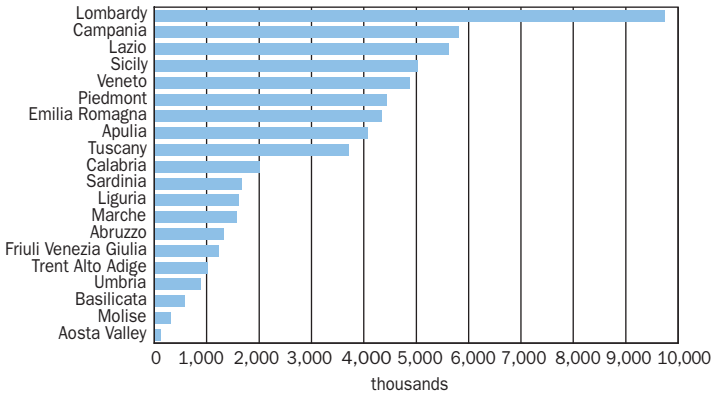
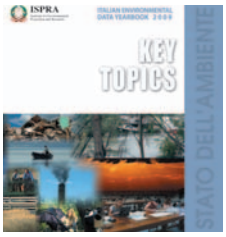



**Figure II.1: Resident population as of 31 December 2008[3]**

[2] Source: ISTAT (for all the data indicated in this section)
[3] Source: ISTAT data processed by ISPRA




*Within Europe as a whole, Italy is one of the most densely populated countries. The most densely populated Italian regions, at respective levels of 428 and 404 inhabitants per km², are Campania and Lombardy.*

The most heavily populated region, with more than 9.7 million residents, is Lombardy, followed by Campania (over 5.8 million) and Lazio (over 5.6). The regions with the largest surface area, on the other hand, are Sicily, Piedmont and Sardinia, with Lombardy in fourth place.
Breaking down the population by age, 20.1% are individuals aged 65 or older, 14% are young people up to the age of 14, and 65.9% of the population is in active age group, meaning the 15 to 64 year-old segment.

Consumption patterns also reflect demographic changes, with variations in family size having an especially noticeable effect on the allocation of available spending. As of 31 December 2008, 99.5% of Italy's resident population lived in a family. The average number of family members remained stable, at 2.4, compared to 2007. It should be noted that 11.3% of the families residing in Italy find themselves in relative poverty (8 million and 78 thousand people), 4.6% live in conditions of absolute poverty (2 million and 893 thousand people).

*Spending on food and beverages accounts for 19.1% of total monthly family spending.*

In 2008 average monthly spending per family was equal, at current values, to 2,485 euro (2,480 euro in 2007), varying from a minimum of 1,692 euro (single-member families) to a maximum of 3,251 euro (families of 5 or more people). Spending on food and beverages stood at 475 euro, while spending on non-food goods was 2,009 euro. Spending on food and beverages accounts for an average of 19.1% of the total monthly spending of families. Compared to 2007, levels of spending on healthcare, transportation, leisure-time and cultural activities, clothing and footwear, furnishings, home appliances and household services fell. On the other hand, the percentages of spending that families allocated to education, communications and tobacco products remained stable, while spending on fuel and energy was on the rise. Looking at regional differences, Veneto remained the region with the highest average level of family spending, at 2,975 euro (3,047 euro in 2007), while Sicily, which registered 1,742 euro (1,764 euro in 2007) once again was the region with the lowest level.

*Compared to 2007, levels of spending for healthcare, transportation, leisure-time and cultural activities, as well as clothing and footwear, furnishings, home appliances and home services, all fell.*


*Spending on food and beverages represents 19% of total monthly family spending, while transportation accounts for approximately 14% and housing for roughly 27%.*

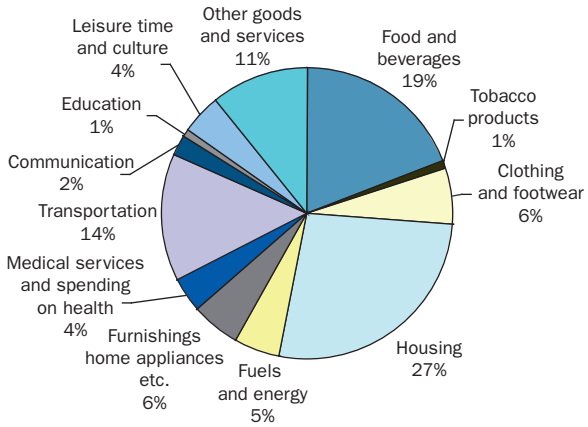


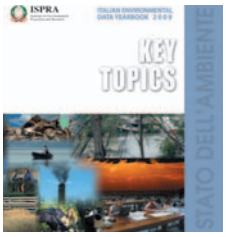

**Figure II.2: Average monthly family spending by category (2008)[4]**

## Economic factors

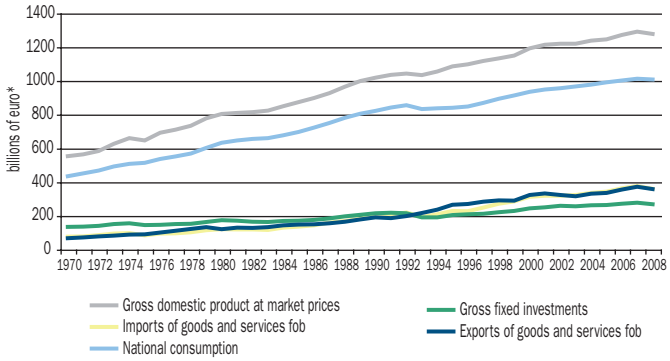
Until such time as the European project "Beyond GDP" generates indicators able to measure long-term economic and social progress more thoroughly and accurately than GDP, and in particular the capacity of a given society to deal with issues such as climate change, the efficient use of resources or social inclusion, classic macroeconomic indicators, estimated on the basis of countrywide results, shall continue to be used to analyse the distinctive features of Italy's economy.

Between 1970 and 2008, the main categories on the income statement for resources and investments registered noteworthy growth, with the GDP, consumption and investments doubling their levels, while imports and exports rose no less than fourfold (Figure II.3).

[4] Source: ISTAT data processed by ISPRA




*Between 1970 and 2008 the GDP, consumption and investments doubled. Imports and exports increased nearly fourfold.*




*= values keyed to the reference of 2000 year

**Figure II.3: Main aggregates of the income statement of resources and investments[5]**

*The national GDP for 2008, calculated in keyed to the reference year of 2000, fell by 1% compared to 2007.*

*The gap between Italy's northern and southern regions is not being reduced.*

*In almost all the countries of Europe, consumption amounts to more than 70% of the national GDP.*

The Gross Domestic Product (GDP), which gives the final result for all the goods and services produced in a country during a given period, stood at approximately 1.277 trillion euro for Italy in the year 2008, calculated in values keyed to the reference year of 2000, representing a decrease of 1% over the previous year.
Unlike the trend within the European Union (EU27), where the countries that start at the lower levels of per capita GDP corrected for ppp[6] are the ones that grow fastest, in Italy do not show this convergence of growth rates, with the southern regions proving unable to close the gap with the richer northern zones.

As for consumption, which constitutes the main component of aggregate demand[7] all the EU countries, except for Ireland and Luxembourg, present levels of consumption that exceed 70% of their GDP. In 2008 consumption in Italy (74.3% of which is tied to the spending of the resident families) was equal to 1.007 trillion euro, or 79% of the GDP, while gross fixed investments

[5] Source: ISTAT data processed by ISPRA
[6] ppp = purchasing power parity
[7] Eurostat, New Cronos Database


accounted for 21%. In certain countries[8], especially outside the EU(15), the sum of consumption and investments as percentages of the GDP is greater than 100, meaning that these countries consume and invest more than they produce, and thus need to draw on foreign markets.
The above situation, which holds for the majority of the countries outside of the EU(15), is also found in southern Italy, whose regions are forced to imports goods and services to sustain levels of consumption and investment which, taken together, exceed the GDP.

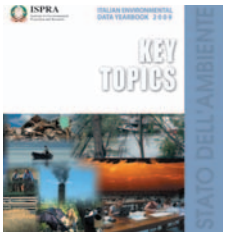
In all the countries of the European Union (EU25), more than 60% of the GDP ( 70.4% in Italy) is generated by the services-industry sector (which include banking activities, tourism, transport and insurance). Industry and agriculture, though they still play significant roles, have declined in economic importance in recent years. In Italy, the incidence of the primary sector in terms of value added for 2008 was only 2.5 percentage points, while the industrial sector (meaning industry in the strict sense, plus construction) accounted for 26.9%.

*In all the countries of the EU25, more than 60% of the GDP is generated by the services-industry sector.*

The composition by sectors of Italy's production structure, as shown by "ASIA" [9] , the archive of Italian enterprises of ISTAT for 2006, is similar to that illustrated for Germany in the EUROSTAT[10] statistics for EU enterprises of 2005, though in Germany large-scale enterprises predominate, as is the case in all the economies of continental Europe. Within Italy, on the other hand, the central regions show a greater vocation towards service enterprises, though the two regions with the largest enterprises in the services sector are Lazio and Lombardy. As for the South, the predominant role is played by micro-enterprises, with a particular emphasis on the services sector in Campania, Calabria, Sicily and Sardinia, while industrial firms are the leading force in Apulia, Basilicata and Molise. In the northeast regions medium-size industrial enterprises are the most widespread, while large-scale industry is dominant in the northwest, and especially in Piedmont.

*Italy's central regions show a greater propensity for service enterprises, while micro-firms are predominant in the South, and medium-size enterprises are the most widespread in the northeast regions. Large-scale industry plays the leading role in the Northwest.*

[8] Ibidem
[9] ISTAT, Statistical Archive on Active Enterprises (ASIA)
[10] Eurostat, *Structural Business Statistics* (SBS)




## Industry

*Small-scale enterprises continue to play the predominant role in the Italian production structure.*

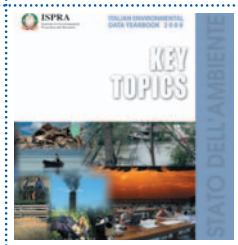
In 2007, there were 4.4 million Italian industrial and service enterprises, employing approximately 17 million workers (11.4 million salaried employees) and generating roughly 722 million euro of value added. The predominant role in the Italian production structure continues to be played by small-scale enterprises. Within the framework of Europe as a whole, our companies are more focussed on manufacturing activities (despite a late but rapid development of the service industries), with the chief manufacturing sub-sectors being those referred to under the umbrella term "*Made in Italy*". Specialisation in these primarily low-tech sectors was further reinforced in the early 2000's. The limited size of the average company is accompanied by a high incidence of self-employment.

In 2007 there were 1.13 million Italian industrial firms employing approximately 6.72 million workers (5.19 million salaried employees) and turning out value added of more than 333 million euro. The average industrial firm had 5.9 employees, while each company in the sector of traditional industry operates with an average of 9.2 workers.
An analysis of the total number of people employed compared to the resident population highlights the fact that industrial activity is carried out primarily by the resident populations of Veneto, Lombardy, Emilia Romagna and Marche.

*In recent years industry has increasingly been called upon to reconcile considerations of growth and competitiveness with those of environmental compatibility and sustainable development.*

It should be stressed that the effect of the industrial sector on the environment regards not only the possibility of different forms of environmental pollution, but also the exploitation of natural resources.
In recent years industry has increasingly been called upon to reconcile considerations of growth and competitiveness with those of environmental compatibility and sustainable development, optimising production processes and applying techniques to eliminate or minimise environmental impact while reducing the use of resources, raw materials and energy and observing principles of prevention, including:

- avoiding or reducing the production of pollutants;
- making effective use of energy resources and raw materials;



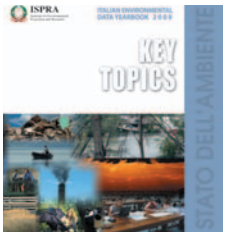

- reducing scrap and, if possible, recycling it within the production cycle.

It is interesting to observe that the number of industrial establishments in Italy considered to be at major accident hazards (MAH), and therefore subject to the obligations stipulated under arts. 6/7 and 8 of Legislative Decree 238/05 (which partially modified the earlier Legislative Decree 334/99), decreased compare to the previous year (2007) by a few dozen units in absolute terms. This variation is due primarily to modifications in the regulations and to the placement in full operation of the procedures that the managers of the plants are required to respect. Only a small portion of the change constitutes actual modifications in industrial activities (closings for the termination of activities, new activities or expansions of existing plants). In terms of the distribution within the national territory of the establishments subject to notification (under arts. 6/7 and art. 8 of Legislative Decree 334/99), fully a fourth are found in Lombardy, while other regions with significant numbers of industrial operations posing risks are: Piedmont, Veneto and Emilia Romagna (all northern regions accounting for approximately 9% each). Such activities are particularly concentrated in certain areas of these regions holding long-time refining and/or petrochemical complexes, such as Trecate (in the vicinity of Novara), Porto Marghera, Ferrara and Ravenna, and in the industrial areas of the provinces of Turin, Alessandria, Bologna, Verona and Vicenza. There are also central-southern regions with a significant presence of activities subject to notification, and specifically: Sicily (approximately 7%), Lazio and Campania (with slightly more than 6%), Tuscany (approximately 5%), Apulia and Sardinia (approximately 4%); these regions also contain petroleum and petrochemical plants, as in the areas of Gela (Province of Caltanissetta), Augusta-Priolo-Melilli-Siracusa, Brindisi, Porto Torres (Province of Sassari) and Sarroch (Province of Cagliari), while there are concentration of industrial activities in the provinces of Leghorn, Rome, Frosinone, Naples and Bari, plus depots for agricultural products in the Province of Ragusa.

*The number of plants in Italy considered to be at risk of a major accident decreased by a few dozen units in absolute terms.*

Nationally, a very low percentage (less than 4%) of plants at major accident hazard (MAH) are located in zones classified as highly dangerous (zone 1). The regions with plants located in such zones

*A very low percentage (less than 4%) of MAH plants are located in zones classified as highly dangerous (zone 1).*




*A fourth of the establishments requiring notification (arts. 6/7 and art. 8 of Legislative Decree 334/99) are concentrated in Lombardy, and in the provinces of Milan, Bergamo, Brescia and Varese in particular.*

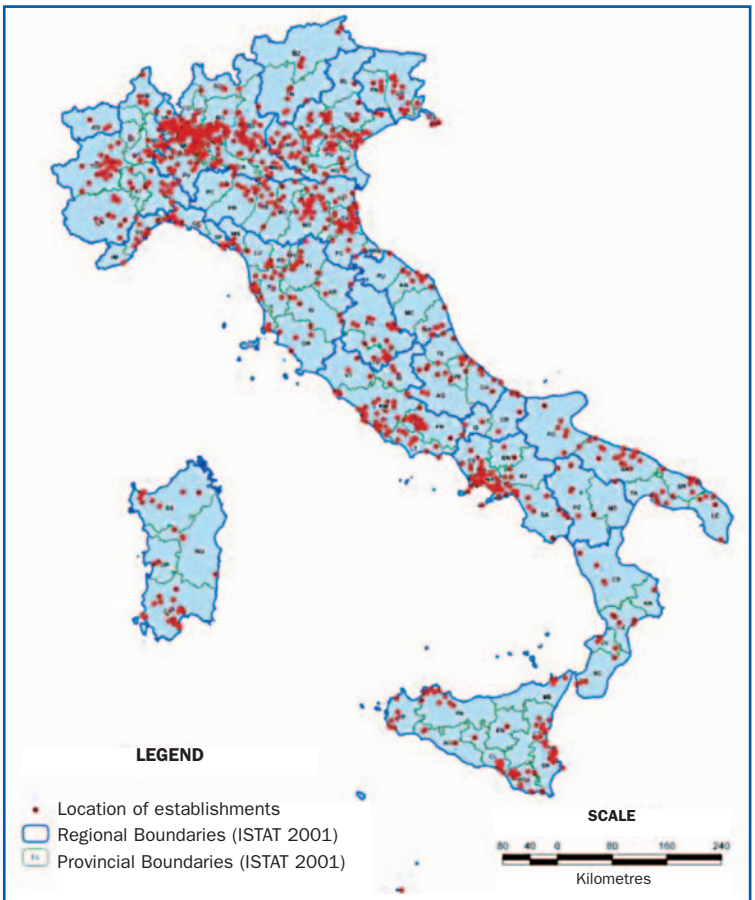
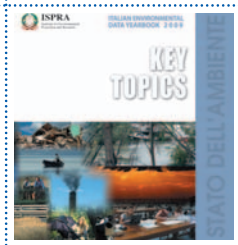



**Figure II.4: Localisation within the national territory of the establishments subject to Legislative Decree 334/99 (30 June 2008)[11]**

are Friuli Venezia Giulia, Umbria, Abruzzo, Molise, Campania, Calabria, Basilicata and Sicily; of these, Calabria contains 75% of the plants in a seismic zone 1. All the regions, with the exception of Trent Alto Adige, Aosta Valley and Sardinia, have MAH plants in

[11] Source: Ministry of the Environment, Land and Sea data processed by ISPRA




zones of elevated seismic risk (zone 2), especially in the case of Sicily and Campania, where more than 90% of the plants fall in such zones. It should also be noted that the plants located in zones falling under the first two seismic classifications, meaning the ones presenting the greatest danger, account for 312 out of a total of 1,090 (approximately 30%), while regions such as Calabria, Sicily, Basilicata, Campania, Molise and Marche have almost 100% of their MAH plants such zones, while the percentage for the regions of Friuli Venezia Giulia, Umbria, Lazio and Abruzzo is approximately 50%. Finally, roughly 70% of the MAH are located in the two other seismic categories (3 and 4), with approximately 40% (459 plants) found in zone 4, which called for no anti-seismic building design prior to introduction of the 2003 classification system.

*70% of MAH plants are located in zones falling in seismic classes 3 and 4.*

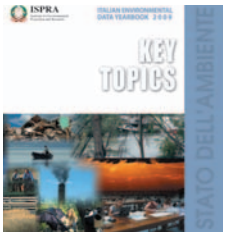
## Energy

As far as the energy sector in Italy is concerned, the most recent data (ISPRA and ENEA[12]) point to a number of different results, including confirmation of the fact that primary energy intensity[13] is lower than the European average. However, a comparison with the situation in the rest of Europe over the years shows that the benefits enjoyed by Italy on account of its initially favourable position in terms of energy intensity are gradually declining, due to the fact that the situation has remained essentially unchanged in Italy over the last decade, while almost all the other European countries have registered improvements. It should also be noted that the ratio between final consumption and total consumption of energy in Italy is higher than the European average. This serves as an indirect sign of efficient conversion of primary energy sources. The increased efficiency - traceable, for example, to a rise in gross production of electric energy by cogeneration plants (starting from 1999), is partially offset by the growing percentage weight of secondary energy sources (electricity, petroleum derivatives) in the final consumption of energy, explaining the extreme variability in the information.

*Apart from confirmation of a number of structural characteristics of Italy's energy system, such as the fact that it outperforms the European average in terms of energy intensity and the ratio between final and total energy consumption, a series of changes in the way energy is procured are also taking place.*

[12] ENEA, 2009, *Rapporto Energia e Ambiente 2008, Analisi e Scenari.*

[13] The "primary energy intensity" indicator measures the energy efficiency of economic systems, meaning the quantity of energy needed per unit of GDP produced.

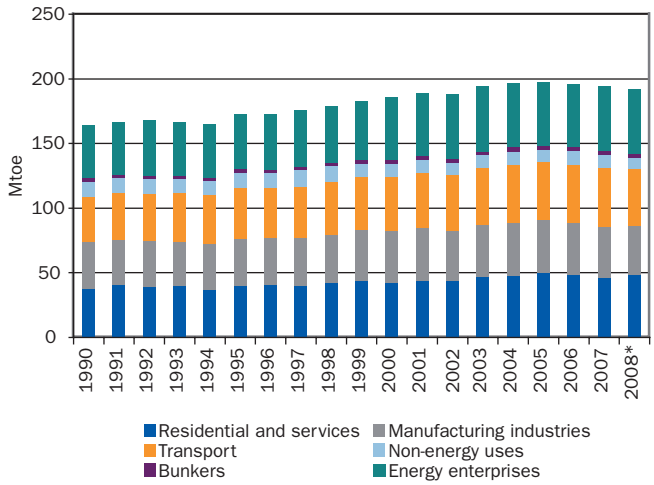



In recent years there has been a series of changes in the sources of energy supplies, such as the growing role of natural gas compared to petroleum products, plus an increasing contribution from renewable sources and cogeneration, along with, from 2001 on, a revival in the consumption of solid fuels, whose contribution to total primary energy sources (including primary electric energy) went from 8.6% in 2001 to 11.5% in 2008. Furthermore, the gradual entry in operation, starting from 1999, of combined-cycle plants – with levels of efficiency higher than those of traditional plants – fuelled by natural gas or gas derivatives explains the decrease in average specific fuel consumption in the production of electric energy from fossil fuels, which has fallen by 12% since 2000 in terms of the net electricity produced.
The dynamics of the energy sector are also influenced by the performance of the international fuel market, as well as developments in the regulatory outlook, such as the liberalisation of energy markets an the introduction of new forms of incentives for the production of electric energy from renewable sources, by establishing a minimum quota of renewable sources for each producer of electricity.

*In 2008, the demand for primary energy stood at 192 Mtoe, for a decrease of approximately one percentage point compared to 2007.*

In 2008, the demand for primary energy stood at 192 Mtoe, for a decrease of approximately one percentage point compared to 2007. As shown by Figure II.5, the trend in the final consumption of energy increased between 1990 and 2005, peaking at 20.7%. Starting from 2006 there was a reversal, with final consumption as of 2008 haven fallen by 4.1% compared to 2005. Overall, final consumption as of 2008 had risen by 15.7% compared to 1990. The primary sectors responsible for the general trend show decreased consumption in recent years. In terms of the break-down in final energy consumption for 2008 (excluding non-energy uses and bunkering), the residential and services sector absorbed 34.4% of consumption, followed by the transportation and industrial` sectors, at respective figures of 34.2% and 29%, while agriculture and fishing accounted for the remaining 2.4% of final consumption.


*In 2008, the demand for primary energy stood at 192 Mtoe, for a decrease of approximately one percentage point compared to 2007.*




**Note:** * Provisional figure

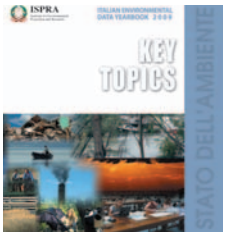
**FigurE II.5: Final national energy consumption by economic sector[14]**

## Agriculture

Relations between agriculture and the environment are extremely complex, working on two levels. On the one hand, agricultural land is directly impacted by other production sectors (i.e. the consumption of the soil), in addition to undergoing the indirect impact of the physical and chemical alteration of the atmosphere, as well as the occurrence of extreme meteorological events. At the same time, agricultural activities – which, in recent decades, have resulted, in many cases, in intensified, concentrated and specialised uses of the land and agricultural techniques – are considered to be among the primary causes of the pollution of water, loss of stability of the land and pollution and acidification of the soil, as well as increases in the greenhouse effect, a loss of biological diversity, a simplification of the landscape and a reduction in the wellbeing of livestock. There is no doubt, however, that agriculture, in addition to guaranteeing good produc-

*Agricultural land undergoes the direct impact of other production sectors, as well as the indirect impact of physical and chemical alterations of the atmosphere, and that of extreme meteorological events.*

[14] Source: Ministry of Economic Development




tion capacity of foodstuffs, wood and fibres, can also play an important role (if properly managed): in the environmental defence of the territory; in the preservation of the biological diversity of ecosystems, species and genomes; in reducing the pollution and deterioration of the land and water.

*Agriculture, in addition to guaranteeing good production capacity of foodstuffs, wood and fibres, can also carry out important environmental services that are specifically acknowledged and sustained under EU policies in different sectors.*

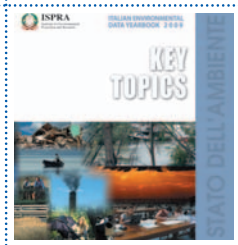
These important environmental services are specifically acknowledged and sustained under EU policies in different sectors, as well as under the strategies of the EU Environmental Action Program and under the Strategy for Sustainable Development. Along these lines, it should be remembered that the concept of "conditionality" was made a part of Common Agricultural Policy, meaning that the disbursement of direct payments allocated to enterprises depends on compliance with regulations and measures of environmental defence. For the most part, these measures regard "obligatory operating criteria" and "good agronomic and environmental conditions". At present there are no fewer than 19 legislative acts that place direct constraints on agricultural enterprises with regard to the environment, public health and the health of plants and animals.

*In 2007 Italy's total Utilized Agricultural Area was equal to 12,744,196 hectares.*

In 2007, Italy's Utilized Agricultural Area totalled 12,744,196 hectares, a slight increase compared to 2005 (+0.3%), but a lower figure than that for 2000 (-2.4%). The largest decreases in comparison with that year were observed in the north (-4.2%) and in the central regions (-4.5%). In terms of the management of farming soil, there was a clear prevalence, in the sequences of crops, of free alternation and rotation, at respective figures of 40.8% and 40.1% of the planted UAA. As far as covering techniques are concerned, controlled growing of grass was favoured over green manure and mulching.

*Total farming enterprises number 1,677,766 units.*

In 2007 there were a total of 1,677,766 agricultural enterprises. This figure was lower than the total from the previous ISTAT census of 2005 (-2.9%) and also represents a decrease compared to 2000 (-22.1%), confirming the ongoing erosion in the sector's economic importance, as well as the operational abandonment of farmland, a trend rooted in the country's economic and social transformation. The largest concentration of enterprises is found in the South (959,642 units), representing a decrease from 2005 (-3.3%) and




an even bigger drop from 2000 (-19.9%). Next comes the North, with 449,325 units, and the Centre with 268,799 units. This last zone registered the most significant drop compared to 2000 (-28.5%).
In Italy, the number of workers employed by the primary sector has fallen over time. In 2007 agriculture accounted for 4% of all men employed by the Italian economy and 3.1% of all women. These figures, lower than the EU-25 averages, placed Italy among the countries that contribute the least manpower to agricultural activities.
Noteworthy in terms of productivity is the comparison between the primary sector and industry: the value added to base prices per unit of agricultural labour in 2008 was equal to 51.2% of the figure for industry. Within the overall overlook, however, the biological branch deserves separate consideration. Though it occupies only 8% of Italy's UAA, it constitutes an important driving force of development and income for the companies involved in biological farming. Though the surface utilised for, or being converted to, biological agriculture decreased by approximately 12.9% compare to the previous year, our country remains one of the main European user of this production technique, in terms of both surface area and number of enterprises involved.

*In 2007 agriculture accounted for 4% of all men employed by the Italian economy and 3.1% of all women.*

*The value added to base prices per unit of agricultural labour in 2008 was equal to 51.2% of the figure for industry.*

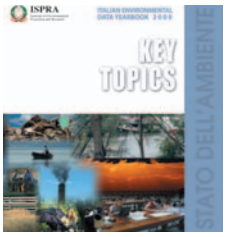
The term Standard Gross Margin (SGM) refers to "*the average level of pre-tax income in a given region or province and for a given production activity*"[15]. Used to determine the economic dimensions of farming enterprises, it is expressed in the European Size Unit (ESU), which is equal to 1,200 ECU of total standard pre-tax income.
The total national SGM for 2007 (Table II.2) was 25,000,347 ESU, making or a noteworthy increase over 2005 (+12.6%) and 2000 (+31.2%).
More than 46% of the SGM for 2007 was produced in Northern Italy, another 40% in the South, and the remaining 14% in the central regions. This break-down matches those registered in the years 2005 and 2000.

*The total national SGM for 2007 was 25,000,347 ESU, a marked in crease compared to 2005.*

Plant health products are used in protecting vegetables or vegetable products from harmful organisms, such as fungi, insects, mites, bacteria, viruses and weeds, and in favouring or regulating the vital

*In 2007 approximately 150 thousand tons of plant care products were placed on the market.*

[15] INEA definition under the RICA methodology




processes of vegetables (not including fertilisers). In 2007 approximately 150 thousand tons of such products were put on the market, a decrease of 3% compared to 2006. Fungicides account for 50.9% of the total, followed by insecticides and miticides (18.1%), herbicides (17.8%), miscellaneous products (fumigators, plant regulators, molluscicides, carriers and other) (12.9%) and biological items (0.2%). Compared to 1997, distribution has fallen by 8.1%. Decreases were registered in all categories, and especially for insecticides and miticides (-31%), apart from "miscellaneous", which rose above 39%. Sicily (Figure II.6), with more than 21,000 tons (13.7% of the national total), was the region with the highest distribution, followed by Emilia Romagna (13.4%), Veneto (12.5%), Apulia (11.1%) and Piedmont (8.6%). Almost 60% of all plant health products, therefore, are distributed in these five regions.

*Sicily, at over 21.000 tons (13.7% of the national total), is the region with the highest distribution of plant care products, followed by Emilia Romagna (13.4%), Veneto (12.5%), Apulia (11.1%) and Piedmont (8.6%).*

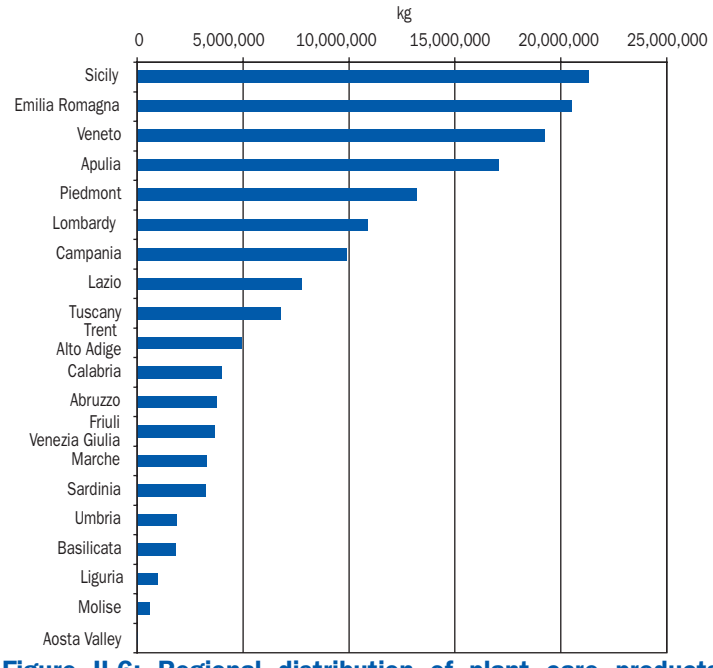
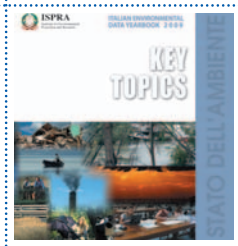



**Figure II.6: Regional distribution of plant care products (2007)[16]**

[16] Source: ISTAT data processed by ISPRA




## Transport and Mobility

Looking at all modes of transport in Italy, mobility of freight and passengers shows constant growth in recent years. Total domestic freight transport for 2008, estimated at slightly more than 230 billion km-tons, shows an increase of 5.8% over 2004. A break-down of the freight traffic data by mode of transport points to an absolute predominance of roadway traffic, which, in 2008, still absorbed 62.3% of the total km-tons transported. In the same year, the percentages absorbed by the remaining modes of transport were: 21% by sea-way ; 16.3% by railway and pipeline; 0.43% by air-way, which continues to cover only a minimal portion of domestic freight transport, being devoted primarily to international transport (Figure II.7).

*Looking at all the modes of transport in Italy, mobility of freight and passengers shows constant growth in recent years.*

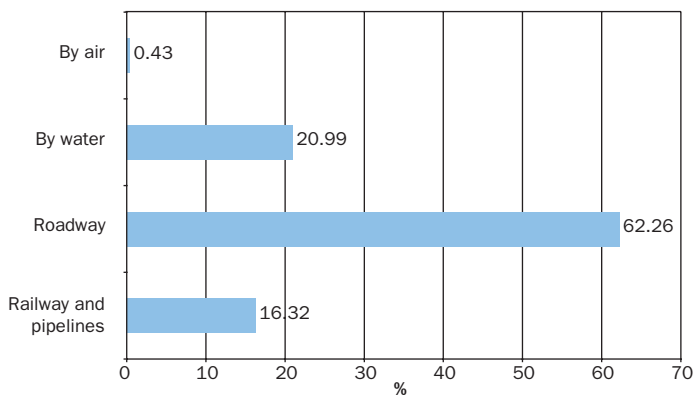


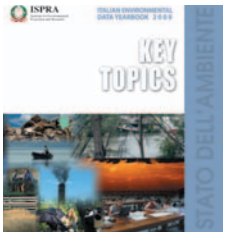

**Figure II.7: Percentage of domestic freight traffic by transport mode (2008)[17]**

*In 2008, roadway transport once again proved to be the predominant mode, accounting for 62.3% of the km-tons transported.*

Domestic passenger transport shows a fluctuating trend during the period 2004-2008, with growth of 6.5% in 2006, compared to 2005, followed by a decrease of -4.7% in 2008, as compared

*Domestic passenger transport shows fluctuating trend for the period 2004-2008, with a decrease of 4.7% in 2008, compared to 2007.*

[17] Source: CNT 2007-2008 data processed by ISPRA




to the previous year. Despite this fragmented trend, there was a slight overall increase of 1.6% between 2004 and 2008.

As in the case of freight transport, the roadway mode is clearly predominant, with 92.2% of the total. The percentages of the other modes remained virtually unchanged, with respective values of 5.8% for transport by railway and other fixed systems, 1.6% for air transport and only 0.4% for transport by sea (Figure II.8).

*Looking at domestic passenger transport, roadway travel is virtually the only mode used (92.2%).*

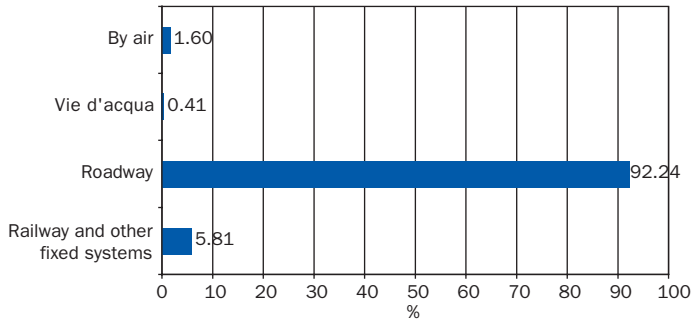



**Figure II.8: Percentage of domestic passenger traffic by mode of transport (2008)[18]**

*Commercial air travel grows by 11.8% between 2004 and 2008.*
*Vehicle traffic registers a 60% increase in km travelled on Italian highways between 1990 and 2008.*
*Between 2004 and 2007, passenger transport on the railway network rises by 5.6%, while freight transport shows a 1.2% increase.*

A more detailed analysis of traffic, broken down by the different modes of transport, highlight a variety of situations. The data on air traffic, based on the number of movements of commercial aircraft (domestic and international), though shows a growth of +11.8% between 2004 and 2008[19], they reduce of -4.3% during the last year. A long-term look at vehicle traffic (1990 – 2008) shows an approximately 60% increase in the kilometres travelled by light and heavy vehicles on Italian highways, while the result for last year (2007-2008) was a slight decrease in traffic (-0.8%)[20]. As for railway traffic 315 million train-km of passenger transport circulated in 2007 on the State Railway

[18] Source: CNT 2007-2008 data processed by ISPRA
[19] ENAC
[20] AISCAT


System (+5.6% compared to 2004), while approximately 63 million train-km of freight of traffic (-1.2% compared to 2004).

To better understand the potential pressures our country, it is necessary to examine the state of its transportat equipment and infrastructures.
As of 31 December 2007, the primary Italian roadway network (not including municipal roads) was 182,136 kilometres long, consisting of 6,588 km of motorways, 19,290 km of other roads of national importance and 156,258 km of regional and provincial roads, for an overall increase of 8.6% compared to 2000.

*As of 31 December 2007, the primary Italian roadway network (not including municipal roads) shows an overall increase of approximately 8.6% compared to 2000.*

Looking at the statistics on roadway traffic, the figures provided by the AISCAT (the Italian Association of Motorway and Tunnel Concessionaire Companies) on the volumes of traffic recorded on the motorway network operated under government concessions (5,485.9 km as of 31 December 2008), shows that the daily average theoretical vehicles in circulation in 2008 numbered more than 41 million (almost a million less than in 2007), consisting of 31.5 million light vehicles (76.2%) and 9.9 million heavy vehicles (23.8%).

As for the railway network, its total track length as of 2007 was approximately 20,035 km, or 771 km more than in 2000. More significant increases are registered in the lengths of the electrified network and of the two-track network, which grew by respective figures of 8.6% and 17.6%.

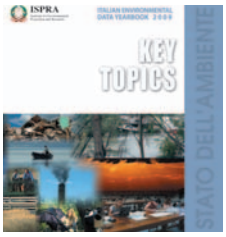
*Between 2000 and 2007 the railway network grew by 771 km.*

The available statistics also point to a significant quantity of port infrastructures in Italian territory. As of 31 December 2007, there were 263 ports, with total dock length of slightly more than 401 kilometres, making for an average of approximately 263 metres per berth and more than 1.5 kilometres per port.
Maritime transport registered an increase of 36.1% in 2007, as compared to 2001, with a total of 1,523 dockings.

*Maritime transport registered an increase of 36.1% in 2007, compared to 2001.*

Examining airport infrastructures in Italy, there were 100 airports distributed throughout Italian territory in 2007, one less than in 2006, while the airport grounds covered a surface area of approx-

*Domestic airports covered a total surface area of 150 km$^2$ in 2007, and overall*




*runway length was approximately 202 km.*

imately 150.6 km$^2$ and runway length totalled approximately 202 km.

An overview of the urbanised surface area set aside for infrastructures and the transport network is provided by Figure II.9, which illustrates the percentage of the total surface area found in for each region. The region with the highest infrastructure density is Lombardy, with a percentage of more than 12.3%, followed by set of regions in the range of 8-10%: Veneto (9.7%), Campania (8.9%), Friuli Venezia Giulia (8.3%) and Lazio (8.2%).

*The region with the highest density of infrastructures is Lombardy, with more than 12.3% of the total, followed by regions falling in a range of 8-10%: Veneto (9.7%), Campania (8.9%), Friuli Venezia Giulia (8.3%) and Lazio (8.2%).*

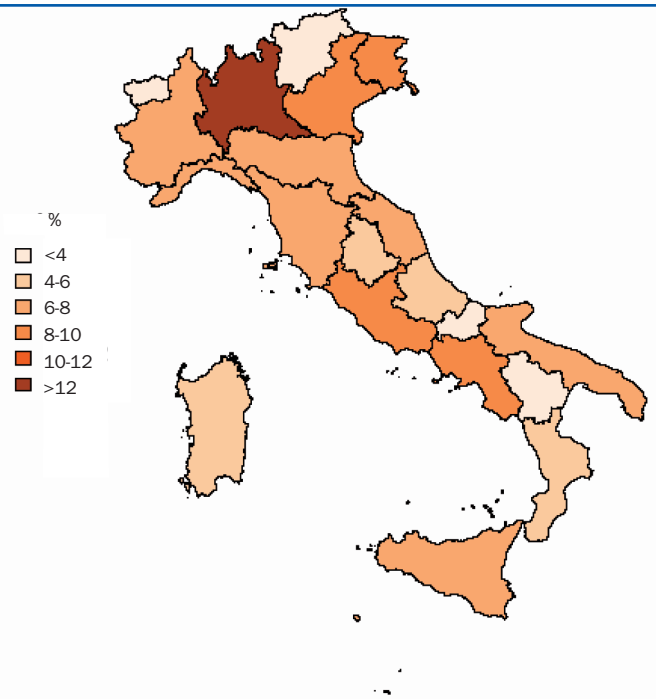
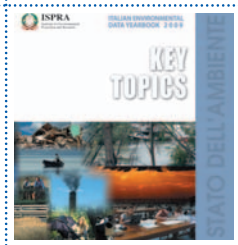



**Figure II.9: Percentage of urbanised areas set aside for infrastructures and the transport network, out of total regional surface areas (2005)[21]**

[21] Source: Ministry of Infrastructures and Transport and ISTAT and APAT-CLC 2000 (urbanised) data processed by ISPRA




## Tourism

It is impossible to address the subject of tourism without making reference to the environment, given the reciprocal interests and dynamics, based on social, historical and cultural factors, between the two sectors. There is a special tie between tourism and the environment, because tourist activities utilise environmental resources, in the broadest sense of the term, as an indispensable asset for their development, while, at the same time, the environment benefits from the resources brought into play by tourist activities, assuming such operations are compatible with the environment.

*Tourism and the environment are closely connected.*

Internationally, arrivals rose by 2% in 2008, compared to 2007. Though Europe is still the most frequently visited destination (53.1% of all international arrivals), the number of arrivals remained essentially stagnant in 2008, rising by only 0.3%, due primarily to growth of 3.1% in the central-eastern European market.

*Europe received 53.1% of international arrivals.*

In 2008, tourist arrivals and overnight stays in all of Italy's hospitality structures registered an overall decrease (respective figures of -0.6% and -0.8%). The average stay (3.9 days) remained unvaried from the previous year, in line with the trend of recent years towards more frequent trips but for shorter periods.

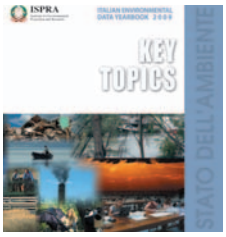
*Tourist arrivals and overnight stays in Italy fell by respective figures of -0.6% and -0.8%.*

Climate is one of the main driving factors behind the seasonal structure of tourist demand, determining its length and quality playing a key role in the choice of the destination and decisions on how much to spend. In 2008 the peak season for tourist flows remained the third quarter (with 49% of overnight stays).

*The climate is one of the key driving factors behind the seasonal structure of tourist activity.*
*In 2008, 49% of the overnight stays again occurred in the third quarter.*

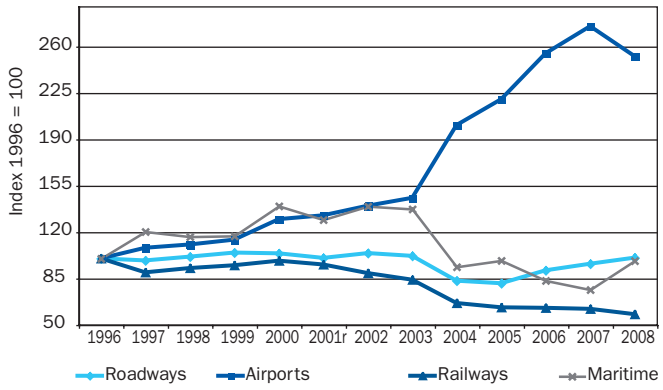
Of the total number of trips taken by Italians (roughly 122 million), 63.6% are taken in cars. The tendency of Italians to travel by air is on the rise (15.6% of the trips), due in part to the increasingly economical and widespread services (low cost/low fare), together with the trend towards "short breaks". As for the modes of transport used by foreign tourists who come to Italy, the car continues to be favoured, registering an increase (+4.7%) between 2007

*The favourite Italian mode of transport for trips is the car (63.6%).*




and 2008. In contrast, air travel as the mode of transport used by foreign tourists to reach Italy showed a decrease (-8.1%) on an annual basis for the first time since 1996, primarily to the advantage of cruise ships, which registered a significant growth (+28.5%) (Figure II.10).

*The car continued to be the preferred modes of transport for foreign tourists to Italy, growing by 4.7% between 2007 and 2008.*



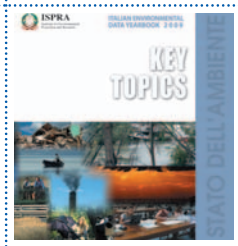

r: The 2001 data relating to border entry points by road and air have been revised, following the introduction of more sophisticated survey methodologies

**Figure II.10: Variations in the number of foreign tourists at Italian border entry points[22]**

*Tourism places a variety of environmental pressures.*

Tourism inevitably brings change with it; the yearning for environmental and cultural values, together with the desire for new experiences, can create disturbances in the balance of socio-environmental factors. Environmental pressures on the environment have a wide variety of effects, though a number of constants can be observed: elevated number of tourists, seasonal concentrations, use of the most polluting modes of transport etc.. A characteristic typical of big cities is the fact that the problems normally caused by residents have been compounded by the role of the cities as extremely popular tourist destinations.

[22] Source: Bank of Italy data processed by ISPRA




It should be noted that tourist flows significantly alter the residential density of certain Italian provinces. Under normal conditions (taking into account only the resident population), Florence, Venice, Rimini and Rome present respective population densities of 278, 342, 559, 755 inhabitants/km$^2$, while the arrival of tourists pushes these figures considerably higher. Rimini goes from 559 inhabitants/km$^2$ to 6,087 inhabitants/km$^2$ (population + tourist arrivals), making it the country's most densely populated province. The same type of jump takes place in Florence, whose resident population density is on a par with provinces such as Livorno, Lodi or Pescara, while the addition of the tourists raises the density (1,440 inhabitants/km$^2$) to a level almost twice that of the resident population density of Rome (Figure II.11).

*Tourist flows radically modify population density, as in the cases of Rimini and Florence, whose densities reach noteworthy levels with the addition of the tourists.*

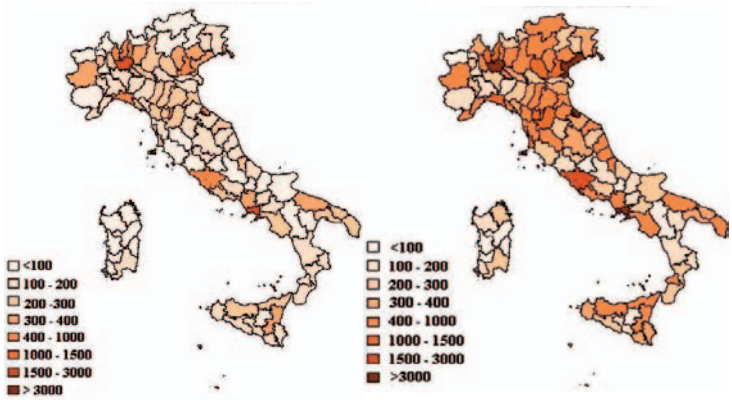


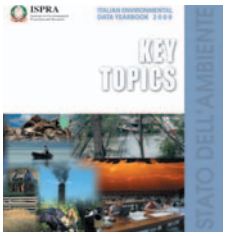

**Figure II.11: Variation in the population densities of Italian provinces taking into account tourist flows (2007)[23]**

*The map on the left, showing the "Population density", groups the Italian provinces into eight population density classes; the map on the right showing the "Total density", groups the provinces into the same eight density classes, but also takes into account the total density, i.e. Resident (Population + Arrivals)/surface area in km$^2$.*

## II.3 Potential developments

Though the ramifications of the current global economic crisis must be dealt with, one of the priorities of Italian policy is to move towards a sustainable environmental economy, enacting forms of environmental governance in order to respond in the most effective manner possible to the increasing challenge of efficiently and

[23] Source: ISTAT data processed by ISPRA




effectively managing water resources, use of the territory, biodiversity and energy, which also constitute the "cornerstones" of policies and measures for mitigation, and adaptation to climate change.

*Italy's priority environmental policies.*

The priority environmental policies, outlined by the Ministry of the Environment, Land and Sea and calling for measures of urgent intervention, are:
1. efficient management of water resources;
2. land reclamation;
3. reduction of waste generation;
4. protection of biodiversity and ecosystems;
5. clean energy and better air quality.

The fight against climate change is the chief challenge for the coming decades, though it will also serve as an opportunity to lessen current environmental pressures caused by unsustainable models of production and consumption that result in emissions of polluting substances, increased waste generation, a shortage of natural resources and a loss of biodiversity and ecosystems.

CHAPTER 1

# CLIMATE CHANGE

*In 2009 growing expectations were placed on the 15th Conference of the Parties (COP-15), held to determine the elements of a new agreement meant to go into effect in the period following that (2008-2012) covered by the Kyoto Protocol.*

*At the G8 summit in Aquila in July of 2009, there was a unanimous consensus on the importance of keeping the increase in the average global temperature below 2°C, as well as on the need to set a global objective for a noteworthy, long-term reduction in emissions.*

## Introduction

In 2009, the issue of climate change was a focal point of attention on the part of both the general public and national and international institutions, with growing expectations placed on the results of the 15th Conference of the Parties (COP-15 Copenhagen 2009), held with the objective of determining the elements of the new agreement meant to go into effect in the period following that (2008-2012) covered by the Kyoto Protocol.

In terms of public opinion as a whole, there was noteworthy awareness of this issue on the occasion of the awarding of the Nobel Peace Prize to US President Barack Obama (which came in the wake of the Nobel Prize awarded in 2007 to the to IPCC and to Al Gore, former Vice President of the United States, for his film "*The Inconvenient Truth*"). Indeed, one of the stated motives for the award of the 2009 Nobel Prize to Barack Obama was the efforts of the US President to give his country "a more constructive role in meeting the great climatic challenges the world is confronting"[1].

In terms of discussions between the different governments in preparation for the COP-15, during the G8 summit held in Aquila in July of 2009, the world leaders confirmed their intent to deal with the subject urgently and effectively, in an effort to arrive at an agreement in Copenhagen.

In the G8 forum, the leaders of industrialised countries have agreed on the need to keep global warming below 2°C compared to pre-industrial levels, as has long been requested by the European Union. Agreement was also reached on the objective of reducing global emissions by 50% by the year 2050, with a reduction of 80% by the developed countries, in order to keep global warming below 2°C (though the reductions will not be calculated from the year 1990). At the same time, the developing countries were also asked to reduce their current growth trends in emissions. And there was also a general consensus on the need to set medium-term objectives in keeping with the long-term goals and to reach a peak in global emissions as soon as possible. The active involvement of all the leading emitting countries, through quantified mitigation initiatives, is held to be an indispen-

[1] http://nobelprize.org/nobel_prizes/peace/laureates/2009/press.html

sable prerequisite for successfully dealing with climate change. The leaders have acknowledged the crucial role of technological development and know how in carrying out mitigation and adaptation initiatives in developing countries and in achieving economic growth with low levels of carbon dioxide emissions. With this in mind, and seeing that the mobilisation of adequate financial resources will be a key factor in arriving at an ambitious and widely endorsed agreement in Copenhagen, the world leaders have confirmed their intention to contribute to a joint effort for the procurement of the necessary funds (both public and private), through national initiatives and international instruments, including financial assistance. In the same period as the summit in Aquila, a meeting of the Major Economies Forum, or MEF, was held in the presence of the General Secretary of the United Nations, attended by all the leading countries in terms of emissions, meaning, in addition to the G8 nations, Australia, Brazil, Canada, China, South Korea, the European Union, India, Indonesia, Mexico and South Africa, in order to reach an agreement as wide ranging and relevant as possible on the key issues at the Copenhagen Conference.

Here too there was acknowledgement of the importance of limiting the average global temperature increase to 2°C, though, contrary to the G8, no agreement was reached on either the reductions to be achieved on a global level nor the level of funding to be made available. The leaders of the countries responsible for the most emissions, on the other hand, have decided to work together in the months leading up to the COP-15, in order to set a long-term global objective for reducing emissions by 2050. The leaders have agreed that all the countries must undertake suitable initiatives on the national level: the developed countries shall enact timely reductions of significant entity in the middle-term, while the developing countries shall undertake actions designed to guarantee a significant departure of emissions levels from the “business as usual” scenario.

The key role of the larger economies in promoting innovation was stressed, and the leaders proposed a global partnership as a way of accelerating efforts. Agreement was reached on the need for a noteworthy increase in public investment in research and devel-

opment, with the goal of doubling the level by the end of 2015. The leaders pledged that they would work to eliminate obstacles to the marketing of low-carbon-emission technologies while creating incentives to accelerate their development, spread and transfer, with an emphasis on the role of the private sector and international cooperation. There was also a broad consensus on the need to increase financing for the climate, from both public and private sources, as well as through carbon markets.

## Basic climate trends

### *Globally*

*The increase in temperature observed in recent decades, both globally and in Europe, is unusual.*

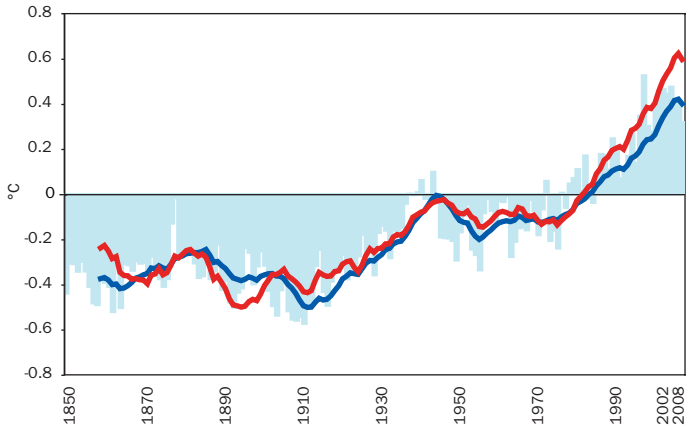
The warming of the global climate system currently stands as an undisputed fact, as shown by the increases observed in the average global atmospheric and oceanic temperatures, as well as the melting of the polar ice caps (especially in the Arctic), the shrinking of glaciers in the middle latitudes (including the covering of snow) and the rise in the average level of the oceans. The increase in the average temperature observed in recent decades, both globally and in Europe, is unusual in terms of both its extent and its rate of variation.

*As of 2008, the overall increase in average global temperature (the land-ocean system) was 0.7°C compared to the pre-industrial level.*

Based on the Fourth Assessment Report of the IPCC *(Intergovernmental Panel on Climate Change)*, the overall increase in average global temperature (the land-ocean system[2]) as of 2008 was 0.7°C compared to the pre-industrial level. The rate of warming, equal to 0.1°C per decade during the last 100 years, rose at 0.16°C per decade during the last 50 years. During the last century (1905-2005), the average temperature of the planet rose by 0.74°C, at increasingly higher rates: in the decades before 1950, the average rate of the rise was less than 0.06°C per decade, while, over the last 50 years, it increased to 0.13°C per decade, and more recently (the last few decades), it reached approximately 0.25°C per decade.
Analyses carried out by the East Anglia University, including figures

[2] In this document, the term "land-ocean" indicates that the temperature was calculated by taking into account both the temperature of the air on dry land and the surface temperature of the seas, while the phrase "land only" means that the reading refers only to the temperature of the air on dry land

for 2008, show that, of the fourteen highest annual temperature levels registered from 1850, the first year for which instrumental temperature readings were recorded, thirteen fall within the period of the last fourteen years, between 1995 and 2008[3] (Figure 1.1).




**Legend:** The lines represent the mobile averages over 10 years, calculated, respectively, for the "land-ocean" system (blue) and for the "land alone" system (red).

**Figure 1.1: Series of the annual anomalies[4] in the average global temperature (land-ocean system) between 1850 and 2008[5]**

*Of the fourteen highest annual temperature levels starting from 1850, the year in which instrumental measurement of temperatures began, thirteen fall within the last fourteen years, between 1995 and 2008.*

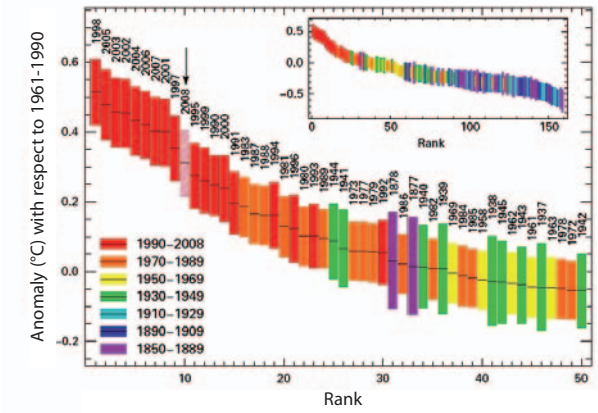
Based on the estimates of the National Climatic Data Centre of the NOAA, the year 2008, together with 2001, was the eighth warmest year of the series starting from 1880, with an average global land-ocean temperature that was 0.49 °C higher than the average for the twentieth century.

The ranking of the 50 highest years in terms of average global surface temperature, as illustrated in figure 1.2 and published by the World Meteorological Organisation, shows the year 2008 in tenth place; as a rule, the ranking of the most recent years, between 1990 and 2008, in the leading positions is confirmed. Projections based on the six emissions scenarios of the IPCC for the

[3] EEA, http://themes.eea.europa.eu/IMS/ISpecs/ISpecification20041006175027 / IAssessment1202733436537/view_content

[4] Anomalies calculated for the reference period 1961-1990

[5] Source: Climatic Research Unit of the East Anglia University




**Legend:** The insert shows the ranking of the average global surface temperatures starting from 1850. The dimensions of the bars point to an interval of confidence of 95%

**Figure 1.2: Ranking of the average global surface temperatures for the 50 warmest years[6]**

end of the 21st century forecast an increase of from 1.8 to 4.0 °C in global temperature by the period 2090-2099, as compared to the period 1980-1999[7]. As for trends in precipitation between 1900 and 2005, noteworthy increases were registered in the eastern portions of North and South America, in Northern Europe and in Northern and Central Asia, while there was reduced precipitation in the Sahel region, in the Mediterranean, in Southern Africa and in certain parts of Southern Asia. Changes in climate variables also lead to increases in the frequency, intensity and duration of extreme events, such as floods, droughts and heat waves. The frequency of intense precipitation events has risen in most portions of the earth's surface above water, in parallel with the warming trend and the heightened amount of water vapour in the atmosphere. The surface temperature of the seas, on a global level, rose by 0.038±0.011 °C per decade during the period 1850-2005, according to an estimate based on the HadSST2 dataset of the Hadley Centre. If policies of mitigation are not implemented, then, in all probability, there will be an increase in the frequency of heat waves and intense precipitation on our planet, together with a rise in the intensity of tropi-

*Changes in climate variables also lead to increases in the frequency, intensity and duration of extreme events, such as floods, droughts and heat waves.*

[6] World Meteorological Organization (2009): WMO statement on the status of global climate in 2008. Report WMO, n. 1039, Geneva 2009

[7] IPCC, 2007, *Climate Change 2007 – Fourth Assessment Report-WGI*

cal cyclones, as well as a decrease in available water supplies in many semi-arid areas, such as the Mediterranean Basin, with noteworthy repercussions in terms of the environment, society and economics.

### *Europe*

As of 2008, the temperature of the land-ocean system in Europe had increased by approximately 1.0 °C, and the temperature of dry land by 1.3 °C, over the pre-industrial levels, a greater rise than the global increase[8]. Projections point to an average temperature increase of between 1.0 and 5.5 °C by the end of this century. Based on the A1B scenario[9], for example, global climatic models estimate an average increase in temperatures between the periods 1980-1999 and 2080-2099 in a range of 2.3 to 5.3 °C in Northern Europe, while an increase of between 2.2 and 5.1 °C would be registered in Southern Europe and the Mediterranean regions[10]. Naturally, when different emissions scenarios are employed, the estimated intervals for temperature increase vary considerably. The greatest warming in Northern Europe is forecast for the Winter season, while the highest increases for the Mediterranean are expected in summer (Figure 1.3).

*As of 2008, the temperature of the land-ocean system in Europe had increased by approximately 1,0 °C, and the temperature of dry land by 1.3°C, over the pre-industrial levels, a greater rise than the global increase.*

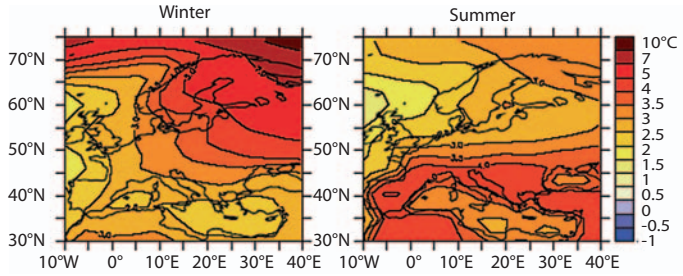



**Figura 1.3: Variation in the average temperature in Europe between 1980-1999 and 2080-2099, estimated on the basis of the A1B emissions scenario[11]**

*Based on the A1B scenario, global climatic models estimate an average temperature increase, between the periods 1980-1999 and 2080-2099, in a range of 2.3 and 5.3 °C in Northern Europe and a range of 2.2 and 5.1 °C in Southern Europe and the regions of the Mediterranean.*

[8] EEA, http://themes.eea.europa.eu/IMS/ISpecs/ISpecification20041006175027 / IAssessment-1202733436537/view_content

[9] Scenario characterised by extremely rapid economic growth, a global population that peaks around the middle of the 21st century, and then begins to decline, the rapid introduction of new and more efficient technology and a balanced distribution of the different sources of energy (IPCC, *Special Report on Emission Scenarios*, 2000)

[10] IPCC, 2007, *Climate Change 2007 – Fourth Assessment Report-WGI*

[11] Source: IPCC, *Fourth Assessment Report*

*During the 20th century, precipitation in creased between 10% and 40% in the regions of Northern Europe, while it decreased by as much as 20% in certain parts of Southern Europe.*

Over the last 50 years, changes have been observed in the distribution of extreme temperatures, with an increase in the frequency and intensity of extremely hot events and a decrease in episodes distinguished by low temperatures. Projections point to a continuation of this trend in the future as well. In terms of precipitation in Europe, an increase of between 10% and 40% was observed in the northern regions during the 20th century, together with a decrease of up to 20% in certain parts of Southern Europe[12].

Based on the A1B scenario, global climate models estimate an increase between 0% and 16% in cumulated annual precipitation between the periods 1980-1999 and 2080-2099 for Northern Europe, with a decrease of between 4 and 27% in Southern Europe and the Mediterranean regions, showing peak levels in the Summer season[13] (Figure 1.4). It should be kept in mind that projections of precipitation, unlike those of temperature, which are distributed fairly uniformly over space, can differ significantly even within relatively small horizontal distances, especially in regions where the lay of the land is complex. It has also been estimated that the frequency and intensity of extreme precipitation events shall increase, especially in the northern regions, while there will be a rise in periods of drought, especially in Southern Europe.

*Based on the A1B scenario, the global climate models estimate an increase in the range of 0% to 16% in cumulated annual precipitation between the periods 1980-1999 and 2080-2099 in Northern Europe, while a decrease of between 4% and 27% is forecast for Southern Europe and the Mediterranean regions, especially during the Summer season.*

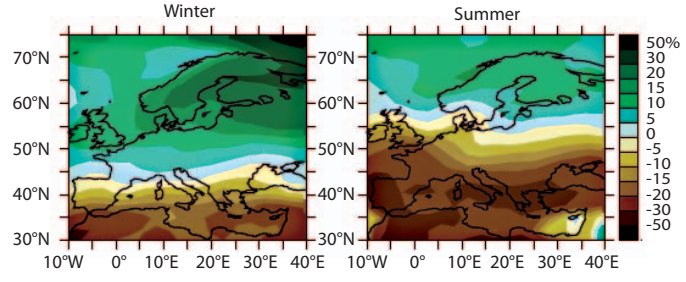



**Figure 1.4: Percentage variation in cumulated precipitation in Europe between the periods 1980-1999 and 2080-2099, estimated on the basis of the A1B emissions scenario[14]**

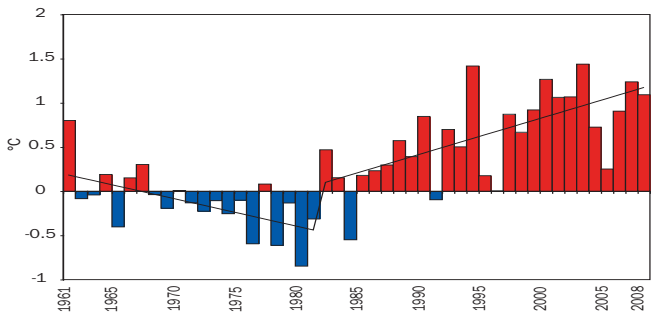
[12] EEA, 2008, *Impacts of Europe's changing climate – 2008 indicator-based assessment. EEA Report* n. 4/2008
[13] IPCC, 2007, *Climate Change 2007 – Fourth Assessment Report - WGI*
[14] Source: IPCC, *Fourth Assessment Report*

Finally, the surface temperature of Europe's seas is increasing more rapidly than the rates observed in the rest of the globe, with the highest rates recorded in the seas of Northern Europe rather than the Mediterranean. Over the last 25 years (1982-2006), the rate at which the temperature of Europe's seas has risen has been roughly 10 times greater than the figure registered for the period 1871 to 2006[15].

### *Italy*

Based on the CNR-ISAC studies (summarised in last year's "Key Topics"), the average annual temperatures in Italy have risen by 1.7°C over the past two centuries (working out to more than 0.8°C per century), though the most significant portion of this increase has occurred over the last 50 years, during which the increase has been approximately 1.4°C (making for a rate of approximately 2.8°C per century). Temperature trends in Italy are updated annually by ISPRA by establishing uniform criteria for the series of results recorded in the period 1961-2008 and applying statistical models, including non-linear ones, to identify and estimate trends. It is estimated that the average temperature in Italy fell between 1961 and 1981, at which point it rise through 2008, for an overall increase of approximately 1.0 °C (Figure 1.5)

*Estimates of trends in average annual temperatures in Italy for the period 1961-2008 point to a decrease in the average temperature between 1961 and 1981, followed by an increase through 2008, for an overall rise of approximately 1.0 °C.*




**Legend:** The staggered line represents the trend estimated with a "*sloped steps*" statistical model[16]

**Figure 1.5: Anomalies in the average temperature in Italy[17]**

*Average annual anomalies in the average temperature between 1961 and 2008, as compared to the normal value calculated for the period 1961-1990, point to a decrease in the average temperature in Italy between 1961 and 1981, followed by an increase through 2008, for an overall rise of approximately 1.0 °C.*

[15] EEA, 2008, *Impacts of Europe's changing climate – 2008 indicator-based assessment. EEA Report* n. 4/2008

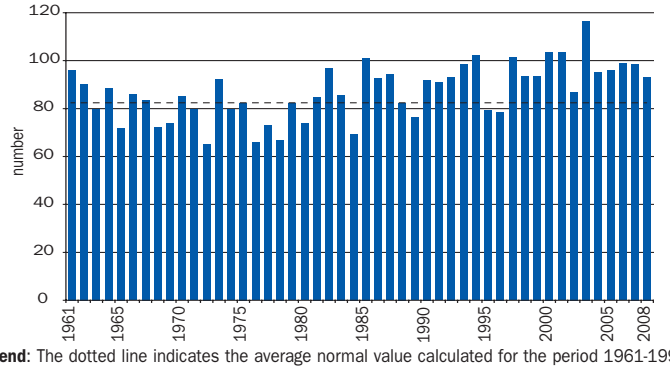
[16] Toreti A. and Desiato F., 2008, *Temperature trend over Italy from 1961 to 2004*, *Theor. Appl. Climatology*, doi 10.1007/s00704-006-0289-6

[17] Source: Italian Air Force data processed by ISPRA

*The increase in the average temperature registered in Italy in recent decades is higher than the global average.*

The increase in the average temperature registered in Italy in recent decades is greater than the global average. In the years 2007 and 2008 the anomalies compared to the thirty-year period 1961-1990 were, respectively, +1.24 and +1.09 °C, in contrast to a global average of 0.67 and 0.53 °C. The year 2008 was the seventeenth consecutive year to register a positive anomaly, and the anomaly was the fifth largest since 1961[18]. A detailed seasonal analysis of the trends for northern, central and southern Italy shows that the increase in average temperature was noteworthy throughout the country in Autumn starting from 1970 and in summer from 1980, while, during the entire period 1961-2006, there were significant increases in the north in Winter and in the central-southern regions in Spring[19]. The warming trend can also be observed in an analysis of extreme temperature levels. A trend analysis of the period 1961-2008 points to an estimated 12% average increase in "summer days"[20] (Figure 1.6), plus an average 42% in "tropical nights", compared to the climatological average[21] (Figure 1.7).

*There was an estimated average increase of 12% in the number of "summer days" during the period 1961-2008, meaning days with a maximum air temperature of more than 25 °C.*




**Legend**: The dotted line indicates the average normal value calculated for the period 1961-1990

**Figure 1.6: Annual average number of summer days between 1961 and 2008[22]**

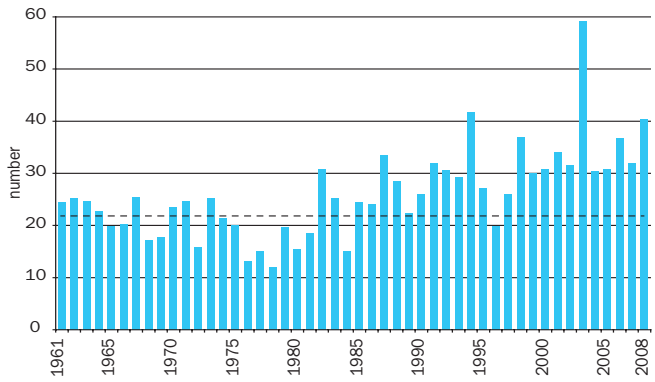
[18] ISPRA, *Gli indicatori del clima in Italia nel 2008*, Report from the State of the Environment Series, no. 12/2009, Year IV

[19] Toreti A., Desiato F., Fioravanti G. and Perconti W., 2009, *Seasonal temperatures over Italy and their relationship with low-frequency atmospheric circulation patterns*, Climatic Change, doi 10.1007/s10584-009-9640-0

[20] Number of days with a maximum air temperature of more than 25 °C

[21] Number of days with a minimum air temperature of more than 20 °C

[22] Source: Stations of the network of the Italian Air Force data processed by ISPRA




**Legend**: The dotted line indicates the average normal value calculated for the period 1961-1990

**Figure 1.7: Average annual number of tropical nights between 1961 and 2008** [23]

*There was an estimated annual increase of 42% in the number of "tropical nights" during the period 1961-2008, meaning nights with a minimum air temperature of more than 20 °C.*

In terms of long-term trends in precipitation, studies of the CNR[24] indicate that, "As a rule, the trends are negative, though only to a slight extent and often without much statistical significance. The magnitude of the reduction in precipitation is on the order of 5% per century; it would appear to be traceable primarily to Spring, the season for which a reduction of nearly 10% per century in precipitation was recorded"[25].

In analysing the most recent period, ISPRA has examined the annual and seasonal precipitation series for northern, central and southern Italy[26]. The annual series do not point to statistically meaningful trends, while the Winter series in northern Italy shows an average decrease of 1.47 mm/year in precipitation between 1961 and 2006 (Figure 1.8).

*The precipitation series for Northern Italy shows an average decrease in precipitation of 1.47 mm/year between 1961 to 2006.*

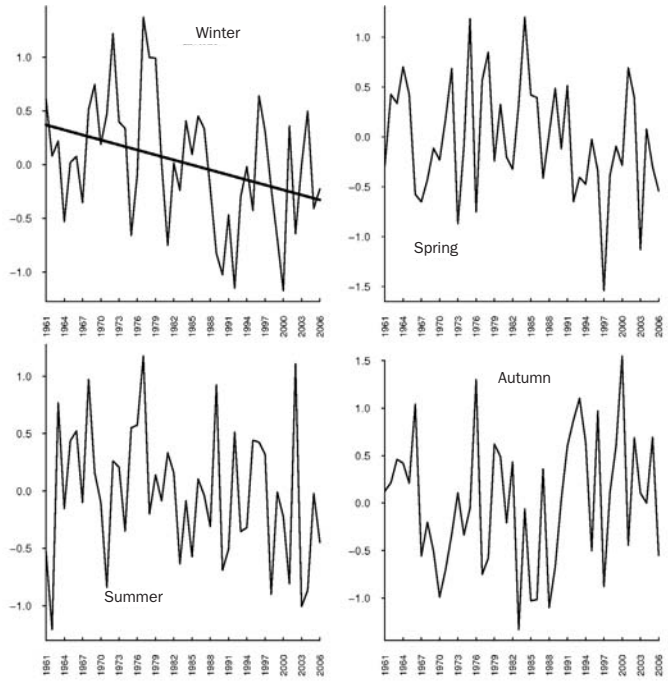
[23] Source: Stations of the network of the Italian Air Force data processed by ISPRA

[24] Brunetti, M. et al. 2006, Temperature and precipitation variability in Italy in the last two centuries from homogenized instrumental time series, International Journal of Climatology, vol. 26:345-381

[25] Nanni T. and Prodi F., 2008, Energia, no.1, 2008, pp. 66-71

[26] Toreti A., Desiato F., Fioravanti G. and Perconti W. 2009, *Annual and seasonal precipitation over Italy from 1961 to 2006, International Journal of Climatology*, doi 10.1002/joc. 1840

*The precipitation series for Northern Italy shows an average decrease in precipitation of 1.47 mm/year between 1961 to 2006.*




**Legend**: On the Winter graph, the vertical axis stands for the estimated linear trend

**Figure 1.8: Series of standardised anomalies of seasonal precipitation in Northern Italy[27]**

In order to determine whether there were any trends involving extreme precipitation events, the following indicators were analysed: "consecutive dry days" (CDD) index, meaning the maximum consecutive number of days with precipitation of less than 1 mm; "very wet days" (R95p) and the "extremely wet days" (R99p) indexes, meaning the number of days in the year when there is precipitation in excess of the 95th (99th) percentile of the climatological distribution of daily precipitation between 1961 and 1990; and the "simple

[27] Source: Toreti A., Desiato F., Fioravanti G. and Perconti W. 2009, *Annual and seasonal precipitation over Italy from 1961 to 2006, International Journal of Climatology*, doi 10.1002/joc.1840

daily intensity" index (SDII), meaning the annual precipitation divided by the number of days with precipitation greater than or equal to 1 mm. The CDD is pertinent to the duration of periods of drought, while the other indicators (R95p, R99p and SDII) provide statistical analyses of events of intense precipitation.
A preliminary analysis of these indexes on a sample group of approximately 50 stations shows no statistically significant trend between 1950 and 2006. However, the limited number of sufficiently continuous times series of controlled quality, plus the fact that they are distributed unevenly within the territory, make it impossible, for the moment, to determine whether or not there are significant trends concerning extreme precipitation events in Italy.

## Impacts and vulnerabilities

Observations made on dry land and on the oceans show – as is illustrated by the Fourth Assessment Report of the IPCC - that many natural systems have been affected by regional climate change, and especially by increases in temperature.
On the global level, in keeping with the warming trend observed, most of the components of the cryosphere are undergoing a generalised reduction in their extension, and at an increasingly rapid pace in recent decades.
The level of the sea rose at a rate of approximately 1.7-1.8 mm a year during the last century, with increase of up to 3 mm a year during the last decade, and the consequences are being felt in many coastal regions. In marine and aquatic ecosystems, many changes in phenology and biogeography, meaning the phases of the development of organisms and the distribution of species, are tied to increases in water temperature, as well as to changes in salinity, levels of oxygen and circulation. Studies of land biological systems point to impacts of global warming over the last 30-50 years, such as the earlier occurrence of Spring and Summer phenological phase and the extension of the growth season in the medium and high latitudes, as well as increased vulnerability of certain species, with cases of extinction on the local level.
In recent years, repeated large-scale forest fires have been associated with drought episodes in the Mediterranean area and in North Africa, as well as in North America.

*Observations on both dry land ad oceans show that many natural systems have been affected by regional climate changes, and especially by increased temperatures.*

Climate change affects not only physical and biological systems, but also socio-economic sectors that depend on climate conditions, and which are already undergoing the consequences, such as farming, fishing, tourism, energy and health, as well as financial services and insurance.

Still, additional efforts are indispensable for reinforcing the basic knowledge on climate change and on the related impact on natural systems and socio-economic sectors, so as to be able to formulate suitable adaptation measures.

This is the direction taken by the initiatives of the IPCC, which recently stressed the need to improve the level of knowledge on impacts, vulnerability and adaptation by pursuing the regional analyses at greater depth. These evaluations shall be included in a specific section of the contribution of Working Group II to the Fifth Assessment Report, expected to be published in the early months of 2014.

In Europe as well, as shown by the latest report of the European Environment Agency on the impacts of climate change[28], many natural systems, plus a large number of socio-economic sectors, have already undergone the consequences of climate change, namely loss of biodiversity, reduced quantities and quality of water resources, risks to human health, damage to farming and forestry activities, to tourism and to the energy and transport sectors. The most vulnerable areas of Europe are mountainous zones, the Mediterranean area, coastal regions and the Arctic, and this will increasingly be the case unless, in addition to a noteworthy reduction in global emissions of greenhouse gases, the measures needed to adapt to the impact of the instances of climate change already underway, and to moderate them, are taken[29].

In the decades to come, overall national water resources shall tend to decrease, on account of lower levels of precipitation and higher levels of evapo-transpiration, as well as the procurement of water supplies. The situation shall prove most critical in Southern Italy, were water supply is already under stress and have far-reaching

[28] EEA, 2008. *Impacts of Europe's changing climate – 2008 indicator-based assessment*. EEA *Report* no. 4/2008

[29] For more in-depth information, see the 2008 edition: Key Topics 2008 – Yearbook of Environmental Data. ISPRA, 2009

implications for farming, tourism, health, industrial production, urbanisation and, last but not least, the insurance sector.
The climate trends underway, and those forecast under the IPCC scenarios, shall shift to higher latitudes climatic and environmental conditions typical of the Mediterranean area. This means that the ecological and forestry systems, and the natural environments, of the Mediterranean shall tend to "migrate" towards western and northern central Europe. However, the pace of the climate change underway is far more rapid that the rate at which the vegetable species are able to colonise the new spaces, especially in the case of the dominant forest species: what can be expected, therefore, is a gradual "breaking up" of many ecosystems, resulting in modifications in the landscape, with noteworthy influences on the agriculture, tourism and leisure sectors, as well as on residential housing.
Even a limited increase in sea-level, along with an intensification of extreme events, such as exceptionally high surges, will aggravate to a noteworthy extent existing problems in coastal environments. A number of low-lying coastal plains (there are roughly thirty major ones, making for a total of approximately 1400 km of linear extension) could be flooded, in addition to which all the low-lying, sandy coastal areas (totalling approximately 4000 km) could be vulnerable to problems of acute coastal erosion, infiltration of salt water in coastal fresh-water tables and damage to the biodiversity of coastal wetlands, especially if their altitude already places such areas below sea level (as in the case of the entire upper Adriatic coastal zone). This problem could have significant effects not only in terms of a loss of biodiversity, with serious consequences for production activities in coastal zones, but, to an even greater extent, and recreational and tourist activities, even reaching the point of threatening historic, artistic and cultural resources, as in the case of Venice.
In addition to possible damage to natural resources, the environment, the surrounding territory and economic activities, there could also be impacts, secondary but worthy of note nonetheless, in terms of work and employment, and as regards social and medical wellbeing, especially for the part of the population most vulnerable to climate change.

This year the European Environment Agency has focussed particu-

*The Alpine environment is one of the most vulnerable in Europe.*

lar attention on the Alpine environment, one of the most vulnerable, and on the impact that climate change can have on water resources and on the socio-economic sectors that depend on such environments and resources[30].

The effects of climate change are already plainly visible from the observation of certain glaciers and the variations they have undergone. Like the majority of the glaciers on the European continent, the mass of the Alpine glaciers is decreasing (Figure 1.9).

*The majority of the glaciers on the European continent are losing mass.*

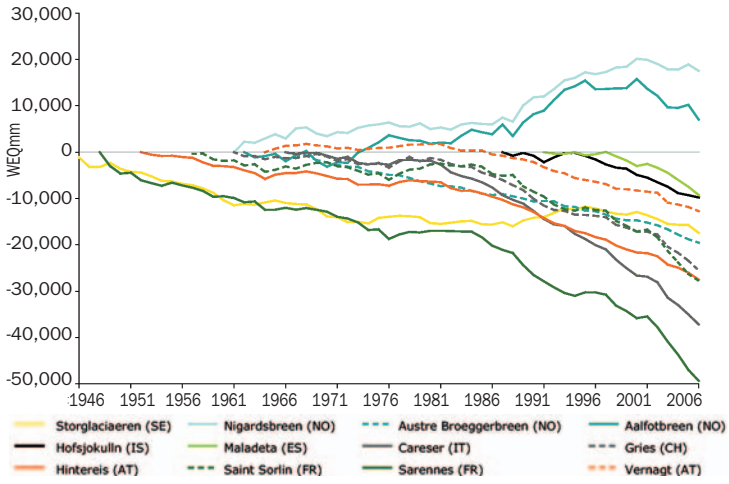



**Figure 1.9: Balance of the cumulative net mass of European glaciers between 1946 and 2006[31]**

*Between 1850 and the end of the 1970's, the Alpine glaciers lost a third of their surface area and half of their volume. Starting in 1985, the trend was found to be accelerating, with 25% of the remaining glacial mass lost by the year 2000. During the exceptionally hot season of 2003, a further*

Between 1850 and the end of the 1970's, the Alpine glaciers lost a third of their surface area and half of their volume. Starting in 1985, the trend was found to be accelerating, with 25% of the remaining glacial mass lost by the year 2000. During the exceptionally hot season of 2003, a further reduction of 5-10% was

[30] EEA, 2009, *Regional climate change and adaptation – The Alps facing the challenge of changing water resources*, EEA Report No 8/2009

[31] Source: EEA, 2008, *Impacts of Europe's changing climate — 2008 indicator based assessment.* EEA Report 4/2008, JRC Reference Report JRC47756. Joint EEA–JRC–WHO report

registered, making for a loss equal to roughly two-thirds of the glacial mass as of 1850.
The Norwegian coastal glaciers, which expanded up through the 1990's, have initiated a phase of retreat, due to lower levels of Winter precipitation and increased Summer melting.
The glaciers of the Svalbard Islands are losing mass at lower altitudes, while the glacial fronts of almost all glaciers are in retreat. Estimates for the Svalbard Islands as a whole show an overall negative balance, with unmistakable signs of accelerated melting, especially in the western area.
Recent studies point to a clear-cut rise in the annual reduction in average global glacial thickness, starting from the new millennium (0.5 m), as compared to the period 1980-1999 (0.3 m). The centuries-long retreat of Europe's glaciers can be traced primarily to increased temperatures in Summer.
In the case of the Alpine region, a noteworthy increase in temperature was registered during the last century: approximately 2 °C, more than double the average rate of warming observed in the northern hemisphere. In addition, an upward trend in precipitation was observed in the northern Alpine zone, while precipitation decreased in the southern sector of the Alps[32].
With rising temperatures and changes in rates of rain and snow, therefore, global warming poses a serious threat to the Alpine hydrological system, as well as to the environmental, social and economic systems that depend on it[33].
A number of the effects of climate change observable both globally and in Europe can already be noted in Italy as well: erosion of coastal areas, desertification, melting of glaciers, scarcity of water, slope instability and risks to health are only some of the examples[34].
Give its sensitivity to increased temperatures and its limited adaptive capacity, the Alpine environment proves to be one of the most vulnerable in our country as well, in keeping with what

*reduction of 5-10% was registered, making for a loss equal to roughly two thirds of the glacial mass as of 1850.*

*The centuries-long retreat of Europe's glaciers can be traced primarily to increased Summer temperatures.*

*In Italy, the Alpine environment is considered to be one of the most vulnerable to climate change.*

[32] EEA, 2009, *Regional climate change and adaptation – The Alps facing the challenge of changing water resources*, EEA Report No 8/2009
[33] Convenzione delle Alpi, Segnali alpini – Edizione speciale 2, 2009. *L'acqua e la gestione delle risorse idriche – Relazione sullo Stato delle Alpi*
[34] For a more detailed description of the impact of climate change on the Italian territory, see the 2008 edition: Key Topics 2008 – Yearbook of Environmental Data. ISPRA, 2009

has been observed in the rest of Europe[35].
Starting from the second half of the 19th century, Italian glaciers have undergone a phase of intensive contraction, resulting in the loss of 40% of their surface area: many minor glaciers have disappeared, while larger ones have broken down into smaller units[36]. Measurements of the glacial mass balance, indicating the algebraic sum of the mass of accumulated ice, the result of the snow precipitation, and the mass lost during the melting period, provides direct, pertinent information on the effect of the climate on glaciers, though the scope is limited, due to the reduced availability of adequate data from the past, except in the case of the Caresèr glacier (Figure 1.10).

*The five glacial bodies considered show a general trend towards deglaciation and melting, developments common to much of the planet's glaciers.*

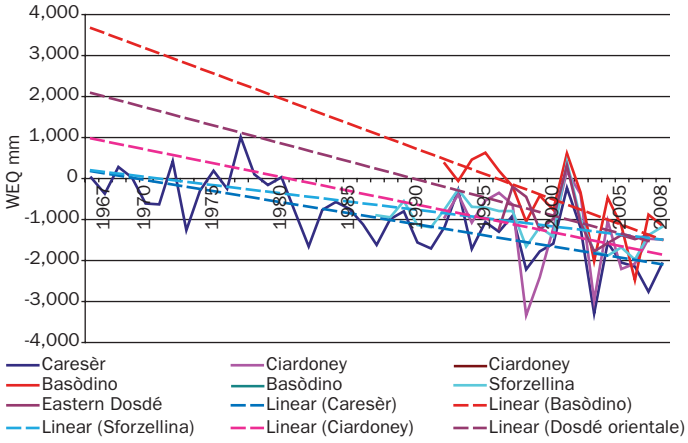



**Figure 1.10: Net mass balance of the glaciers Caresèr, Ciardoney, Basòdino, eastern Dosdé and the Sforzellina, plus the related trend lines[37]**

[35] APAT, Ministry of the Environment, Land and Sea, 2007. *Gli eventi preparatori della Conferenza – Sintesi dei lavori*
[36] Source: The Italian Glaciology Committee http://www.disat.unimib.it/comiglacio/comitatoglaciologico.htm
[37] Sources: Italian Glaciology Committee – Trent SAT Glaciology Committee, in collaboration with the Autonomous Province of Trent, Department of Civil Engineering and the Environment of the University of Trent, Tridentino Museum of Natural Science (Caresèr); Italian Meteorological Society (Ciardoney); Swiss Weather Service (Basòdino); Italian Glaciology Committee (Sforzellina and eastern Dosdè)

Figure 1.10 illustrates the changes that have occurred in 5 glacial bodies representing different climate sectors: the Basòdino glacier in the northwestern Alps, the Caresèr in the central Alps, the eastern Dosdè of the Piazzi-Campo chain in Lombardy, the Sforzellina on the Lombardy side of the Ortles-Cevedale and, finally, in the western Alps, the Ciardoney glacier. As is the case for most of the planet's glaciers, all the glacial bodies observed show a general tendency towards deglaciation, with an especially evident example being the trend for the Caresèr glacier, which has been consistently negative since back in 1981.
Figures 1.11, 1.12 and 1.13 illustrate the changes in the average minimum altitude of the fronts of a number of glacial units. At first, data was considered (starting from 1958) for a set of 1,028 individual glacial units (329 in the western Alps, 545 in the central Alps and 96 in the eastern Alps) while later, the focus was narrowed to a subset held to be significant, and open to variation from year to year. All the glaciers for which data were recorded have a surface area of more than 12 acres. Each glacier has distinctive characteristics (altitude, substrate, exposure, morphology etc.): depending on the type of glacial unit involved, an effective retreat does not always correspond to an evident increase in the minimum altitude of the front.

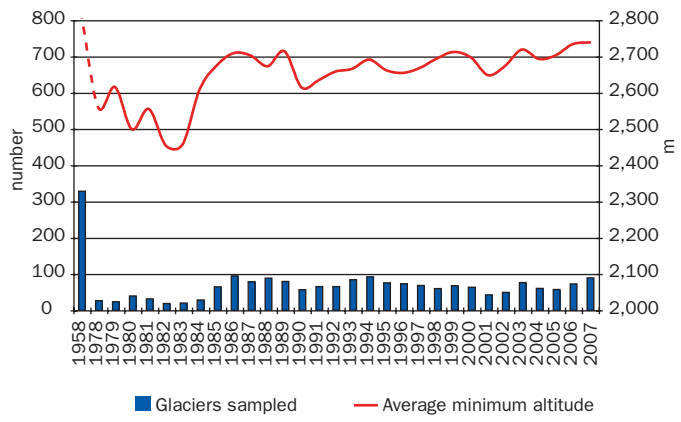



**Figure 1.11: Changes in the average minimum altitude of the glacial fronts in the western Alps[38]**

*The rise in the minimum altitude in the western Alps is hard to ignore.*

[38] Source: Italian Glaciology Committee data processed by ISPRA

*In the central Alps, the tendency of the glaciers to retreat is confirmed by the overall trend, though with a number of discrepancies.*

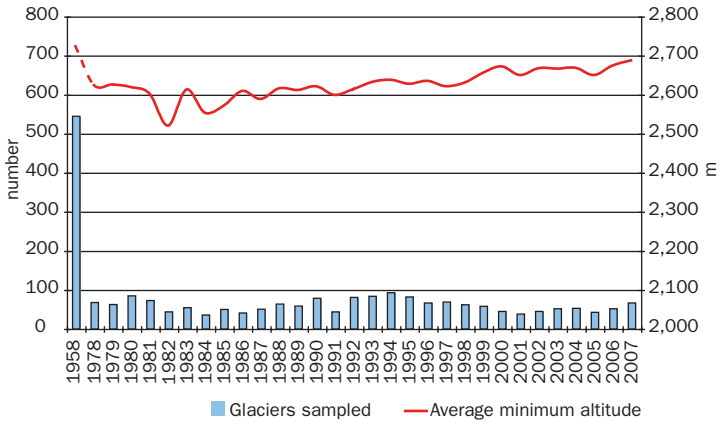



**Figure 1.12: Changes in the average minimum altitude of the glacial fronts in the central Alps[39]**

*In the eastern Alps, the tendency of the glaciers to retreat is confirmed by the overall trend, though with a number of discrepancies.*

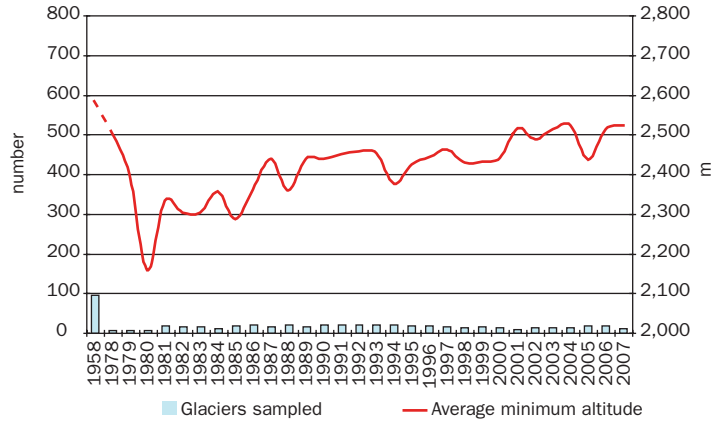



**Figure 1.13: Changes in the average minimum altitude of the glacial fronts in the eastern Alps[40]**

[39] Source: Italian Glaciology Committee data processed by ISPRA
[40] Source: Italian Glaciology Committee data processed by ISPRA

Changes in the glacial fronts point to an overall declining trend, meaning a rise in the average minimum altitude of the fronts.
The most recent changes show different trends in the three Alpine sectors: in the western Alps, the rise in the minimum altitude is fairly notable, while, in the central and eastern Alps, the withdrawal is demonstrated by the overall trend, though with a number of discrepancies[41].
Further scientific observation demonstrates, beyond any reasonable doubt, the impact of climate variations on the cryosphere and on the Alpine hydrological cycle, in the form of a reduction in the snow covering, a rise in the snow line and thawing of the permafrost, as well as variations in the outflow of watersheds and a decrease in available water resources.
These variations will have a particularly significant effect, and increasingly so in the future, on slope stability, biodiversity and the economic sectors that depend on water, especially tourism, energy generation and agriculture.
Winter tourism in the Alps is probably the economic sector that will suffer the heaviest losses on account of climate change, due to the reduced availability of snow in quantities sufficient for skiing. At present, the LAN, or Snow Reliability Line, meaning the average altitude above which precipitation in the form of snow, together with the temperature, guarantee at least 100 days a year when there are 30 cm of snow, is found at approximately 1,500 metres above sea level[42]. Of the 251 ski complexes in operation today in Italy, only 167, meaning 66%, have at least half of their surface located above the LAN, and can therefore be considered reliable in terms of the presence of snow (Table 1.1).

*Climate variations have an impact on the cryosphere and on the Alpine hydrological cycle, reducing the snow covering, raising the snow line and thawing the permafrost, in addition to causing variations in the outflow of watersheds an d a decrease in available water resources.*

*In the Alps, winter tourism is probably the economic sector that will suffer the largest losses on account of climate change, due to the reduced availability of sufficient quantities of snow for skiing.*

[41] ISPRA, 2009, Yearbook of Environmental Data 2009
[42] FEEM, 2008. *Cambiamenti climatici e strategie di adattamento in Italia – Una valutazione economica*

**Table 1.1: Reliability of snow in Alpine ski resorts[43]**

| Region | Reliable ski resorts (with at least half their surface located above the LAN) | Total ski complexes |
|---|---|---|
| | no. | |
| Aosta Valley | 22 | 25 |
| Piedmont | 30 | 54 |
| Lombardy | 21 | 33 |
| Veneto | 14 | 46 |
| Trentino | 25 | 34 |
| Alto Adige | 54 | 54 |
| Friuli Venezia Giulia | 1 | 5 |
| **ITALY** | **167** | **251** |

Under the various scenarios for temperature increases, and resulting rises in the LAN[44], a large part of the ski resorts could gradually lose reliable snow covering, leading to massive economic losses.

*Looking at the energy sector, the impact of climate change on Alpine water resources plays a key role in the production of hydroelectric energy.*

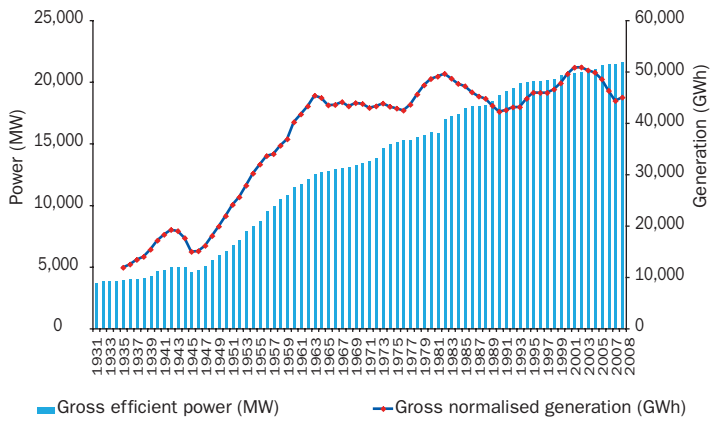
Looking at the energy sector, the impact of climate change on Alpine water resources plays a key role in terms of hydroelectricity generation, a fundamental economic resource for the entire area and a major factor in Italy's national energy balance, seeing that the presence of the glaciers in the Alps makes possible intensive use of water as a source of energy.

However, while in the past hydroelectricity was long Italy's main energy source, today it covers approximately 15-18% of the national demand for energy. At the same time, available hydroelectric capacity has risen significantly in absolute terms (Figure 1.14).

[43] Source: Ministry of the Environment, Land and Sea and the European Academy of Bolzano-EURAC, 2007. *Data and elaboration on the Italian Alpine and Pre-Alpine Ski Stations, Ski Facilities and Artificial Snowmaking*

[44] It is estimated that both the snow line and the line of snow reliability (LAN) can rise by 150 m for each °C of temperature increase. Assuming a constant upward trend, this would result in an increase of from 300 m to 600 m in the LAN altitude, due to an increase of from 2°C to 4°C in temperature

*Hydroelectricity was long Italy's main source of energy, but today it covers approximately 15-18% of the national energy demand. In absolute terms, however, available hydroelectric capacity has risen significantly.*




**Legend**: Hydroelectricity generation has been normalised to attenuate annual fluctuations[45]

**Figure 1.14: Gross hydroelectricity generation and installed capacity in Italy through 2008[46]**

The trend in hydroelectricity generation can provide noteworthy indications regarding variations in the hydrological cycle as a result of changing climate conditions, especially if consideration is also given to the development over time of the installed capacity for electricity generation. Installed capacity shows a constant increase, while electricity generation followed a parallel trend during the period 1931-1963, but later showed periodic fluctuations around an average level; the slightly upward trend did not appear to be precisely correlated to the available capacity.
In the short term, it is foreseeable that the melting of the glaciers will send much more water to the power plant turbines. But over the medium-long term, the gradual reduction and loss of the glaciers will pose a threat to an important source of renewable energy.

[45] Hydroelectricity generation was normalised under the criteria found in Directive 2009/28/EC (Annex II). Gross production, which includes the energy for pumping, reflects the production average for a period of five years
[46] Source: TERNA S.p.A. data processed by ISPRA

*The increase in extreme events and hydrogeological risk could pose a threat to certain crops found in unstable, exposed areas, while higher temperatures and reduced water supply of water could have long-term negative consequences on Alpine crops.*

With regard to agriculture, there is still little documentation on the impact of the climate change underway in the Alpine area. In the short to medium term, an increase in productivity can actually be observed, due to the fertilising effect of $CO_2$. However, the increase in extreme events and hydrogeological risk may pose a threat to certain crops found in unstable, exposed areas. At the same time, higher temperatures and reduced water supply could have long-term negative consequences on Alpine crops, including feed crops and pasture areas, with related effects on livestock breeding.

## Pressures on the climate system

*Much of the warming observed in the last 50 years can be traced to human activities.*

Without meaning to overlook the effects of natural phenomena, such as the variability of the intensity of solar radiation, the vast majority of the scientific community is convinced that "There are new and even more meaningful elements" for holding that "most of the observed warming over the last 50 years is likely to have been due to human activity"[47]; these results receive ample confirmation in the Fourth Assessment Report on Climate Change of the IPCC, which reiterated that, "warming of the climate system is unequivocal", and that human activities can be pointed to as the causes for this warming with a "very high confidence"[48].
With regard to $CO_2$, the main greenhouse gas, the average global atmospheric concentration of carbon dioxide has risen from 280 ppm during the period 1000-1750 to 385 ppm in 2008, corresponding to a growth in carbon dioxide emissions from roughly zero to 31.2 billion tons, taking into account solely emissions from the use of fossil fuels in combustion processes and in cement production[49]. According to the IPCC assessments of the carbon cycle, between 1750 and 2000 an amount of fossil fuels equal to approximately 390 billion tons of carbon was extracted from below the ground and burned, producing, in turn, approximately 1400 billion tons of carbon dioxide. Of this quantity, 57% was

[47] IPCC, 2001, Climate Change 2001 – Synthesis Report
[48] IPCC, 2007, Climate Change 2007 – WG-I, WG-II, WG-III, Technical summary
[49] *Global Carbon Project* , 2008, *Recent carbon trends and the global carbon budget 2007*

absorbed by the oceans (in part dissolved in the water and in part absorbed by the phytoplankton) and by the vegetation on land (through chlorophyll photosynthesis and forest sinks), while the remaining 43% remained in the atmosphere, raising the concentration of carbon dioxide to a level that is the highest in the last 650 thousand years, and probably in the last 20 million years as well. The other greenhouse gases, such as methane, nitrogen dioxide and the fluorocarbons, have shown similar patterns of growth, with an even higher rate.

Italy is not exempt from this growth trend of greenhouse gas emissions: the most recent figures for the national inventory of greenhouse gas emissions show that emissions in equivalent tons of $CO_2$ went from 516.32 million to 552.77 during the period 1990-2007, making for an increase of 7.06%, whereas, according to the Kyoto Protocol, Italy should have brought its emissions down, during the period 2008-2012, to levels 6.5% lower than emissions in 1990, meaning to 482.76 Mt$CO_2$eq.

*From 1990 to 2007 greenhouse gas emissions in Italy went from 516.3 to 552.8 Mt $CO_2$ eq, for an increase of 7.1%. Under the Kyoto Protocol, Italy should have lowered its emissions, in the period 2008-2012, to levels 6.5% lower than emissions in 1990, meaning to 482.8 Mt $CO_2$eq.*

Globally, Italy is responsible for no more than 1.51% of overall emissions generated by the use of fossil fuels in 2007, meaning that it ranks twelfth among the countries with the highest levels of greenhouse gas emissions[50].

Between 1990 and 2007, greenhouse gas emissions in Italy registered an overall growth of 36.45 million tons of carbon dioxide equivalent (Mt $CO_2$eq).

During this period, there were reductions in fugitive emissions, those due to accidental losses during the extraction and distribution of hydrocarbons (-3.51 Mt $CO_2$eq), as well as in emissions generated by manufacturing industries (-10.06 Mt $CO_2$eq), agriculture (-3.37 Mt $CO_2$eq), the use of solvents (-0.26 Mt $CO_2$eq) and industrial processes (-0.17 Mt $CO_2$eq), while there were increases in the emissions generated by waste (+0.52 Mt $CO_2$eq), the residential sector and services (+3.71 Mt $CO_2$eq.) and, to an even greater extent, those of the energy industries (+20.61 Mt $CO_2$eq) and the transportation sector (+25.47 Mt $CO_2$eq). The increasing trend has reversed starting from 2005: in 2006, a decrease of 1.87% in overall emissions

[50] IEA, 2009, *$CO_2$ emissions from fuel combustion. Highlights.* 1971-2007

*Starting from 2005, a reduction in overall emissions was registered each year, for a decrease of 1.9% in 2006 and an additional reduction of 1.8% in 2007, compared to the previous year. Emissions from processes of combustion fell by 2.3%.*

was registered, as compared to the previous year. In 2007, emissions showed an additional decrease compared to 2006 (-1.81%).

The reduction took place in almost all the sectors: energy industries (-1.04%; -1.75 Mt $CO_2$eq compared to the previous year), the residential sector and services (-6.94%; -6.07 Mt $CO_2$eq), waste (-1.32%; -0.25 Mt $CO_2$eq), fugitive emissions (-1.83%; -0.14 Mt $CO_2$eq), the manufacturing industry (-3.88%; -3.25 Mt $CO_2$eq) and the use of solvents (-0.64%; -0.01 Mt $CO_2$eq).

Only agriculture, transportation ad industrial processes moved in the opposite direction, showing growth in emissions compared to 2006 (agriculture: +1.59%; +0.58 Mt $CO_2$eq; transportation: +0.13%; +0.17 Mt $CO_2$eq; industrial processes: +1.06%; +0.38 Mt $CO_2$eq).

On the whole, total emissions fell by 10.21 Mt $CO_2$eq (-1.81%) in 2007, compared to the previous year, essentially on account of reduced emissions from combustion processes (-2.33%; -10.78 Mt $CO_2$eq) (Figure 1.15).

*Between 1990 and 2007, there were increases in emissions from waste, the residential sector and services and, to an even greater extent, from the energy industries and transportation.*

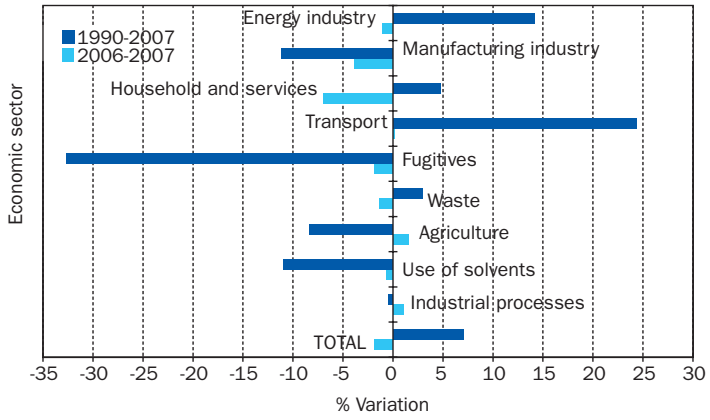



**Figure 1.15: Percentage variation in emissions of greenhouse gases by economic sector for the year 2007, compared with the previous year and with 1990[51]**

[51] Source: ISPRA

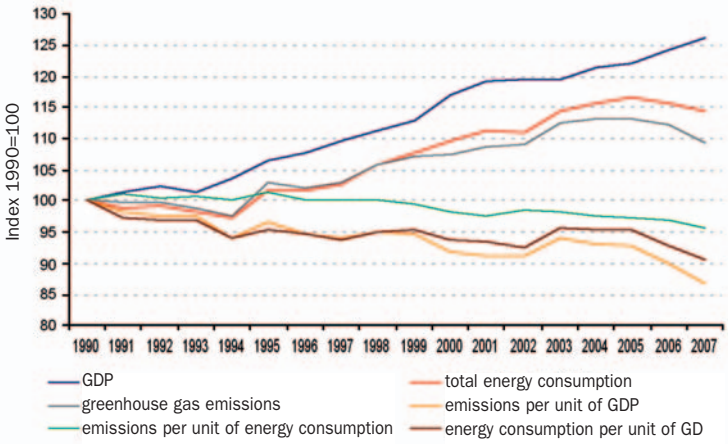



**Figure 1.16: Trends of for the main economic, energy and emissions indicators[52]**

*A comparison of levels of greenhouse gas emissions with the figures for the main variables of economic growth show that, during the period 1990-2007, the growth in greenhouse gas emissions was generally slower than the growth of the economy, pointing to a relative decoupling of the two trends.*

A comparison (Figure 1.16) between the levels of greenhouse gas emissions and of the main variables depicting economic growth (such as the GDP and value added) show that, for the period 1990-2007, growth in greenhouse emissions was generally slower than economic growth, pointing to a relative decoupling of the two trends[53].

In contrast, an analysis of levels of greenhouse gas emissions per total energy unit shows that emission levels in the 90's essentially followed those of energy consumption, with a decoupling arising only in recent years, due primarily to the use of natural gas in place of combustibles with higher carbon contents to produce electric energy and fuel industrial activities.

A decomposition analysis was carried out to determine the main

*Greenhouse gas emission levels in the 90's essentially followed those of energy consumption, with a decoupling arising only in recent years, due primarily to the use of natural gas in place of fuels with higher carbon contents for electricity generation and industrial activities.*

[52] Source: ISPRA

[53] If the economic variable shows positive growth while the growth rate of the environmental variable is less than or equal to zero, then it is said that an "absolute decoupling" has occurred. In contrast, when the growth rate of the environmental variable is positive, but lower than that of the economic variable, then a "relative decoupling" is at work (OECD, 2002)

factors underlying the variation in greenhouse gas emissions[54]. Specific consideration was given to the variation in greenhouse gas emissions for which economic activities were responsible in the period 1992-2006, with the use of three sets of data – environmental, energetic and economic – all collected on a consistent basis (meaning in accordance with the principles, definitions and classifications of national accounting)[55].

In breaking down the variation in greenhouse gas emissions in the period 1992-2006, the following factors were taken into consideration:

- the level of economic activity (to evaluate the effect of economic growth);
- the percentage weight of the different sectors of the economy (to assess the effect of changes in the production structure);
- the economic efficiency of fuel use (to assess the effect of changes in energy intensity per unit of product);
- the emission intensity of energy consumption (to assess the effects of changes in emission intensity).

The decomposition analysis indicates that the increase in emissions between 1992 and 2006, equal to approximately 24 million tons of $CO_2$ eq (Figure 1.17), is due exclusively to the "economic growth". And if the effects of economic growth had not been offset by those of the other components, the overall variation would have been approximately 30.8% instead of the actual 5.6%.

More specifically, the improvements in the two technological factors "emission intensity" and "energy intensity" should have led to a reduction of 20.7% in potential emissions. The factor "production structure" also played a significant role, though to a lesser extent, in reducing greenhouse gas emissions (-4.5%).

[54] Femia A. (ISTAT), Marra Campanale R. (ISPRA), *Production-related air emissions in Italy 1992-2006, a decomposition analysis*, in "*Environmental Efficiency, Innovation and Economic Performance*", edited by Anna Montini, Massimiliano Mazzanti, June 2010

[55] This type of analysis does not refer to the total emissions estimated by ISPRA using the IPCC methodology employed for the UNFCCC, but rather to a NAMEA type context (*National Accounting Matrix including Environmental Accounts*). The NAMEA classification method considers only emissions that can be traced to the production activities responsible for them, and it is consistent with the national economic statistics. As a result, no direct comparison can be established between the NAMEA data and the data used for UNFCCC

*The decomposition analysis shows that the increase in emissions caused by economic activities, equal to 24 million tons of $CO_2$ eq between 1992 and 2006, was due exclusively to the "economic growth" factor.*

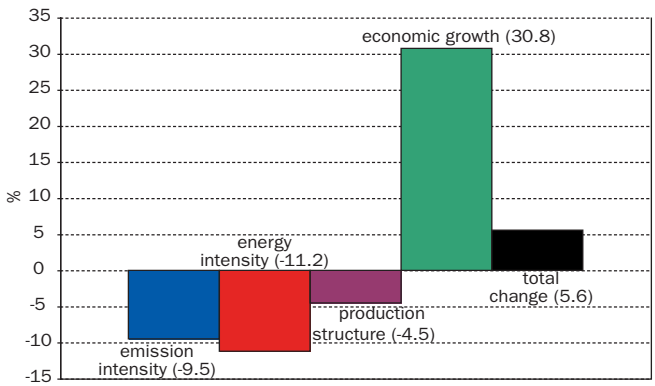



**Figure 1.17: Variations between 1992 and 2006 in greenhouse gas emissions due to economic activities, broken down by determinants[56]**

An analysis of the annual variations shows that the overall change for 1992-2006 (-9.5%) traceable to "emission intensity" was arrived at, for the most part, by accumulating small annual increases in efficiency during the period (though, in a number of years, the annual variation in intensity was positive). This demonstrates that there was indeed an improvement, though admittedly a slow one, in the environmental efficiency of Italian industry, thanks to a decrease in emissions not involving the use of fuels (but, for example, the use of solvents); the switch to less polluting combustible fuels; the use of technologies that improve production processes, such as integrated technologies; the installation of devices that reduce *end-of-the-pipe* emissions. In contrast, the effect of the "energy intensity" is characterised by an irregular, unpredictable pattern that often features major changes from one year to the next, such as the increase of 3.4% in 2003 and the upward variations of 2005 and 2006, all of which suggests that the use of energy has become less efficient in recent years. This factor takes into account the effects of a number of possible real improvements, such as the introduction of less fuel intensive techniques and the removal from operation of machines or plants that waste energy. However, both the overall importance of the factor and its volatility can be explained, at least in

[56] Source: Processing by Femia A. (ISTAT), Marra Campanale R. (ISPRA) of ISTAT-ISPRA data

part, by the delocalisation of Italian production activities. In effect, an increasing number intermediate and final products of Italian industrial concerns are manufactured abroad, with only the very last phases performed in Italy. This means that the output is achieved without having to use all the energy necessary for "production" in the sector (in reality, frequently acquired abroad, as intermediate input, in the form of goods that are almost finished and the resold following a small transformation). In 2007 greenhouse gas emissions exceeded the Kyoto objective by 70 Mt $CO_2$ eq. (+14.5%). The increase in emissions was due primarily to the energy industry and transportation sectors.

*In 2007, greenhouse gas emissions in Italy exceeded the Kyoto objective by 70 Mt $CO_2$ eq.*

*Under the Kyoto Protocol, Italy should lower its emissions, during the period 2008-2012, to levels 6.5% below those of 1990, meaning to 482.76 Mt $CO_2$eq.*
*In 2007 greenhouse gas emissions exceeded the Kyoto target by 70 Mt (+14.5%).*

*According to the assessments of the European Environment Agency, Italy will be able to reach its objectives under the Kyoto Protocol only if, in addition to drawing on emission credits gained through LULUCF activities and acquiring quotas generated by the flexible mechanisms provided for under the Protocol, it implements additional measures to reduce emissions, above and beyond those already taken.*

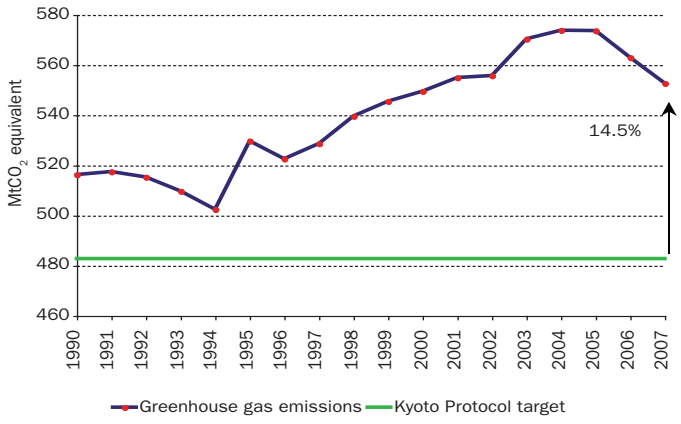
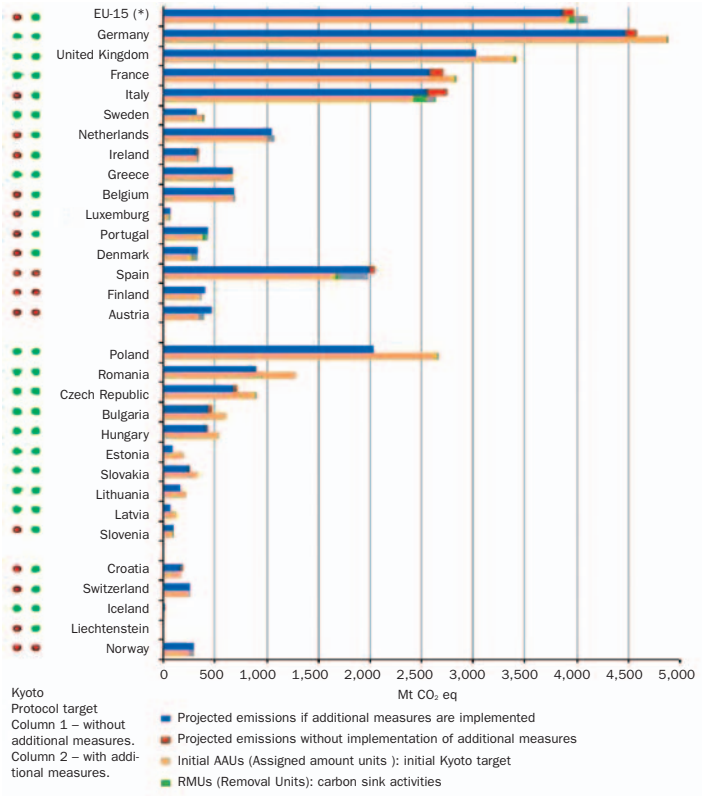



**Figure 1.18: Total greenhouse gas emissions in Italy, compared with the Kyoto target[57]**

According to the assessments in the report "*Greenhouse Gas Emission Trends and Projections in Europe* 2009 - *Tracking progress towards Kyoto targets*" of the European Environmental Agency, Italy will be able to reach the objectives set under the Kyoto Protocol only if, in addition to drawing on emission credits gained through LULUCF activities (*Land Use, Land Use Change and Forestry*) and acquiring quotas generated by the flexible mechanisms provided for under the Protocol, it implements additional measures to reduce emissions, above and beyond those already taken; such measures, however, must still be determined and enacted.

[57] Source: ISPRA




**Note:** The countries are divided into the groups EU15, EU12 (with the exception of Malta and Cyprus, which do not have objectives under the Kyoto Protocol) and non-EU countries. Within these groupings, the countries are ranked in ascending order, based on the absolute interval between the emissions forecast for the period 2008-2012 and their respective objectives under the Kyoto Protocol. The first coloured dot to the left of each country indicates the difference between the projected greenhouse gas emissions and the Kyoto objectives with only the measures already taken (excluding sink activities and the Kyoto mechanisms: CDM, JI), while the second coloured dot indicates the difference between the projection of greenhouse gas emissions and the Kyoto objectives in the event that additional measures are taken. The green and red dots indicate that emissions fall, respectively, below or above the levels required under the Kyoto Protocol.
(*): annual average emissions for the EU15, while the projections for the individual countries regard total emissions for the period 2008-2012 and the Kyoto objectives.
The projections for the period 2008-2012 are communicated by the member states (Belgium, Bulgaria, Denmark, Ireland, Italy, Luxemburg and Portugal) or estimated by the European Environmental Agency on the basis of the emissions of 2007 and the projections for 2010 and 2015, as communicated by the countries.
For each country, the upper bar represents the quantity of emissions permitted for the period of 2008-2012 (the initial objective under the Kyoto Protocol, plus the emissions estimate resulting from the reduction of emissions through sink activities and through the purchase of credits under the flexible mechanisms provided for in the Protocol). lThe lower bar represents the emissions projection for the period 2008-2012.
A country can reach its objective when its emissions (the upper bar) do not exceed its Kyoto objective (lower bar).

**Figure 1.19: Comparison between the emissions forecast for the European countries for the period 2008-2012 and their targets under the Kyoto Protocol[58]**

[58] Source: EEA, *Greenhouse Gas Emission Trends and Projections in Europe* 2009 - *Tracking progress towards Kyoto targets, forthcoming*

*According to the EEA, at present only three member states (Austria, Finland and Spain) hold that they will not be able to meet their Kyoto target without taking further measures.*

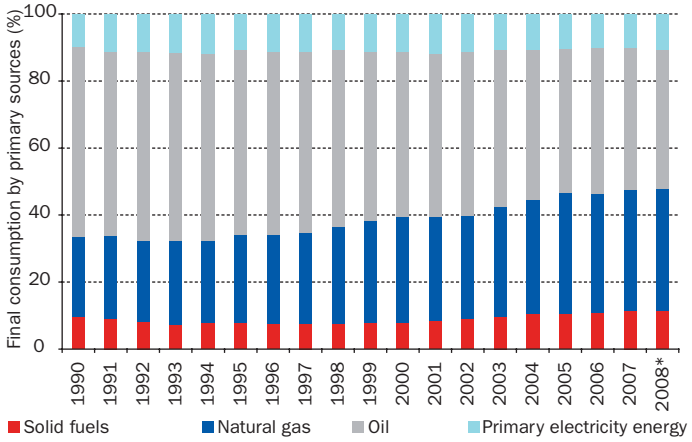
*In terms of the goal of reducing green house gas emissions by at least 20% within 2020, compared to the levels of 1990, the EU is roughly halfway there, having registered, in the year 2007, a 9.3% reduction in emissions compared to 1990.*

*Energy prices fluctuations are one of the causes of the ongoing changes in the energy supply mix.*

According to the European Environmental Agency, at present only three member states (Austria, Finland and Spain) feel that they will not be able to reach their Kyoto objective without taking further measures. In terms of the goal of reducing greenhouse gas emissions by at least 20% within 2020, as compared to the levels of 1990, assessments are still in the preliminary stage; taken as whole, the EU is roughly halfway there, having registered, in the year 2007, a 9.3% reduction in emissions compared to 1990.

Energy prices fluctuations are one of the causes of the ongoing changes in the energy supply mix, with natural gas playing an increasingly important role, at the expense of oil products, and with an upward trend in the contribution of renewable sources and cogeneration, plus, starting from 2001, renewed consumption of solid fuels, whose contribution to primary energy sources (including primary electric energy) went from 8.6% in 2001 to 11.5% in 2008.

*The energy sector is undergoing changes in the supply of primary sources, with growth in the consumption of natural gas, at the expense of oil products, and a contribution from renewable sources and cogeneration, plus, since 2001, consumption of solid fuels.*




**Legend :** * Provisional figures

**Figure 1.20: Total consumption of energy by primary sources[59]**

[59] Source: Ministry of Economic Development data processed by ENEA

Despite changes in the mix of primary energy sources, our country's energy dependence remains high, having risen from 82.8% in 1990 to 85.5% in 2008, for an increase of 2.7%. With the goal of limiting the vulnerability of our economic system on account of this supply structure, the current Government has presented legislative measures meant to select locations for new nuclear power plants.

*Despite the modifications in the mix of primary energy sources, our country's energy dependence remains high.*

Starting from 1990, there was a constant upward trend in total final energy consumption, with the peak reached in 2005 (+20.7% compared to 1990). A reversal in the trend was observed from 2006 on, with a 4.1% drop in final consumption registered in 2008, as compared to 2005. Final total consumption for 2008 amounted to a 15.7% increase over 1990.

*Starting from 1990, there was a constant upward trend in final energy consumption, with the peak reached in 2005 (+20.7% compared to 1990). A reversal in the trend was observed from 2006 on, with a 4.1% drop in final consumption registered in 2008, as compared to 2005.*

The main sectors that contribute to the overall trend have shown falling consumption in recent years. In particular:

- industry has registered a decrease of 8.6% in energy consumption since 2004;
- the household and services sector shows 3.5% lower consumption than in 2005, though the level rose last year (+4.8% compared to 2007);
- in contrast to the other sectors, consumption for transportation has increased constantly since 1990 (+29.6% in 2008), with the sole exceptions of drops in consumption in 2005 and 2008, compared to the preceding years. Based on provisional estimates, the decrease in 2008 was 1.7%;
- consumption in the agriculture and fishing sector has declined constantly since 2005 (-3.9%).

With regard to the break-down of energy for final consumption (not including non-energy uses or bunker fuels), the household and services sector accounts for 34.4% of consumption, followed by the transportation and industrial sectors, at 34.2% e 29% respectively. The agriculture and fishing sector accounts for the remaining 2.5% of final consumption. The decrease in Italy's total energy consumption in recent years, together with the limited growth of its GDP, explain the significant reduction in energy intensity between 2005 and 2008 (-5.3%), following a series of decidedly high values (around 159 toe per millions of Euro) registered between 2003 and 2005. In 2007, Italy was the G20 country with the lowest total energy intensity, with GDP corrected for purchasing power parity, rating below the worldwide average and that of the OECD.

*The decrease in Italy's total energy consumption in recent years, together with the limited growth of its GDP, explains the significant reduction in energy intensity between 2005 and 2008 (-5.3%).*

*In 2007, Italy was the G20 country with the lowest total energy intensity, with GDP corrected for purchasing power parity, rating below the worldwide average and that of the OECD.*

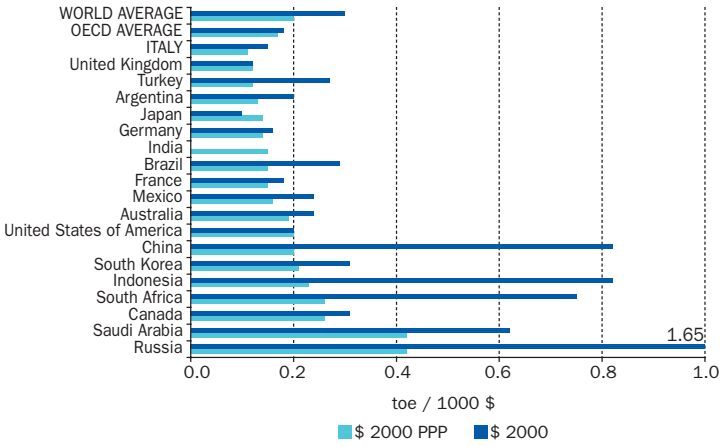



**Figure 1.21: Total energy intensity of the G20 countries, with GDP measured in year-2000 dollars and corrected for purchasing power parity (PPP) (2007)[60]**

*Between 1994 and 2008 the electricity generation grew at a rate considerably higher than total energy consumption.*
*This result points to the growing role of electricity as a vector in the national energy system.*

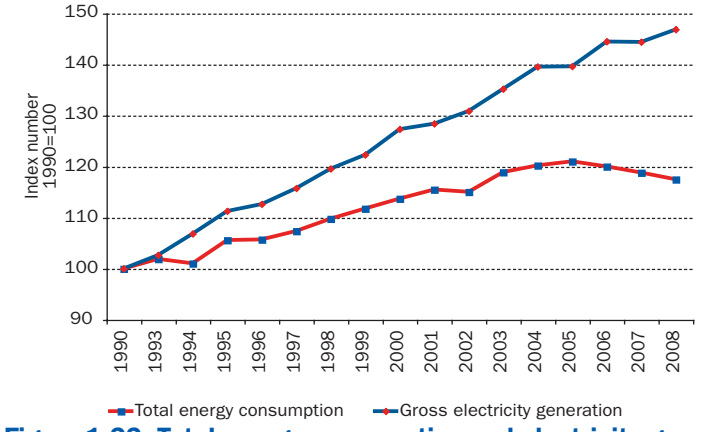



**Figure 1.22: Total energy consumption and electricity generation (1990 = 100)[61]**

[60] Source: International Energy Agency (IEA)
[61] Source: Ministry of Economic Development and TERNA S.p.A. data processed by ISPRA

Between 1994 and 2008, the rate of growth for electricity generation was considerably higher than that for total energy consumption. This result points to the growing role of electricity as an energy vector in the national energy system.

*Between 1994 and 2008 electricity generation grew at a rate considerably higher than total energy consumption.*

Looking at the regional break-down, final energy consumption varies considerably within the national territory. The figures for 2008 show that Lombardy consumes 21.6% of the national total, followed by Veneto at 10.1%, while Emilia Romagna and Piedmont account for respective levels of 9% and 8.4%, and other regions, such as Lazio, Tuscany, Apulia, Campania and Sicily find themselves in and around an average value of 6.1%. Taken as a whole, these nine regions consume 79.5% of the Italian total (Figure 1.23).

*Regional final energy consumption reveals a highly varied structure within the national territory.*

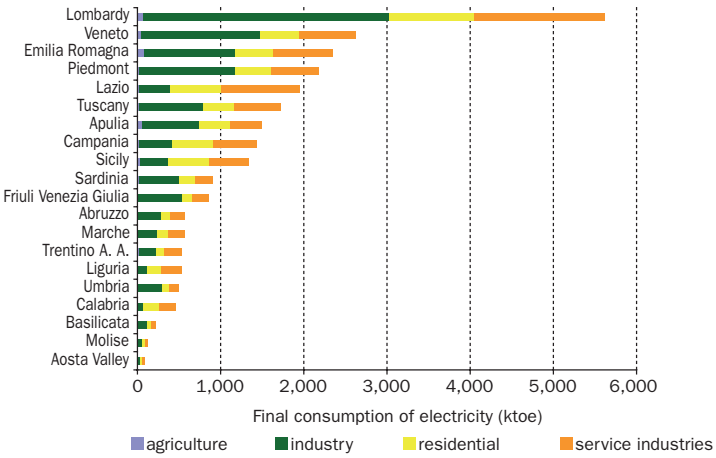



**Figure 1.23: Final energy consumption by region and by economic sector (2008)[62]**

*Regional consumption of electricity reveals a highly varied structure within the national territory. Lombardy consumes 21.6% of the national total. Nine regions (Lombardy, Veneto, Emilia Romagna, Piedmont, Lazio, Tuscany, Apulia, Campania and Sicily) account for 79.5% of total Italian consumption.*

The transportation system must respond to sharp rises in the demand for mobility. During the period 1990-2008, the demand for passenger transport increased by 34%, while the demand for domestic transport of cargo for distances of more than 50 km grew by 23.2% over the same period.

*The transportation system must respond to sharp rises in the demand for mobility. During the period 1990-2008, the demand for passenger transport increased by 34%, while the demand for domestic transport of cargo for distances of more than 50 km grew by 23.2% over the same period.*

[62] Source: ENEA data processed by ISPRA

Growth in passenger demand remained constant during the period 2000-2005, followed by increases over the following two years.
In 2008, there was a drop in the demand for transportation (-4.7% compared to 2007) (Figure 1.24).
The demand for passenger transportation continued to be met primarily by roadway transportation, the least efficient mode from an economic and environmental perspective. In 2008, automobiles, motorcycles and scooters covered 81.6% of passenger transportation demand.
Italy ranks second, after Luxembourg, in terms of the ratio of automobiles in circulation to the resident population, but it is first when motorcycles, scooters and commercial vehicles are taken into consideration; worldwide, only the USA has a higher rate of motorisation in terms of vehicles per inhabitant.

*During the period 1990-2008, the demand for passenger transport increased by almost 34%. Roadway transportation (automobiles, motorcycles and scooters) covered 81.6% of the demand for passenger transport (automobiles alone 73.8%) in 2008.*

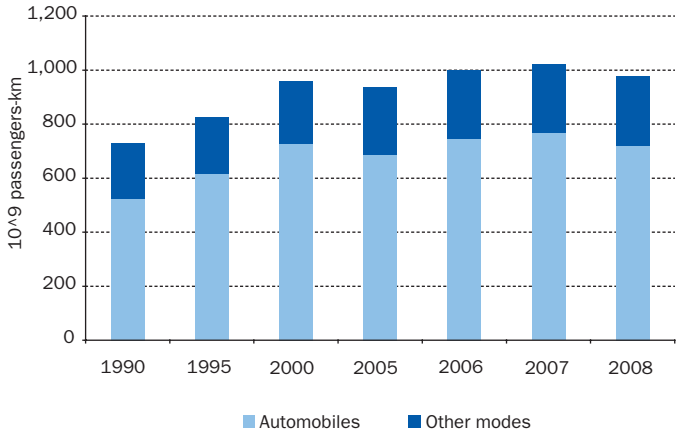



**Figure 1.24: Demand for passenger transport[63]**

The demand for passenger transport shows a growth trend from 1990 to the present (+23.2% in 2008, compared to 1990), being

[63] Source: Ministry of Infrastructures and Transport data processed by ISPRA

closely tied to the dynamics of economic development and the process of European integration (Figure 1.25).
Transportation of freight takes place primarily by truck, with the rate having remained fairly constant since 1990, at in and around 70% compared to the other modes of transport (68.2% in 2008). In 2008, domestic freight transport by sea and by railway accounted for respective percentages of 17.7% and 9.5, while air transport represented a marginal 0.4% of total transport.
The demand for freight transport showed noteworthy growth during the period 2000-2005, following by decreases in subsequent years. Roadway transport has increased by 0.9% compared to 2000. Under the category "other modes", cargo transported by sea showed a significant increase (+43.8%) from 2000 on, while more modest growth was registered by railway transport (+3.9%). The increases for air transport and transport by pipeline were, respectively, 17.8% and 18.6%, compared to the year 2000.

*Transportation of freight takes place primarily by truck, with the rate having remained fairly constant since 1990, at in and around 70% compared to the other modes of transport (68.2% in 2008).*

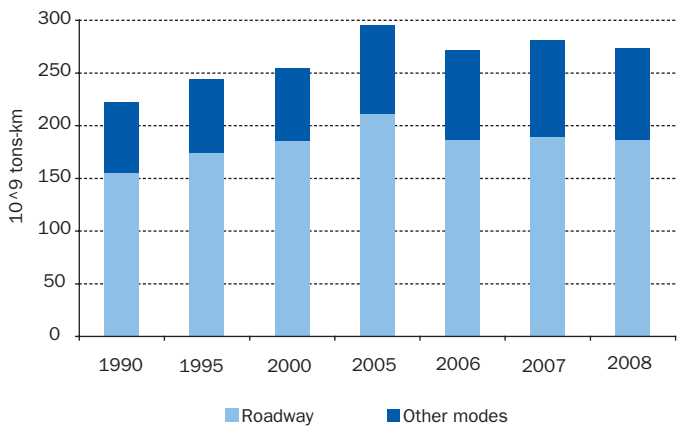



**Figure 1.25: Demand for freight transport[64]**

*The demand for transport showed growth of 23.2% between 1990 and 2008. Furthermore, estimates for 2008 show that freight transport within the national territory occurs primarily by roadway travel (68.2%) while other modes, such as the transport of freight by sea and by rail, account for respective shares of 17.7% and 9.5% of total transport.*

[64] Source: Past series recalculated by ISPRA under uniform criteria, using data of the Ministry of Infrastructures and Transport (National Accounting of Infrastructures and Transportation); the past series on freight transport is affected by variations in the data-collection methodology employed by the ISTAT

*The main response measures involve mitigation (reducing greenhouse gas emissions) and adaptation to climate change underway.*

*The year 2009 saw publication in the Official Journal of the European Communities of all the legislative documents in the "Energy – Climate Change" package that was the subject of the historic agreement known as "20-20-20".*

## Response measures

The main measures of response to climate change involve mitigation, which means reducing greenhouse gas emissions, as well as adaptation, whose objective is to minimise the potential negative consequences of climate change and prevent related damage. Such measures are complementary.

As concerns mitigation measures, it is important to note that the year 2009 saw publication in the Official Journal of the European Communities of all the legislative documents in the "Energy – Climate Change" package that was the subject of the historic agreement known as "20-20-20", reached in the European Council on 18 December 2008; specifically:

- Directive 2009/28/EC on the promotion of renewable energy, which sets the binding objective for the EU of bringing the percentage contribution of renewable sources as a percentage of total energy consumption to 20% by 2020, with the effort distributed among the Member States; Italy's assigned objective is 17%;
- Decision 406/2009 on effort sharing, which sets the binding objective for the EU of reducing by 10% compared to the Community levels for 2005 greenhouse gas emissions in the sectors not regulated by 2003/87/EC; the burden of the effort is distributed among the Member States, with Italy assigned an objective of 13%;
- Directive 2009/29/EC on the revision and strengthening on the European emissions trading system, setting for the EU the binding objective of reducing greenhouse gas emissions by 21% compared to the levels of 2005 for the sectors governed by Directive 2003/87/EC;
- Directive 2009/31/CE on carbon capture and storage, a measure that establishes a legal framework for the geological storage of carbon dioxide, so as to ensure permanent containment of this substance and reduction to a minimum of possible risks to the environment and to human health.

On the subject of adaptation, in April 2009 the European Commission presented a White Paper entitled: "*Adapting to climate change: Towards a European framework for action*", with

*On the European level, in April 2009 the European Commission presented a white paper: "Adapting to climate change: Towards a European framework for action", with the goal of making the EU less vulnerable to the impact.*

the goal of making the EU less vulnerable to the impact of climate change[65].

The document lays out guidelines for action, structured around the following points:

- consolidation of basic knowledge regarding the risks and consequences of climate change;
- consideration on the impact of climate change on the main EU policies;
- integration of the different policy measures to obtain the best possible effect (for example, new forms of financing, including market-based programs, could be utilised to facilitate adaptation,);
- support of more wide-ranging international adaptation efforts;
- implementation of activities in collaboration with national, regional and local government bodies.

In operating terms, the White Paper states that:

- access to a wider range of data on the impact on the climate could facilitate decision-making processes;
- by 2011 a clearinghouse mechanism should be established for the exchange of information, making it easier to gain access to multiple sources of information on the consequences of climate change, on areas at risk and on successful practices;
- consideration of adaptation in formulating the primary policies of the EU.

By the end of 2011, the European Commission and the European Environment Agency plan to develop a series of instruments in support of adaptation policies, including:

- guidelines for the formulation of regional strategies of adjustment to climate change;
- sets of indexes of impact, vulnerability and adjustment;
- economic assessments of the costs and benefits of adjustment.

[65] Commission of the European Communities, 2009, *White Paper: "Adapting to climate change: Towards a European framework for action"*, COM(2009) 147 definitive, Brussels, 01/04/2009

*In the countries of the European Union, a central role in strategies of mitigation has been given to implementation of the European emissions trading system established under Directive 2003/87/EC.*

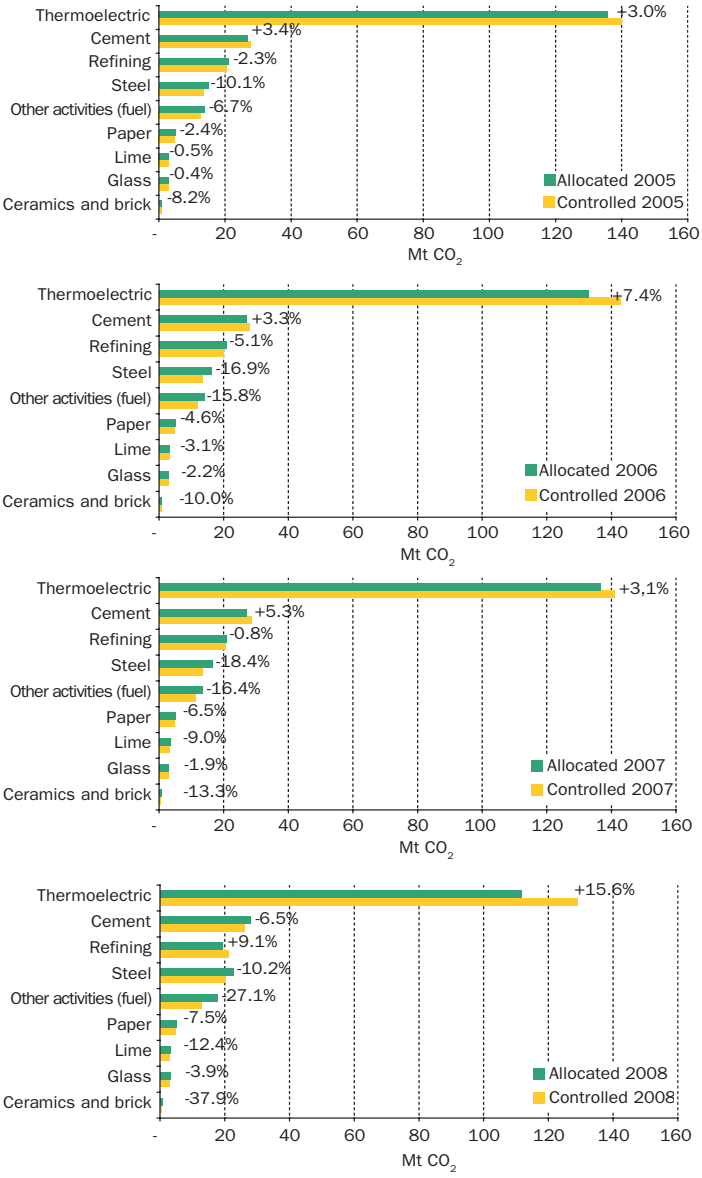
## Mitigation

In the countries of the European Union, a central role in strategies of mitigation (meaning prevention of climate change by reducing emissions of greenhouse gas emissions and increasing absorption of carbon dioxide removals) has been given to implementation of the European emissions trading system established under Directive 2003/87/EC. This system entails the setting of a maximum limit (cap) on the greenhouse gas emissions of industrial plants falling under the directive. Emissions allowances are assigned to each eligible plant under a National Allocation Plan (NAP). Each allowance (an EAU, or European Allowances Unit) entitles the holder to emit a ton of carbon dioxide into the air during the year in question. $CO_2$ emissions allowances that are allocated but not used may be exchanged among operators on the European market. This system should give rise to a competitive market mechanism that leads to a reduction in emissions by industrial plants. Furthermore, the price at which emissions permits are traded on the European market shall provide a useful indicator of the effectiveness of the system and its capacity to signal to operators when allowances are in short supply.

The initial period of implementation of the emissions trading system (ETS) began on 1 January 2005 and concluded on 31 December 2007. In Italy, the quotas for the first period were assigned under the decree DEC/RAS/74/2006 of the Ministry of the Environment, Land and Sea. More recently, the National Committee for the Management and Implementation of Directive 2003/87/EC, consisting of representatives of the Ministry of the Environment, Land and Sea and of the Ministry of Economic Development, passed a ruling of 20 February 2008 assigning the quotas for the second period (2008-2012).

The final figures on greenhouse gas emissions are available for the years 2005 to 2008.

During the three-year period 2005-2007 (Figure 1.26), power stations and cement plants registered emissions levels higher than their respective allocations, while the levels observed for the remaining sectors were lower than the threshold set under the allocation plan. It can also be seen that, in a number of sectors (steel, other combustion activities, paper, lime, ceramics and




**Legend**:
The percentage figure represents the variation in $CO_2$ emissions, as compared to the assigned quotas.
"Allocated": $CO_2$ emissions quotas assigned to the plants.
"Controlled": quantities of $CO_2$ actually emitted by the plants.

**Figure 1.26: Comparison of emissions allocated to emissions controlled for the three years of the first period 2005-2007, and for 2008, in the different industrial sectors[66]**

[66] Source: ISPRA

*Considering the sum total of the quotas assigned and issued in the three-year period 2005-2007, the differential for greenhouse gas emissions by plants participating in the ETS system was +5.7 Mt $CO_2$ above the maximum threshold.*

*In the first year of the second period (2008-2012), total emissions of $CO_2$ exceeded the assigned quotas by 9 Mt $CO_2$.*

*Considering the sum total of the quotas assigned and issued during the three-year period of 2005-2007, the differential for greenhouse gas emissions from the plants participating in the ETS system was +5,7 Mt $CO_2$ above the maximum threshold.*

*In the first year of the second period, (2008-2012), total emissions of CO2 exceeded the assign ed quotas by 9 Mt $CO_2$.*

bricks), the reduction, in terms of the allocation, gradually increased over the three years. Total emissions were higher than the national allocation for the first two years (+0.8% in 2005 and +1.9% in 2006), while the quantity of emissions registered in the last year was slightly lower than the allocation (-0.2%).
Considered overall, meaning in terms of the sum total of the quotas assigned and issued during the three-year period of 2005-2007, the differential for greenhouse gas emissions from the plants participating in the ETS system was +5,7 Mt $CO_2$ above the maximum threshold.
With regard to the first year of the second period (2008-2012), total $CO_2$ emissions exceeded the assigned quotas by 9 Mt $CO_2$. Emissions were found to be higher than the assigned thresholds in the thermoelectric sector (+15.6%) and for refineries (+9.1%), while the other sectors recorded reductions of between 3.9% and 37.9%, as compared to their assigned thresholds.
Working from the emissions data declared by the plants taking part in the European emissions trading system, a number of assessments were run in an attempt to determine the environmental effectiveness of the system by estimating the reduction in $CO_2$ emissions that can be credited to its operations. Obviously there are no proven methods or past references for calculating this reduction: the estimates must take into account the past emission trend (baseline), as well as the actual parameters of the main economic and energy parameters for the period to which the emissions refer.
This type of assessment points to a total reduction of approximately 70 Mt$CO_2$ in $CO_2$ emissions in Europe, for the year 2005, as a result of the operations of the ETS, an amount that corresponds to roughly 3% of the emissions recorded in Europe[67]. Using the same method, which essentially consists of a comparison between the actual emissions and the forecasts, with respect to benchmark year, ISPRA analysed the figures for the Italian plants

[67] Ellerman A.D., Buchner B.K., *The European Union Emissions Trading Scheme: Origins, Allocation, and Early Results, Review of Environmental Economics and Policy*, Volume 1, Number 1, Winter 2007

participating in the ETS during the first period (2005-2007)[68]. Three scenarios for annual growth in $CO_2$ emissions, starting from the base year, were used as references (0.5%, 1.0% and 1.5%). The estimates show that the trading of $CO_2$ emissions quotas by the production sectors that are part of the ETS system has a positive impact. In the specific case of the scenario considered most probable (annual emissions growth of 1.0%), it was estimated that emissions would be reduced by 9.1 Mt $CO_2$ in 2005, 10.0 Mt $CO_2$ in 2006 and 13.4 Mt $CO_2$ in 2007 (respectively 4.0%, 4.4% and 5.9% of the controlled emissions).

*It is estimated that the operations of the ETS were responsible for a total reduction of approximately circa 70 Mt$CO_2$ in $CO_2$ emissions in 2005 in Europe, corresponding to roughly 3% of the controlled emissions throughout Europe.*

Worthy of note nationally is the growing role played by cogeneration, which makes it possible to increase the efficiency of the conversion of the energy available from primary sources. Since 1997, the net amount of electricity from thermal power stations produced through cogeneration has followed a trend parallel to that for total thermoelectric production: between 1997 and 2008 the average annual increase was approximately 5,424 GWh/year for electricity generated through thermal cogeneration, while the overall average increase in total electricity generated by thermal power plants was 5,487 GWh/year. The figures for the production of electricity alone remained almost constant during the period considered, with an average annual increase, between 1997 and 2008, of 64 GWh/year. These figures show that, since 1997, the need for new electricity generation from thermal power plants has been completely met through cogeneration (Figure 1.27).

*Worthy of note nationally is the growing role played by cogeneration, which makes it possible to increase the efficiency of the conversion of the energy available from primary sources*

As for the mix of the primary sources, it should be noted that the growing role of natural gas in thermal electricity generation has a positive influence on the trend in greenhouse gas emissions. This is due not only to the low emissions factor of natural gas compared to other primary sources, but also to the greater efficiency of combined cycles fuelled by natural gas, as opposed to traditional steam cycles.

*The growing role of natural gas in thermoelectric production has a positive influence on trends in greenhouse gas emissions.*

[68] Gaudioso D., Caputo A., Arcarese C., "*A preliminary assessment of $CO_2$ emissions abatement resulting from the implementation of the EU ETS in Italy*", proceedings of the workshop "eceee 2009 Summer Study", 1–6 June 2009, La Colle sur Loup, Côte d'Azur, France, http://www.eceee.org/conference_proceedings/eceee/2009/

*The average annual increase in electricity generation between 1997 and 2008 was approximately 5,424 GWh/year for thermal electricity generation with cogeneration and 5,487 GWh/year for total thermal electricity generation, while the generation of electricity alone remained almost constant during the period considered.*
*These figures show that, since 1997, the need for new electricity from thermal power plants has been met entirely through cogeneration.*

*During the period 1996-2008, the specific average consumption of all fuels used for net electricity generation fell by 12.8% (-1.4% between 2007 and 2008).*

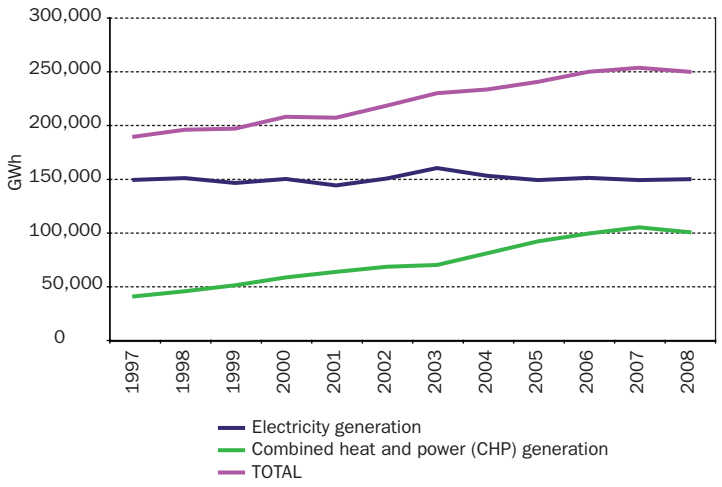



**Figure 1.27: Net thermal electricity generation[69]**

During the period 1996-2008 a decrease of 20.1% was registered in the specific average consumption of natural gas for net electricity generation. Derivative gases also showed a significant drop in specific consumption in 2008, for a decrease of 19.1% compared to 1996. Taking into consideration all the fuels used for electricity generation, specific average consumption fell by 12.8% (-1.4% between 2007 and 2008). Specific average consumption of all fuels for electricity generation was influenced by the use of oil products and solid fuel, which are less efficient than gas fuels. In fact, during the period considered, average specific consumption of oil products and solid fuel rose by respective figures of 11.1% and 10.4% (Figure 1.28).

[69] Source: TERNA S.p.A. data processed by ISPRA

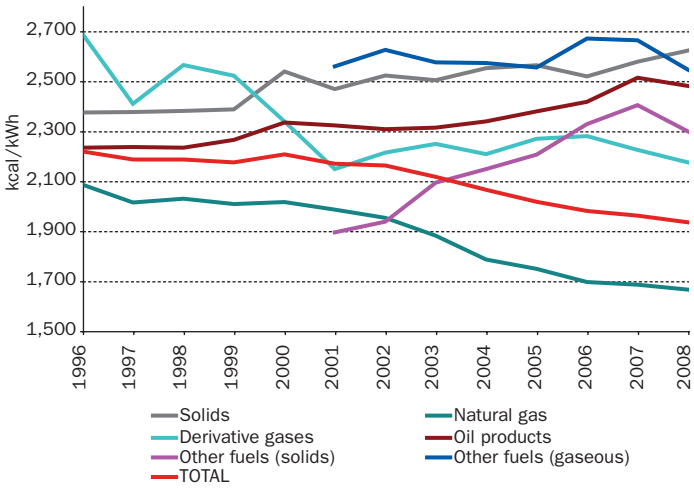



**Figure 1.28: Average specific fuel consumption in the net electricity generation from fossil sources[70]**

*During the period 1996-2008 there was a decrease of 20.1% in the average specific consumption of natural gas, and a decrease of 19.1% in consumption of derivative gases. In terms of electricity generation in general, average specific consumption fell by 12.8%, while oil products and solid fuel rose by respective figures of 11.1% and 10.4%.*

In terms of end-uses energy efficiency, Directive 2006/32/EC sets objectives for Member States regarding the efficiency of the end-uses of energy and energy services. The general national objective for energy savings is 9% within the ninth year of the implementation of the directive (2016). Under the provisions of art. 4, Member States must enact effective measures to achieve this objective; the Action Plan for Energy Efficiency, presented by Italy in July 2007, in fulfilment of art. 14 of the Directive, identifies a series of actions that will make possible energy savings of 9.6% in 2016, as compared to average energy consumption between 2001 and 2005.

*Under Directive 2006/32/EC, the general national objective for energy savings is 9% by 2016.*

Of the measures referred to above, a key role is played by the system of white certificates, contemplated under art. 6 of Directive 2006/32/EC, and which Italy was the second country to implement, right after the United Kingdom, doing so through the Ministerial Decrees of 20 July 2004. The objective of the decrees, subsequently supplemented by a Ministerial Decree of 21 December 2007, is to achieve energy savings that are to increase

*The objective of the Ministerial decrees of 20 July 2004 and 21 December is to achieve energy savings that keep increasing, until they reach, in 2012, a level of 6 Mtoe a year.*

[70] TERNA S.p.A. data processed by ISPRA

year after year, until they reach, by 2012, a level of 6 Mtoe a year through the introduction of obligatory quantities of energy savings for distributors of electricity and natural gas.

*During the first four years of operation of the white certificate system, the certified energy savings were equivalent to the sum of the annual energy savings objectives set under the decree.*

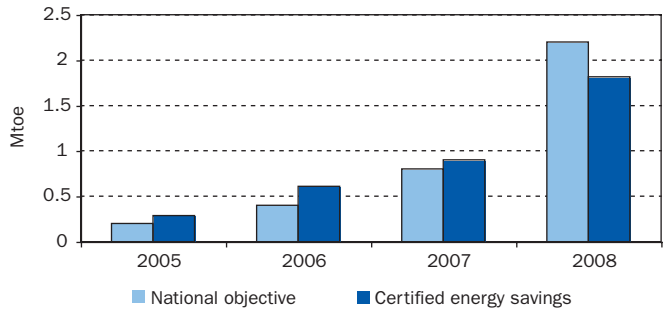
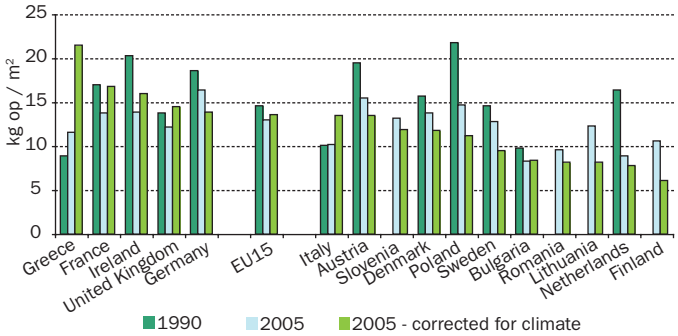



**Figure 1.29: Comparison between national energy savings objectives and certified energy savings[71]**

Figure 1.29 highlights the fact that, in the first four years of the system's operation, the certified energy savings were equivalent to the sum of the annual energy savings objectives set under the decrees referred to above, confirming that the system works. The majority of the measures for improving energy efficiency contemplated under the Action Plan for Energy Efficiency regard the residential sector, and specifically the energy needs of buildings (for hearting and cooling), as well as consumption by devices that are final energy users.

The potential for the first type of initiative is made clear by the data from 2005 on the energy consumption per surface area of EU15 buildings adjusted for climatic conditions. The data place Italy among the leading countries in terms of consumption per $m^2$, together with Germany, the United Kingdom Ireland, France and Greece. Other countries of the EU15, such as Austria, Denmark, Sweden, the Netherlands and Finland present levels of energy consumption lower than those registered for our country (Figure 1.30).

[71] Source: Italian Authority for Electricity and Gas, "*The Mechanism of Energy Efficiency Certificates from 1 January to 31 May 2009, Second Intermediate Statistical Report on the Obligatory Year 2008, drawn up in accordance with article 8, paragraph 1, of the Ministerial Decree of 21 December 2007*"




**Note:** The data for 1990 and 2005 were corrected to attenuate the effects of long-term climate variations in the individual countries. The year 2005 was also corrected for the average climate of the European Union, to take into consideration the temperatures in the different countries.

**Figure 1.30: Energy consumption per m² in buildings[72]**

*In 2005, the data for energy consumption per m², adjusted for climatic conditions, showed that Italy ranks among the leading countries in terms of consumption.*

In our country, the legislative process concerning energy certification of buildings is very lengthy. The principle was introduced in Italy under Law no. 10 of 9 January 1991, which addresses the various aspects of energy certification for buildings, but this law was never enacted.

In 1998, Legislative Decree no. 112 of 31 March 1998 transferred the administrative authority for the energy certification of buildings to the regional governments. Directive 2002/91/EC was transposed into Italian law with Legislative Decree no. 192 of 19 August 2005, recently revised and supplemented by Legislative Decree no. 311 of 29 December 2006.

On 10 July 2009 the Ministry of Economic Development published a decree containing guidelines for the energy certification of buildings. Starting from 25 July 2009, the regions that have not yet drawn up a regional law must follow the national guidelines. At present, only a few regions have established rules for the issue of energy certification. The decree defines the national guidelines for the energy certification of buildings, together with instruments of liaison, concerted effort and cooperation between the national government and regional governments, some of which

*On 10 July 2009 the Ministry of Economic Development published a decree containing guidelines for the energy certification of buildings. Starting from 25 July 2009, the regions that have not yet drawn up a regional law must follow the national guidelines.*

[72] Source: EEA/ODYSSEE data processed by ISPRA

have already established their own certification procedures, which shall be integrated with the national measure, respecting the distinctive characteristics of each regional law. The measure comes in the wake of Decree no. 59 of 2 April of 2009, issued by the President of the Republic to set the minimum energy requirements for new buildings and for the restructuring of existing ones.
An additional measure is expected to establish the professional profile of energy certifiers authorised to issue certificates.

*Since 2006, there has been a noteworthy in Italy in the installed capacity for all renewable energy sources.*

Starting from 2006, a noteworthy increase was observed in the installed capacity for all renewable energy sources. In 2008, the gross efficient operating capacity was equal to 23,859 MW, making for an average annual growth rate of 6%. The increase in the capacity in 2008, compared to the previous year, was 1,552 MW. In 2008 electricity generation from renewable sources stood at around 59.7 TWh out of total electricity generation of 318.2 TWh, meaning that renewable sources account for 18.8% of total electricity generation. The break-down of overall production was characterised by annual fluctuations in the contribution by hydroelectricity, a result of meteorological conditions, as well as the growing contribution of non-traditional sources (wind power, geothermal energy, biomasses and waste). In 2008, hydroelectricity accounted for 69.7% of the electricity generated from renewable sources. In recent years, there has been a noticeable increase in the electricity generated from wind (from 117.8 to 4,861.3 GWh during the period 1997-2008) and from biomasses/waste (from 820.3 to 7,522.5 GWh). Electricity produced from geothermal sources also increased from 3,905.2 to 5,520.3 GWh during the period 1997-2008, though production from this source has remained essentially unchanged over the last three years. The contribution of photovoltaic systems remains negligible (193.0 GWh in 2008), though last year the quantity of electricity generated from that source increased by 395%.

*Electricity generation from renewable sources, nationwide, accounts for 18.8% of all the electricity generated.*

Directive 2001/77/EC set a recommended objective of 22% as the portion of gross domestic consumption of electricity that should be generated from renewable sources (equal to approximately 75 TWh when gross domestic consumption stands at 340 TWh). Though this directive has since been rendered obsolete by

Directive 2009/28/EC, it still represents the only benchmark for assessing the generation of electricity from renewable sources. In calculating the target figure, electricity produced from renewable sources but imported from other European countries must also be considered. Based on the data provided by the GSE, in 2008 gross generation from renewable sources, including imports from abroad, amounted to 24% of the gross domestic consumption of electricity[73].

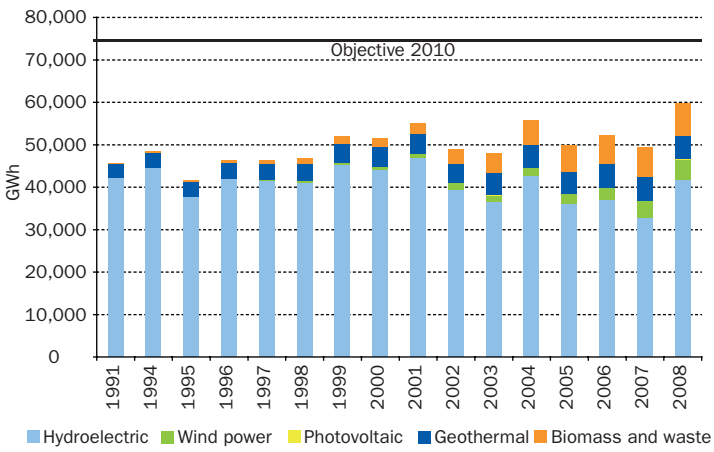



**Figure 1.31: Gross domestic electricity generation from renewable sources[74]**

*On a national scale, electricity generation from renewable sources accounts for 18.8% of all electricity generated. Between '97 and 2008 there was a noticeable increase in the electricity generated from wind (from 117.8 to 4,861.3 GWh), as well as from biomasses/waste (from 820.3 to 7,522.5 GWh), and even, though to a lesser extent, from geothermal sources (from 3,905.2 to 5,520.3 GWh).*

Based on the GSE data, imported electricity generated produced from renewable sources accounted for an average of 8% of gross domestic consumption of electricity between 2002 and 2008, while the contribution of electricity produced domestically from renewable sources averaged 14.7%.

[73] GSE, 2009, Statistics on renewable sources in Italy. Year 2008
[74] Source: TERNA S.p.A. data processed by ISPRA

*In 2008 gross electricity generation from renewable sources, including electricity imported from abroad but produced from renewable sources, accounted for 24% of gross domestic consumption of electric energy.*

**Table 1.2: Electricity generated from renewable sources compared to gross domestic electricity consumption in Italy[75]**

| Year | G.D.C.[(1)] | Gross generation from RES[(2)] | | Foreign from RES | Gross generation Renewable + Foreign from RES | |
|---|---|---|---|---|---|---|
| | TWh | TWh | % of G.D.C. | TWh | TWh | % of G.D.C. |
| 2002 | 327.3 | 48.3 | 14.8 | 24.6 | 72.9 | 22.3 |
| 2003 | 337.2 | 47.1 | 14.0 | 26.5 | 73.6 | 21.8 |
| 2004 | 341.4 | 54.1 | 15.9 | 34.9 | 89.0 | 26.1 |
| 2005 | 346.0 | 48.6 | 14.1 | 9.7 | 58.3 | 16.9 |
| 2006 | 352.6 | 50.8 | 14.4 | 35.0 | 85.8 | 24.3 |
| 2007 | 354.5 | 47.9 | 13.5 | 38.2 | 86.1 | 24.3 |
| 2008 | 353.6 | 58.2 | 16.5 | 26.7* | 84.9 | 24.0 |

**Legend:** [(1)] Gross Domestic Consumption: Gross national production – Pumping production + foreign balance
[(2)] Renewable Energy Sources
* Provisional figure

*Hydroelectricity, concentrated in the regions of the Alpine arc, accounts for almost 69.7% of the electricity generated from renewable sources.*

A regional analysis points to noteworthy differences in the energy sources used. Hydroelectricity, found primarily in the regions of the Alpine arc, accounts for 69.7% of the electric energy generated by renewable sources. Geothermal electricity generation, found only in the Tuscany region, represents 9.2% of the electricity produced from renewable sources. Biomasses account for 12.6% of the total, while wind and photovoltaic power registered a share of 8.5% of the electricity produced from renewable sources, though almost all of this last type of production takes place in the southern regions and on the major islands (98.4%). The increase of approximately 1,550 MW in installed power registered between 2007 and 2008 was due primarily to the development of wind power (823 MW) and photovoltaic power (345 MW), followed by biomasses and water power, at respective figures of 218 MW and 164 MW.

[75] Source: GSE data processed by ISPRA

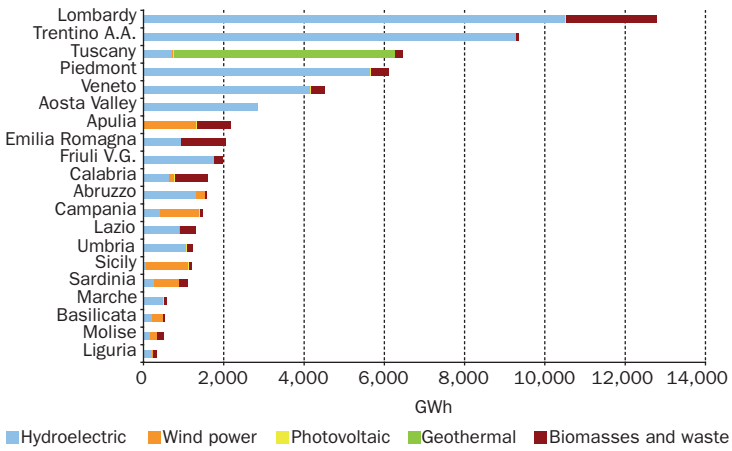



**Figure 1.32: Regional analysis of gross electricity generation from renewable energy sources (2008)[76]**

*Regionally, noteworthy differences can be observed in the renewable energy sources used. The primary renewable source used to produce electricity is hydroelectricity, concentrated in the Alpine arc, while production from wind and photovoltaic systems takes place in the southern regions and the main islands (98.4%).*

Directive 2009/28/EC stipulates what portion of final domestic energy consumption is to be produced from renewable energy sources by each country of the European Union as of 2020; these quotas include not only energy from renewable sources consumed for the production of electricity, but also renewable energy used for heating and transport. The Directive also makes it possible the statistical transfer from one Member State to another of a certain quantity of energy from renewable sources, as well as cooperation between the countries, or with non-EU countries, in the production of energy from renewable sources. The renewable–energy consumption objective assigned to Italy is 17% of final domestic consumption. In 2007, total renewable energy as a percentage of final consumption was equal to 6.9% (Figure 1.33).

*Directive 2009/28/EC stipulates what portion of final domestic energy consumption is to produced from renewable energy sources by each country of the European Union as of 2020.*

[76] Source: TERNA S.p.A. data processed by ISPRA

*The renewable energy consumption objective assigned to Italy (Directive 2009/28/EC) is 17% of gross final consumption. In 2007 overall renewable energy as a percentage of final consumption was equal to 6.9%.*

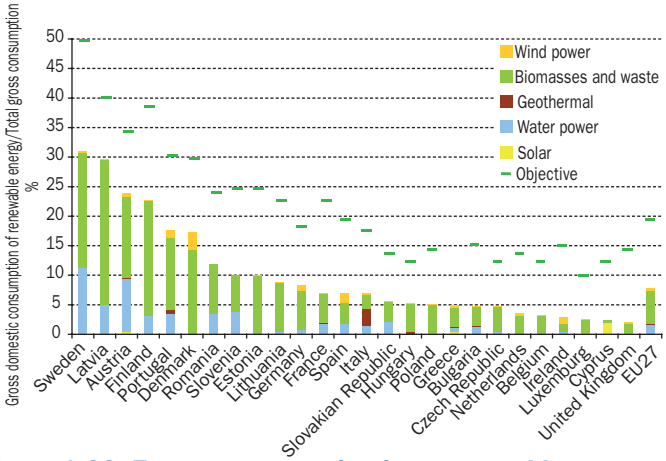



**Figure 1.33: Energy consumption from renewable sources as a percentage of final consumption in the European countries (2007)[77]**

Looking at the transportation sector, there was a constant increase in fuel consumption between 1990 and 2007 (+25.3% compared to 1990), with the only decrease registered between 2004 and 2005. Consumption levels appear to be characterised by brief periods of stabilisation, followed by resumption of the upward trend. The percentage of fuels with low environmental impact (natural gas, LPG, bio-diesel) out of total fuels shows irregular results, going from 5.6% in 1990 to 4.8% in 2007, with a peak value of 6.1% in 1995. Since 2000, consumption of these fuels has dropped by 13.8%.

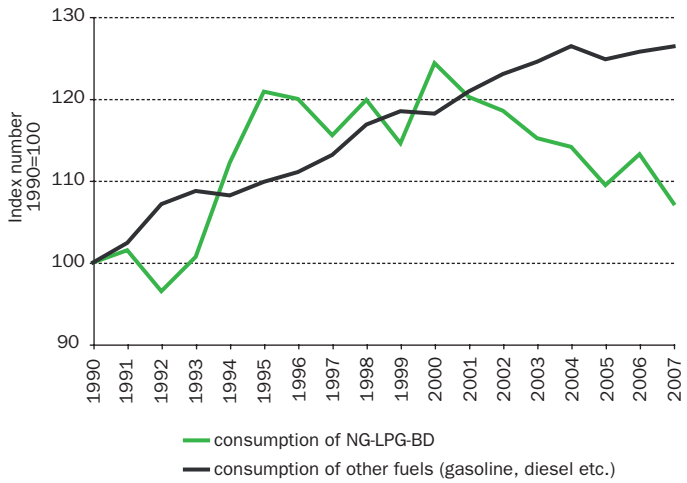
Variations in the percentages of the fuels consumed show that, while the classic fuels (gasoline, diesel fuel etc.) have increased constantly, levels of natural gas, LPG and bio-diesel have clearly been on the decline since 2000, apart from a few sporadic increases. As of 2007, the overall increase in the consumption of low-impact fuels, compared to 1990, was only 7.2%.

Based on the available data, it is clear that the progress made in

[77] Source: EUROSTAT data processed by ISPRA

the transportation sector through the implementation of technological measures involving engine efficiency are offset - and to a greater extent in Italy than in the other European counties, by growth in the demand for transportation, and especially the roadway mode, meaning that the environmental impact of the transportation sector continues to grow. As for the quality of the fuels used, it can be observed that the quantity of low-impact fuels, in addition to being of marginal importance, is often highly irregular, as demonstrated by the fact that, between 2000 and 2005 there was a constant decrease in the share of total fuels represented by low-impact fuels, followed by only a slight increase between 2005 and 2006.

*The effects of technological measures are offset by the growth in the demand for transportation and especially the roadway mode.*




**Legend**:
NG: natural gas;
LPG: liquefied petroleum gas;
BD: biodiesel

**Figure 1.34: Consumption of fuels for transportation (1990=100)**[78]

*The use of low-impact fuels is subject to noteworthy irregularities: between 2000 and 2005 there was a constant decrease in their share of total fuel consumption.*

[78] Source: Ministry of Economic Development data processed by ISPRA

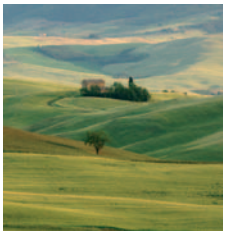
*In 2007, the LULUCF sector was responsible for the capture of 70.9 Mt di $CO_2$ eq in Italy. Much of the absorption was due to forests.*

In contrast to the increase in emissions of greenhouse gases resulting from various production activities and processes of deforestation, a noteworthy quantity of carbon dioxide has been removed from the atmosphere by the LULUCF sector, for quantities on the order of 0.2 billion tons of carbon during the period 1980-1989 and 0.7 billion tons of carbon during the period 1989-1998 globally[79]. In Italy, the LULUCF sector, which encompasses the different existing uses of the land (such as forests, cultivated land, meadows, urban settlements and wetlands), as well as changes in the designated use of land, was responsible for the capture of 67.5 million tons of carbon in 1990 and 70.9 million tons of carbon in 2007. However, only the portion removed from managed forests can be include in the accounting for the Kyoto Protocol, as stipulated under articles 3.3 (forestation, reforestation and deforestation) and 3.4 (forest management[80]).

[79] IPCC, 2000, *Land-use, Land-use change and forestry*, IPCC *Special Report*
[80] Italy chose only forestry management as an additional secondary activity, in accordance with art. 3.4 of the Kyoto Protocol; the other activities are the management of cultivated land, the management of pastureland and re-vegetation

CHAPTER 2

# BIODIVERSITY AND NATURAL, AGRICULTURAL AND FOREST AREAS



*Biodiversity is the richness of life on the Earth and a source of goods, resources and services indispensable to the survival of man.*

## Introduction

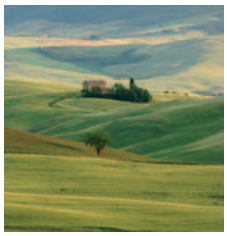
Biodiversity can be defined as the richness of life on the Earth: the millions of plants, animals and micro-organisms, the genes that they contain and the complex ecosystems of which they are the component parts in the biosphere. The *Convention on Biological Diversity* (CBD), whose provisions were set during the world summit held in Rio de Janeiro in 1992, defines biodiversity as the variety and variability of living organisms and of the ecological systems in which they live, stressing that the diversity in question involves genes, individuals and ecosystems as a whole.

Biodiversity consists not only of the range of different forms and structures of living beings, but also of their diversity in terms of abundance, distribution and interactions among the different components of biodiversity itself. Biodiversity also includes variety in human culture, though this is another area subject to the same negative repercussions that affect, as we shall see, the biodiversity of the gene pool, of species and of the ecosystem as a whole.

Biodiversity, apart from its intrinsic value, is a source of goods, resources and services (ecosystems services) that are indispensable to man's survival. These services (classified by specialists under the categories of *provisioning*, *regulating*, *cultural* and *supporting*) provide both direct and indirect benefits to all the planet's human, animal and plant communities, in addition to playing a key role in constructing the economies of the world's nations.

For example, plant biodiversity, in the form of both cultivated and wild plants, provides the underpinnings of agriculture, making possible the production of food while contributing to the health and nourishment of the global population. In the past, genetic resources have been used to improve species of cultivated plants and bred animals , and they shall continue to serve this function in the future. Genetic variety can also be drawn on to respond to ongoing developments on markets for agricultural products and to adapt to climate change and changing environmental conditions.

The priority objectives of the CBD are the preservation of biodiversity and the sustainable and durable use of its components, in addition to a just and equitable distribution of the benefits it provides. In 2003, on the occasion of the sixth session of the Conference of the Parties to the CBD, 123 nations committed



themselves to reduce significantly loss in biodiversity at local, national and regional level by 2010. Unfortunately, as even the international conservation agencies admit, there is no hope of achieving this objective. The decline of biodiversity moves forward with unprecedented speed: species are becoming extinct at a rate 100 greater than that registered in the pre-human era.

The variety of bio-geographic, geo-morphological and climatic conditions that characterise continental Europe and the Mediterranean basin make Italy a nation with an extraordinary concentration of species, habitats and areas with bountiful natural resources. Major centres of biodiversity have been identified in Italy, such as the Tyrrhenian islands and the Maritime and Ligurian Alps, to say nothing of the high rate of endemic species that characterises many areas, such as, to name just one, the Apennine chain. On the global level, Italy is considered one of the "hot spots" of biodiversity[1], being recognised as a priority eco region[2].

*Italy is considered one of the planet's key "hot spots" of biodiversity.*

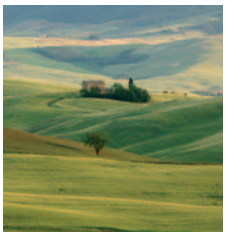
This massive natural heritage is threatened by a series of critical problems traceable to the general course of economic development, both global and national, such as the destruction and fragmentation of habitats due to urban development and agricultural practices, the deterioration of habitats on account of unsustainable management, plus the serious threat to diversity posed by the introduction of alien species and the unsustainable use of resources and species, as well as the effects of climate change. In addition to these general critical threats, there are other factors that place more direct pressure on natural systems, such as water, air and soil pollution, the increasing transformation of watersheds into artificial systems, the intensification of the grid of infrastructures, the spread of genetically modified organisms whose effects on natural dynamics are not always clearly identified and the growing presence of natural risks.

*Many critical problems pose either indirect or direct threats to Italy's national heritage.*

The loss of biodiversity is countered, on the national and international levels, through the use of both indirect and direct instruments. The first category includes all the initiatives taken to reduce the sources of pressure, such as controls on the levels of emissions of polluting substances and defence of the quality of waters. The second category consists of direct efforts to preserve species and ecosys-

*National and international instruments, both indirect and direct, are meant to fight the loss of biodiversity.*

[1] *http://www.biodiversityhotspots.org/xp/Hotspots/hotspotsScience*
[2] *http://www.worldwildlife.org/science/ecoregions/ecoregion-conservation.htlm*



tems. A noteworthy regulatory framework supports policies of conservation, making it possible both to take increasingly effective measures at the various levels of territorial jurisdiction and to establish forms of coordination between increasingly focussed and effective initiatives involving safeguards, territorial planning and general programming. Still, the regulatory sphere needs further reinforcement, in particular through increased and more widespread application of controls, higher levels of funding and adjustment of the regulations to address newly emerging problems, such as the spread of alien species and global climate change.
Starting from the information provided by the indicators found in the ISPRA Yearbook of Environmental Data, this chapter provides an overview of biodiversity in Italy, briefly outlining the state of the country's natural environments, the most important threats to biodiversity and, finally, the primary actions of defence undertaken.

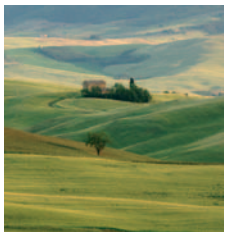
## The state of the natural and semi-natural environments

*Italy is one of Europe's richest countries in terms of biodiversity, possessing half of the European plant species and a third of the animal species.*

Italy is one of Europe's richest countries in terms of biodiversity, essentially on account of its favourable geographic position, as well as its extensive geo-morphological, microclimatic and vegetative variety, plus the additional influence of factors of history and culture. Italy possesses roughly half of all the plant species found in European territory, and it is the leading nation on the continent for number of species in absolute terms; as for animal species, Italy holds approximately a third of those currently found in Europe: certain groups, including a number of families of Invertebrates, are present at two or three times the concentration, if not higher, than in other European countries. All the above reflects what is known as the "latitude gradient" of richness of species, or the fact that diversity falls as latitude rises.

*Italy has the highest number of animal species in Europe (more than 58,000), with a high incidence of endemic species, including more than 9% of the terrestrial fauna.*

Based on the studies carried out to date, as well as the recent *European Fauna,* Italy has the highest number of animal species in Europe, with a noteworthy incidence of endemic species. Italian fauna are estimated to include more than 58,000 species, of which approximately 55,000 are Invertebrate species and 1,812 are species of Protozoa. Taken together, these categories account for roughly 98% of the total number of species, in addition to which there are 1,258 Vertebrate species (2%). The most abundant



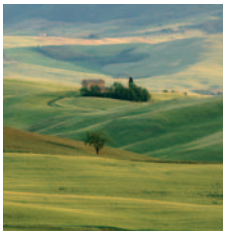
*phylum* is that of the Arthropods, with more than 46,000 species, of which approximately 65% belong to the Insect class[3].
Approximately 42,000 species of terrestrial fauna have been identified to date in Italy, of which over 9% are of particular importance, being endemic species. The number of species found in freshwater habitats (not including Protozoa) is estimated at 5,500, meaning approximately 10% of all Italian fauna. The checklist of Italy's marine fauna holds more than 9,000 species, and, given the country's geographic position, these probably account for the majority of the species in the Mediterranean.
Italian bryological flora, including Mosses and Hepaticae, are among the most abundant in Europe, consisting of 1,130 species, of which 851 are Mosses and 279 are Hepaticae[4]. It should also be remembered that knowledge of the number of these groups is continuously being updated, thanks to further exploration of little known areas of the national territory, together with the ongoing development of techniques of genetic research. Italy can also be counted among the European countries presenting the largest variety of Lichens, with 2,323 *taxa* recorded[5].

*Italy's bryological and lichen flora are among the most abundant in Europe.*

Italy's vascular flora consist of 6,711 species, breaking down into 144 species of Pteridophytes, 39 Gymnosperms and 6,528 Angiosperms[6], with endemic species accounting for 15.6% of the total. The greatest number of flora is found in the regions with the most extensive environmental variations and the largest territories, such as Piedmont (3,304 species), Tuscany (3,249), Veneto (3,111), Friuli Venezia Giulia (3,094), Lazio (3,041) and Abruzzo (2,989). Looking at the flora species that are most rare, and found in small areas, the regions that possess the greatest number of endemic species and exclusive species, meaning those

*Of Italy's more than 6,700 species of vascular plants, 15.6% are endemic species.*

[3] Source: *GIS NATURA Il GIS delle conoscenze naturalistiche in Italia*, Ministry of Environment and Defence of the Land, Department for the Protection of Nature, Milan Polytechnic, 2005; *Stato della Biodiversità in Italia*, Blasi *et al.*, 2005
[4] *Check-list and red-list of liverworts (Marchantiophyta) and hornworts (Anthocerotophyta) of Italy,* Aleffi & Schumacker, 1995; *Check-list of the Mosses of Italy,* Cortini Pedrotti, 1992; *New Check-list of the Mosses of Italy,* Cortini Pedrotti, 2001
[5] *ITALIC, the information system on Italian lichens*, Nimis & Martellos, 2002; *Licheni*, Nimis & Martellos, 2005, in: *Stato della biodiversità in Italia. Contributo alla strategia nazionale per la biodiversità*, Blasi *et al.*, 2005
[6] *An annotated checklist of the Italian vascular flora*, Conti *et al.*, 2005

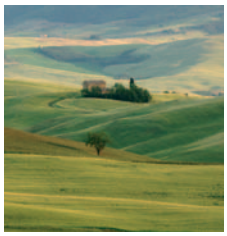


found in that region alone, are Sicily (322 endemic species and 344 exclusive ones) and Sardinia (256 endemic species and 277 exclusive ones).

Italy also possesses an especially rich stock of forests, whose quantity, depending on the type of specifications adopted for the statistics, can be estimated at approximately 6,860,000 hectares[7] and 8,760,000 hectares[8], in addition to which there are 1,710,000 hectares of sparse or low forest formations, as well as bushes and shrubs (CFS-INFC, 2005). Taking the most restrictive approach, the national forest area index is equal to 22.8%, a figure that is increasing in a gradual but constant manner (Figure 2.1). The CFS-INFC also reports that a significant portion of the new forests is recently planted and in the growing phase. These last results, together with the dynamics in the change of the cover and land use, as shown by a comparison of the *Corine Land Cover 1990* and the *Corine Land Cover 2000* (the two European projects for surveying and monitoring the characteristics of cover and land use), point to an expansion of national forest resources estimated at approximately 5,500 hectares per year[9]. From the time there have been precise statistics on the land uses in our country, this is the largest recorded extension of forest area. The trend, which involves not only Italy, but the rest of Europe as well, has been underway for a number of decades and is destined to continue in the future. It is caused not only by policies and measures for the preservation of existing resources, combined with forestation and reforestation activities, but also, and to an even greater extent, by natural forest expansion in abandoned farming areas found in hilly and mountainous zones.

*The national forest area index is 22,8%, and it is constantly growing.*

[7] ISTAT data 2006 processed by ISPRA
[8] *CFS-INFC, 2005*
[9] *La realizzazione in Italia del progetto europeo Corine Land Cover*, APAT, 2005



*Italy has an especially rich stock of forests, and its forest area index is constantly on the rise, thanks to activities of forestation and reforestation, plus the natural expansion of forests.*

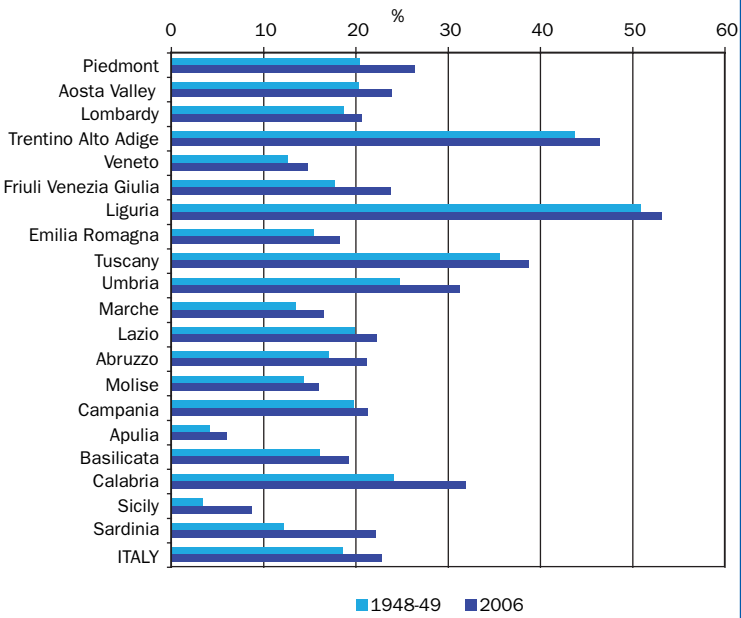
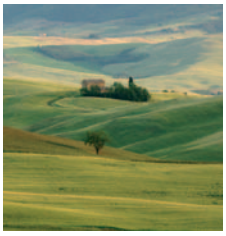



**Figure 2.1: Regional forest area index[10]**

In addition to natural and semi-natural environments in the strict sense of the terms, Italy also possesses urban green areas that constitutes an important component of its natural assets, in light of the increasing expansion of urban areas. Green areas within cities serve a variety of functions: in addition to improving appearances and setting the stage for recreational activities, they also mitigate pollution in the different environmental matrices (air, water, soil), in addition to improving the micro-climate and contributing to the preservation and enrichment of biodiversity. But despite the importance of urban green areas, there is still a shortage of data, both on account of a lack of shared data-banks and due to the failure to arrive at a universally accepted definition of "urban green areas". In cities that are provincial seats, the quantity of urban greenery managed (directly or indirectly) by government entities (municipalities, provinces, regions, the central govern-

*The quantity of urban greenery in provincial seats followed a positive trend between 2000 and 2008, in terms of both density and per capita availability.*

[10] Source: ISTAT data processed by ISPRA

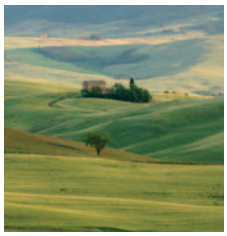


ment) showed a positive trend between 2000 and 2008, in terms of both density (percentage of the total municipal surface area) and per capita availability (ISTAT, 2008). The average density of urban greenery in these cities went from 7,8% in 2000 to 8.3% in 2008, while the average per capita availability went from 88.40 square metres per inhabitant in 2000 to 93.60 square metres per inhabitant in 2008.
The wealth of biodiversity illustrated up to this point, however, is seriously threatened and risks being lost forever. The outlook in terms of threats to animal species within the national territory has been illustrated by a number of different authors in specific Red Lists, especially with regard to autochthonous Vertebrate species. In evaluating the different categories and levels of threats, the authors make reference to the IUCN categories[11]. An analysis shows that the percentage of Vertebrate species at risk fluctuates, depending on which author is consulted, from 47.5 % to 68.4%[12] (Figure 2.2). In the specific cases of Cyclostomes and Fishes in inland waters, more than 40% of the threatened species were found to be in an especially critical condition (the IUCN categories of CR – *critically endangered* and EN – *endangered*), while, with regard to Birds and Mammals, respective percentages of 23% and 15% of the threatened species were in serious danger of extinction. A further analysis, carried out on endemic and subendemic species, confirmed the overview just formulated. A third of the threatened Fishes species, and a sixth of the Reptiles species at risk, are endemic. But the most critical situation is that of the Amphibians, which show the highest percentage of all for endemic species in danger, at more than 66%. As of today, for obvious reasons, there exists no similar evaluation for the levels of threat faced by Invertebrates. Nevertheless, considering the elevated number of species, plus the fact that the percentage of endemic species is higher than in the case of Vertebrates, being equal to more than 10% of the total, as well as the elevated niche specialisation and the limited areas of distribution of many species, it can reasonably be assumed that, when faced with the same conditions as the Vertebrates, in terms of threats,

*The percentage of Vertebrate species at risk fluctuates, depending on the author consulted, from 47.5 % to 68.4%.*

*Of the threatened species, a third of the fish, a sixth of the Reptiles and no less than 66% of the Amphibian species are endemic.*

[11] *The World Conservation Union*, 1994
[12] *Libro rosso degli Animali d'Italia*, Bulgarini *et al.*, 1998; *Application to the terrestrial vertebrates of Italy of a system proposed by IUCN for a new classification of national Red List categories*, Pinchera *et al.*, 1997; *Condannati all'estinzione? Biodiversità, biologia, minacce e strategie di conservazione dei Pesci d'acqua dolce indigeni in Italia*, Zerunian, 2002



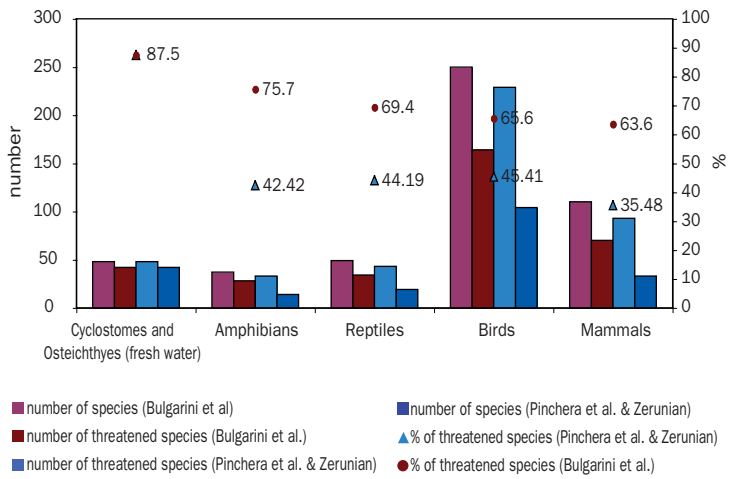



**Figure 2.2: Vertebrate species found in Italy and placed on Red Lists[13]**

*The percentage of Vertebrate species at risk fluctuates, depending on the author consulted, from 47.5 % to 68.4%. The situation is especially critical for freshwater Fishes, Amphibians and Reptiles.*

the level of danger for the Invertebrates, and thus the threat of extinction, will prove decidedly higher. The statistics on the threat faced by plant species in Italy are also taken from Red Lists published by specialists. In 1992 the number held to be in risk of extinction was 458[14], a figure that rose to 1,011 in 1997, with publication of the Regional Red Lists on Plants in Italy[15], to which the IUCN categories of threat (version 2.3) were applied. This list was subsequently revised and combined with the Atlas of Species at Risk of Extinction[16], resulting in the identification of 1,020 specie, whose precise distribution is also indicated. At present, therefore, 15.2% of Italy's vascular flora are threatened with extinction, a situation that proves even more acute for lower plants, approximately 40% of which, out of all the known species, were found to be in danger (Figure 2.3).

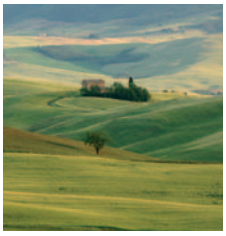
*15% of the higher plants are at risk and 40% of the lower plants.*

[13] Source: ISPRA processing of data taken from: *Libro rosso degli Animali d'Italia*, Bulgarini *et al.*, 1998; *Application to the terrestrial vertebrates of Italy of a system proposed by IUCN for a new classification of national Red List categories*, Pinchera *et al.*, 1997; *Condannati all'estinzione? Biodiversità, biologia, minacce e strategie di conservazione dei Pesci d'acqua dolce indigeni in Italia*, Zerunian, 2002

[14] *Libro Rosso delle Piante d'Italia*, Conti *et al.*, 1992

[15] Conti *et al.*, 1997

[16] Scoppola & Spampinato, 2005



*15% of the vascular flora in Italy are threatened with extinction, while the situation is even more critical for the lower plants, with approximately 40% of all known species found to be in danger.*
*In detail, the Italian plants at risk include 772 species of Hepaticae, Mosses and Lichens, plus 1,020 vascular plants.*

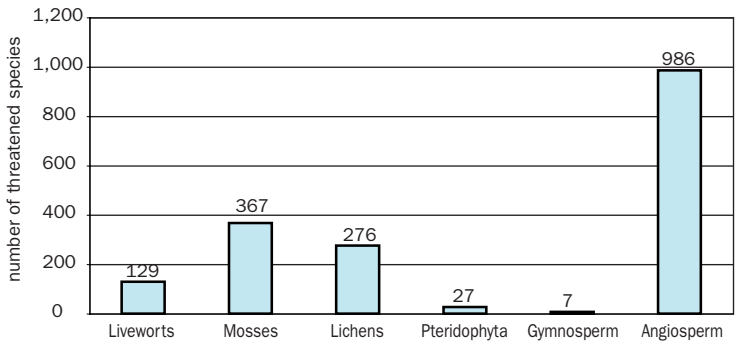


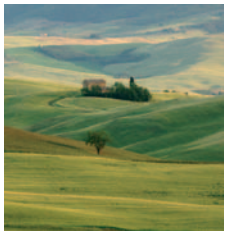

**Figure 2.3: Threatened plant species in Italy, distributed by system groups[17]**

Current knowledge of Italian vegetal units at risk is far from complete, and so the state of preservation of the *taxa* of Italian flora should be evaluated according to the most recent criteria, published by the IUCN in 2001, in order to draw up a New Red List for Italy. To this end, the Italian Botanical Society undertook the "Italian Initiative for the Implementation of the IUCN Categories and Criteria (2001) for Formulation of new Red Lists" in 2006. In 2008 the experts involved in this initiative published the initial results of application of the IUCN criteria to 40 target species of Italian flora[18]. The experts' assessment work continues, as new reports are currently being prepared for publication on other Italian plant species at risk.

*Based on the Habitat Directive, over 50% of the European habitats to be protected are found in Italy.*

Closely connected with the state of preservation of the different species is the state of preservation of habitats. As we shall see further on, in applying the "Habitat Directive" (92/43/EEC), which constitutes one of the most important regulatory instruments for preserving habitats and biodiversity, Italy plays a role of noteworthy importance. In fact, the country's geographic characteristics place

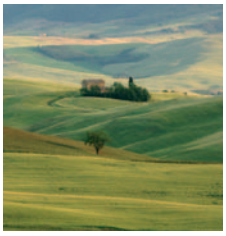
[17] Source: *Libro Rosso delle Piante d'Italia*, Conti *et al.*, 1992; *Liste Rosse Regionali delle Piante d'Italia*, Conti *et al.*, 1997; *Atlante delle specie a rischio di estinzione (CD-ROM)*, Scoppola & Spampinato, 2005
[18] *Informatore Botanico Italiano*, vol. 40, suppl. 1, 2008



it within three different bio-geographic zones (Alpine, Continental and Mediterranean), while, according to the directive, over 50% of the habitats to be protected are found in Italy.
Our country holds 130 of the habitats in annex I to the Habitat Directive, as well as a total of 455 of the species founds in annexes II, IV and V[19]. In Italy there are 212 animal species, including 7 species of cetaceans and sea turtles, whose presence in our seas is held to be occasional, plus 113 plant species, when the species of 3 different genera of lower plants are considered in a joint evaluation.
Of the habitats listed in annex I to the Habitat Directive, no fewer than 24, of which 13 are given top priority, are found only in Italy within their bio-geographic region of reference[20]. Nevertheless, the "Italian Manual for Interpretation of Directive 92/43/EEC", recently published by the Ministry of Environment, Land and Sea, together with the Italian Botanical Society, points to the need to update the directive annexes to include 15 new habitats found in our country and worthy of being listed, in addition to reviewing the "priority" status attributed to certain habitats. As a rule, the habitats at risk in Italy are uniformly distributed throughout the national territory, with this being true for the quantities of the different types of habitats as well[21]. Worthy of separate mention are the 9 marine habitats protected under the directive, of which only the Prairie of Posidonia is a marine habitat in the strict sense of the term. Regarding the latter, it should be noted that the European Commission does not hold the network of sites proposed to date by Italy for the Nature Network 2000 to be complete.[22]
The state of conservation within Italian territory of the habitats and species of Community interest included in the annexes of the Directive was illustrated in the 2nd National Report, which Italy drew up and sent to the European Commission in 2007, in accordance with the provisions of art. 17 the same Directive. This Report,

*24 habitats listed in the Habitat Directive as requiring protection, off which 13 are given top priority, are found only in Italy within their bio-geographic region of reference.*

[19] *Attuazione della Direttiva Habitat e stato di conservazione di habitat e specie in Italia.* Ministry of Environment, Land and Sea, 2008
[20] *Reference list of habitat type, EU Commission and EEA*, 2009
[21] *Libro rosso degli Habitat d'Italia. Petrella S. et al., 2005, WWF Italia Onlus Roma*
[22] *Ruling of the Commission approving the list of SCI for the Mediterranean region*, 2006



*The Italian habitats in the worse state of conservation are those of the dunes, followed by freshwater and rocky habitats.*

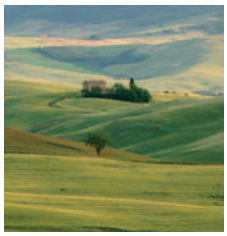
covering the period 2001-2006, provides a benchmark for comparisons with the results to be presented by subsequent national reports, which, as stipulated under art. 17, are to be drawn up every six years. The current results show that the habitats in the worst state of conservation are those consisting of dunes, followed by freshwater and rocky habitats. It was also found that the available data are not sufficient for forecasting the future prospects of much of the habitats, meaning that their fate will depend, in large part, on the management strategies followed, inside and outside the Nature 2000 Network.

In addition to natural environments, agricultural areas also play an important role when it comes to biodiversity and other environmental factors. Not only do they support the production of food and fibres, but they are closely tied to the environment, giving rise to extremely complex relations, at times in contradiction the one with the other. In demonstration of the importance of agriculture with regard to natural resources, it should be remembered that roughly 42% of the national territory is earmarked for agriculture (ISTAT, 2007), and that a portion of this area, the equivalent of approximately 21% of the UAA (Utilised Agricultural Area), presents characteristics of noteworthy naturalistic value in terms of genetic and species biodiversity, as well as that of the landscape, also serving as zones of connection with natural spaces. Italy, together with Spain, Greece, northern Great Britain and Scandinavia, preserves an elevated percentage of agricultural areas of significant natural worth, such as Alpine meadows and pastures.

*Roughly 42% of the national territory is devoted to agricultural activity, and approximately 21% of the UAA (Utilised Agricultural Area) presents characteristics of noteworthy naturalistic value.*

*The decrease in UAA frequently corresponds to an operational abandonment of agricultural soil, following which processes of vegetative renewal are possible, though also processes of soil deterioration, erosion and desertification.*

In recent decades, running parallel to the stagnation in demographic growth and in the demand for agricultural products, as well as to the exodus from rural areas and the rise in productivity per unit of surface area, Italy has registered a noteworthy decrease in the number of farming enterprises and in the UAA. This last measure fell by 2.3 million hectares between 1990 and 2007, meaning a loss of more than 15% (ISTAT). It is important to note, however, that this decrease has been accompanied by a gradual rise in the UAA of the average enterprise, which went from 6.1 hectares in 2000 to a figure of 7.6 hectares in 2007, making for an increase of 25.1%. The reduction in the overall UAA frequently corresponds to an operational abandonment of farmlands, which can then undergo



processes of renewed colonisation on the part of tree, bush and herbal vegetation (re-vegetation), though they can also be subject to processes of soil deterioration, erosion and desertification. The process of vegetative renewal can be sharply limited by a loss of natural qualities caused by agricultural activities, with the extent of the loss depending on the characteristics of the agricultural activities and their duration. The fertility of the soil in abandoned farmland always proves to be impoverished, while the composition of the original seed bank of the soil is totally compromised. These factors, together with the situations of deterioration and fragmentation typical of the agricultural areas of industrialised countries, block or slow the natural dynamics of vegetative succession.

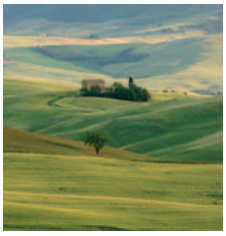
In Italy, as in many other countries of the Western world, the process of agricultural specialisation and intensification underway between the 1950's and the early nineties, together with the globalisation of the agricultural economy, have resulted in a serious loss in biodiversity. At present, almost half of the 12.7 million hectares of UAA are dominated by only five crops: wheat, corn, rice, olives and grapes. And even these crops are subject to a worrisome level of genetic erosion.

At the same time, it should be noted that the set-aside policies promoted under the 1992 reform of Common Agricultural Policy, calling for subsidies to be paid to farmers to put to rest 10% of the cultivated surface area, has facilitated the restoration of habitats that had almost disappeared, such as wetlands, meadow areas alternating with shrubs and flooded meadows, with the result that meadows and pastureland (currently 27.1% of the UAA), together with fallow land and other crops (currently 4.1% of the UAA), have registered growth over the last ten years.

Confirming the loss of agricultural biodiversity is a study carried out by *BirdLife International*, *European Bird Census Council* and the *Royal Society for the Protection of Birds*, showing that, of the 124 species of birds most widespread in Europe, 54 have decreased over the last 40 years. Of these species, no fewer than 33 are typical of agricultural environments, and their numbers have been nearly halved in 25 years' time. The decrease in agricultural species is even more pronounced in Italy, specifically affecting the Swallows, Martins, Warblers, Stonechats, Larks, Shrikes, the White Wagtail, the Italian Sparrow and the Tree Sparrow.

*The specialisation and intensification of agriculture, as well as the globalisation of the agricultural economy, have resulted in a serious loss in biodiversity, even though set-aside policies have facilitated the restoration of habitats that had almost disappeared, such as wetlands, meadow areas alternating with shrubs and flooded meadows.*

*In recent decades, there has been a noteworthy decrease in ornithological species tied to agricultural environments.*



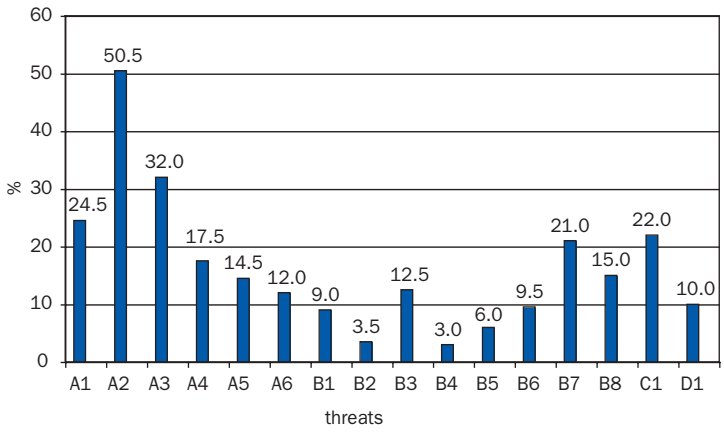
*The primary threats to biodiversity are human activities and the growing demand for natural resources and ecosystem services.*

## The main causes of threats to biodiversity

The main threats to the natural heritage are tied to the impact of human activities and to the growing demand for natural resources and ecosystem services, which proves increasingly incompatible with the preservation of those resources and services in a state able to guarantee their survival and transmission to future generations. In Western and Central Europe, and throughout the Mediterranean basin, the presence of man from ancient times has led to alterations in the natural ecosystems and habitats, which today, in the majority of cases, appear fragmented and subject to various types of disturbances. Five main causes for the loss of biodiversity are particularly worthy of note[23]: the deterioration and destruction of habitats, fragmentation, the introduction of alien species and the excessive exploitation of resources and species. This last factor is traceable, first and foremost, to a lack of adequate regulation for governing, according to ecological criteria, the procurement of supplies of resources, plus, as a secondary consideration, the collection and sale of wild species. These threats lead to a reduction in biodiversity, as a result of the deterioration and impoverishment of ecosystems, together with the local extinction of many species, primarily the most sensitive, the endemic species, the rare ones and those that prove most vulnerable. At times there is a turnover involving different types of species, with the often irreversible disappearance of many species typical of a natural habitat being accompanied by the entry of species that are exotic, competitive, generalist, ruderal or connected to human phenomena. With respect to Vertebrate animal species, Figure 2.4 shows the overall outlook for the various factors of risk and their relative incidence on the state of preservation, determined on the basis of the Red Lists published to date on the different categories of threats by the IUCN. Generally speaking, the analysis shows that the most frequent threat (50.5% of the species at risk) of all the indirect influences of human origin consists of the transformation and modification of natural habitats (A2), while poaching and illegal fishing (B7) constitute the predominant threat among direct influences of human origin.[24]

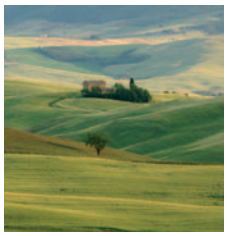
*The transformation and modification of habitats threatens 50.5% of the Vertebrate animal species.*

[23] *Conservazione della natura*, Primack & Carotenuto, 2007
[24] *Libro rosso degli Animali d'Italia*, Bulgarini *et al.*, 1998; *Application to the Terrestrial Vertebrates of Italy of a System Proposed by IUCN for a New Classification of National Red List Categories*, Pinchera *et al.*, 1997; *Condannati all'estinzione? Biodiversità, biologia, minacce e strategie di conservazione dei Pesci d'acqua dolce indigeni in Italia*, Zerunian, 2002




**Legend:**
Indirect influences of human origin:
A1: Reclamation of wetlands
A2: Modifications and transformations of habitats (construction, buildings, roads, ports, lining of riverbanks with concrete, variations in climate tied to influences of human origin, barriers blocking water ways, intakes of water supplies, modifications of flow)
A3: Use of pesticides and water pollution
A4: Fires and cutting of forests
A5: Changes in farming, livestock and fishing activities
A6: Leisure time activities (tourism, bathing, excursions, nautical sports, sport fishing, photographic hunting, mountaineering or free climbing)
Direct influences of human origin:
B1: Hunting
B2: Suppression of pests
B3: Harvesting of eggs, chicks, larva and adults for the purpose of sale or collection
B4: Vandalism
B5: Genetic pollution
B6: Excessive fishing
B7: Poaching and illegal fishing
B8: Competition or predatory behaviour on the part of outside species and/or populations
C1: Natural causes
D1: Unknown causes
The figure refers only to threatened species for which confirmed chorological information is available.
It should be noted that the categories of threats indicated in the reference source were later modified by the IUCN, and so do not correspond to those currently in use (ver. 3.0).

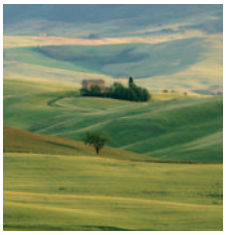
**Figure 2.4: Incidence of the risk factors for Vertebrates out of the total species threatened[25]**



*In Italy the primary threats to biodiversity are human activities and the growing demand for natural resources.*
*Of all the indirect threats of human origin, the most frequent involve the transformation or modification of natural habitats, while poaching and illegal fishing constitute the primary threats among the direct influences of human origin.*

Though difficult to quantity, poaching represents a very serious threat to Birds and Mammals in Italy. In many regions the illegal capture of wild animals with traps, snares and jaw traps is still widespread, as is the killing of animals with poison and firearms. These practices are especially common in certain critical areas, such as the Brescia and Bergamo valleys, the Tyrrhenian Islands and the Strait of Messina[26].

[25] Source: ISPRA processing of data taken from: *Libro rosso degli Animali d'Italia*, Bulgarini *et al.*, 1998; *Application to the Terrestrial Vertebrates of Italy of a System Proposed by IUCN for a New Classification of National Red List Categories*, Pinchera *et al.*, 1997; *Condannati all'estinzione? Biodiversità, biologia, minacce e strategie di conservazione dei Pesci d'acqua dolce indigeni in Italia*, Zerunian, 2002
[26] *Bracconaggio e trappolaggio. Todaro G., 2006, Perdisa Ed., Bologna*



*Worth mentioning among the causes of impact are those tied to hunting, which can be practiced in more than 62% of the national territory, though hunting pressure differs from one region to the next.*

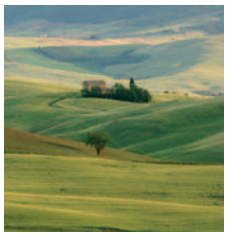
Moving on to a more detailed analysis of the causes of impact, mention can be made of those tied to hunting, an activity that, it should be noted, can be practiced in more than 62% of the national territory (ISTAT, 2007). Pressure from hunting is not uniformly distributed throughout the country: in certain regions, such as Liguria, Umbria, Tuscany and Lazio, the level is definitely higher than in others. The greatest levels of pressure are to be found both in large-size regions (Tuscany, Lazio, Lombardy, Campania) and in those of limited extension (Umbria and Liguria). Assuming that the number of hunters constitutes the primary factor of hunting pressure within a given territory, a decrease in this pressure was observed between 2000 and 2007, due to a drop of 6.2 percent in the number of hunters on the national level. Looking at the different regions, no fewer than eleven showed percentage reductions in the number of hunters higher than the decrease for Italy as a whole. Only five regions (Trentino Alto Adige, Lazio, Calabria, Sardinia and Molise) showed increased numbers of hunters.

*Fishing is an important factor of impact in marine environments. Italy accounts for approximately 5% of the total European catch, but, as do the other countries of the Union, it takes part in efforts pursued by the EU for some time now to limit fishing.*

As far as fishing is concerned, it has a major impact on the marine environment. Italy accounts for approximately 5% of the total European catch, though, together with the other countries of the Union, it takes part in the efforts to limit the impact of fishing pursued for some time now by the EU and forcefully confirmed in the new Common Fisheries Policy (CFP), which went into effect on 1 January 2003. The year 2008 registered a continuation of the trend begun in 2000, with the size of the fishing fleet falling in terms of both ships and overall engine power, while the figure for the total tonnage of the national fleet, which had reversed its downward trend in 2007, increasing by 20% over 2006, once again showed a decrease, though a slight one, in 2008. The primary fishing indexes (fishing effort and CPUE - *Catch Per Unit of Effort*) moved in the same direction, as both figures, though their results had differed in previous years, showed decreases in 2008[27].

As a rule, the Italian fishing fleet consists of modest and medium-size vessels, with non-industrial-scale fishing in many regions accounting for 80% of the entire fleet (Ministry of Agricultural, Food and Forestry Policies-IREPA, 2008). Naturally, the situation varies throughout the national territory: in 2008 more than 55% of the vessels

[27] Ministry of Agricultural, Food and Forestry Policies-IREPA, 2008



of the national fishing fleet were registered in Sicily (24%), Apulia (13%), Sardinia (9%) and Campania (9%), while the highest figures for average days of fishing were recorded in Apulia, Campania, Marche and Molise. The most frequently used fishing systems are bottom and mid-water trawling, together with small-scale coastal fishing, confirming the general tendency of the Mediterranean to favour non-industrial modes of fishing. In the case of small-scale coastal fishing, it is common for different systems to be used in different periods of the year. In 2008, 37.3% of the total catch in Italy was made by trawling, with the boats of Sicily and Apulia responsible for 44% of the overall figure[28]. Even though the vessels are generally small in size, and fishing activities have been successfully limited in recent years, more than 50% of the vessels still operate exclusively along the coast (MIPAAF, 2008), subjecting this zone, in which a large part of the resources of the entire marine system are located, to greater pressure.

The biodiversity of forest ecosystems is also subject to a variety of threats, though, as noted earlier, the trend in total forest surface area in Italy has been positive for a number of years now. This increase largely reflects decisions made in other economic sectors rather than being the result of deliberate forestry or environmental defence policies, as demonstrated by the growing wooded area is increasingly subject to abandonment and the accompanying deterioration, first and foremost in the form of fire. An especially critical period for forest fires was recorded in the mid 80's, followed by years in which the level remained high, on the whole, with a gradual falling off up to 2006, then a sharp rise in 2007, followed by another lessening of the level in the year 2008, during which slightly less than 6,500 events occurred, involving approximately 66,000 hectares, of which 30,000 can be classified as forest area in the strict sense of the term (CFS, 2008).

The expansion of Italy's forest area is accompanied by a rise in the volume of roundwood and large branches (the latter figure, equal to 1.269 billion cubic metres, for an average of 145 cubic metres per hectare), making for a current total increase in forests of roughly 36 million cubic metres (4.1 cubic metres per hectare)[29].

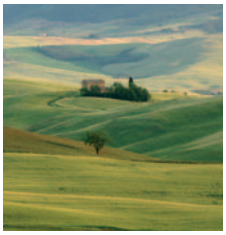
*The biodiversity of forest ecosystems is also subject to a variety of threats, despite the positive trend.*

*After a sharp revival in the number of forest fires in 2007, the level dropped once again in 2008.*

*The increase in wood volume is limited by the harvesting of supplies, fires, plant disease and mortality.*

[28] Source: Ministry of Agricultural, Food and Forestry Policies-IREPA data processed by ISPRA

[29] CFS-INFC, 2005

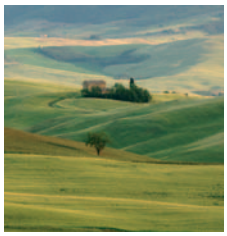


*Use of forests appears extremely limited, following a downward trend since 2005, especially as regards firewood.*

*The rate of harvesting gradually fell between 1999 and 2002, registering constant annual values in the years that followed.*

*Harvesting of a number of non-wood products decreased in 2007, as compared to 2000, though with certain exceptions.*

This last statistic is limited by the harvesting of wood supplies, by fires, by plant disease and by mortality.
Wood harvesting, as registered by ISTAT (though numerous independent studies hold the figure to be significantly underestimated), appears very limited, and on the decrease since 2005, especially in terms of the harvesting of firewood. This last activity fell from 5.2 million cubic metres in 2005 to 5.0 million cubic metres in 2007. Total supplies harvested in 2007 were equal to 8.5 million cubic metres (7.5 million cubic metres, not counting wood outside of forests), of which 66.8% was firewood. In recent years, the trend in the harvesting of wood has been downward, accompanied by a noteworthy reduction in the average surface area cut.
In terms of the harvesting rate (the ratio between the cubic metres harvested and the forest area), it fell gradually between 1999 (the year when it reached the level of 1.3 cubic metres per hectare) and 2002 (0.8 cubic metres per hectare), after which a constant annual figure of 0.9 $m^3$/ha was registered in the years that followed. This decrease was especially pronounced for firewood (-40% compared to 2000), which still constitutes more than 60% of overall wood production.
A decrease in the harvesting of some non-wood products was registered in 2007 as compared to 2000 (ISTAT, 2008), with the noteworthy exceptions of mushrooms and pine seeds with shells, while the year 2005 also registered a significant truffle harvest. In all likelihood the downward trends were tied to processes of urban development, with the resulting difficulty of recruiting labour, not to mention the loss of local traditions, while the growth exceptions involve niche and/or industrial products with a market. As a rule, these trends can be interpreted as a lessening of pressure on forest ecosystems, though consideration should also be given to the fact that a renewal of production activities, if properly managed, can end the state of abandonment of forests and improve the manner in which they are managed, with positive fallout in terms of conservation as well.
The introduction of potentially invasive allochtonous species – or alien, exotic or non-native ones - constitutes another threat to biodiversity. Their presence in Nature can essentially be traced to three modes of introduction: intentional (through raising, culti-



vation, as a hobby etc.), accidental or secondary (i.e. through the transport of cargo, ballast water in ships, fouling etc, or *taxa* originally introduced in areas outside Italy's borders, only to enter our country, at a later point in time, on their own) and unknown. Based on the available data for the presence of alien animal or plant species introduced in Italy since 1500, the year used as the benchmark for species introduced into Europe, the current overall number of documented alien species is 2,029[30-31]. It is important to stress, however, that this figure underestimates the true extent of the situation, both on account of the limited number of specific studies and focussed monitoring efforts available and due to the delay with which the species, once they are identified, are placed on the lists or databases.

An analysis of the percentage break-down of the alien species into the various taxonomic/environmental groups (Figure 2.5), based on the taxonomic categories of the DAISIE, shows that, of the 2,029 documented alien species in Italy, plants account

*The introduction of potentially invasive allochtonous species constitutes another threat to biodiversity. The number of alien animal and plant species in Italy currently stands at 2,029.*

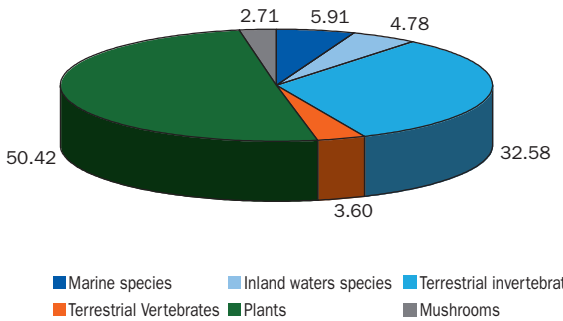


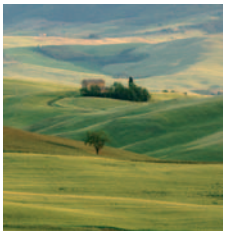

**Figure 2.5: Percentage break-down among environmental/taxonomic groups of the 2,029 allochtonous species introduced into Italy since 1500 (updated to 2007 and, only for vascular plants, to 2009)[32]**

*Plants account for 50% of all documented alien species in Italy, followed by terrestrial Invertebrates, at 33%.*

[30] *DAISIE European Invasive Alien Species Gateway (http://www.europe-aliens.org)* – updated to 2007

[31] *Non-native flora of Italy*. Celesti-Grapow *et al. (eds),* 2009

[32] Source: ISPRA processing of data taken from *DAISIE European Invasive Alien Species Gateway (http://www.europe-aliens.org)* – updated to 2007*; Non-native Flora of Italy,* Celesti-Grapow *et al. (eds.),* 2009



*The rapid increase in alien species introduced into Italy from 1900 on is traceable to the rise in trade and the development of transportation systems, and would not appear to have had any saturation effect on ecological systems.*

for 50% of the total, followed by terrestrial invertebrates, at 33%. The other groups register significantly lower percentages: marine species almost 6%, those of inland waters 4.8%, terrestrial Vertebrates 3.6% and Mushrooms 2.7%.

A trend analysis, involving calculation of the cumulated number of alien species introduced into Italy from the year 1900 on (Figure 2.6), points to an exponential increase in the number of species introduced, specially from the 1950's onward.

This rapid increase, traceable to the growth in trade and the development of transportation systems, would not appear to lead to a saturation effect, backing the assertion that ecological systems are rarely saturated by the new species introduced.

*The trend for species introduced in Italy from 1900 on points to an exponential increase in the number of alien species, especially from the 1950's onward.*

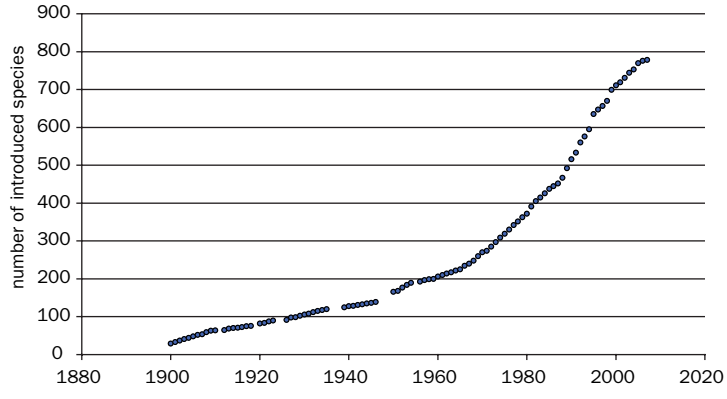
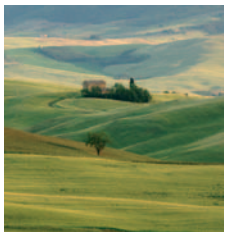



**Figure 2.6: Cumulated number of alien species introduced into Italy starting from 1900, calculated in terms of 778 species whose introduction date is certain (updated to 2007)[33]**

*The average annual rate of new introductions, calculated from the year 1900 on, points to an exponential increase in the average number of alien species introduced per year.*

Furthermore, the annual average rate of new "introductions", calculated from 1900, on the basis of the same contingent of species, points to an exponential increase in the average number of alien species introduced each year, with the rate going from slightly more than one species a year in the early 1900's to approximately 15 species a year by the end of that same century.

[33] Source: ISPRA processing of data taken from *DAISIE European Invasive Alien Species Gateway (http://www.europe-aliens.org)* – updated to 2007



Though "introductions" of unknown origin have risen at a higher rate than the other mechanisms of introduction, intentional modes are still the most widespread, especially for certain groups of animal species, such as Mammals, or freshwater species involved in sport fishing.

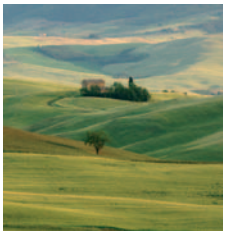
Mention should also be made of the indirect effects of actions of human origin, and especially those traceable to climate changes, already referred to and noted in numerous studies and reports. A widely read article in the review *Science*[34] stated that, before the year 2050, climate change is destined to become the second leading cause (after deforestation and forest deterioration) of loss of biodiversity on both sea and land. Various studies conducted over extended period of time have shown that the climate anomalies that have occurred to date, and especially those involving daytime temperatures and levels of rain, have altered certain physiological processes (photosynthesis, respiration, the growth of plants, efficient use of water, composition of tissues, metabolism and decomposition), as well as the distribution and phenology of plants, plus the reproduction periods of many animal species and the interactions between these species and both biotic and abiotic factors.

*The indirect effects of actions of human origin, and especially those traceable to climate changes, have been noted in numerous studies and reports.*

In Italy, the impacts observed up to this point include the shifting northwards, and towards higher altitudes in the geographic range, of many species. The lengthening of the vegetative season has led to increased productivity in the Alpine bio-geographic region, while the drier, hotter climatic conditions are responsible for a decrease in forest productivity and an increase in the number and severity of forest fires in the Mediterranean region.
One of the scenarios proposed by the Intergovernmental Panel on Climate Change (IPCC) points to a rise of 4 °C in the average temperature of our peninsula and the country's islands before the end of the century. The impact of a similar change would translate into a "latitudinal transgression" of 400 km of many species, along with a "transgression in altitude" of 400 m, as these species

*In Italy the impacts of climate change influence the geographic ranges of many species, as well as the vegetative seasons.*

[34] *Global Biodiversity Scenarios for the Year 2100.* Sala O.E. *et al.* (2000). *Science* 287:1770-1774



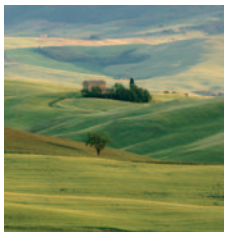
search for more fitting climatic conditions. Many areas, for example, could become suitable for growing grapes, or for new varieties (replacing others no longer suited to the changed climate); on the other hand, certain grape-growing regions may loose their capacity to bring the traditional varieties of grapes to ripening; regions with hot-arid climates (Pantelleria, Salento) could be pushed outside of the grape-growing zone (as well as that for growing olives and citrus fruit). Interesting studies carried out at the University of Padova point to the problems that could arise during the production of raisin wines (Recioto, Amarone, Gambellara).

*The capacity of natural, semi-natural and agricultural areas to resist climate change, as well as their resilience in the face of its effects, is closely tied to biodiversity.*

There is ample scientific evidence demonstrating that the capacity of natural, semi-natural and agricultural areas to resist climate change, and to adjust to its effects in resilient fashion, is highly dependent on biodiversity, in terms of specific locations, bioregions, the gene pool and the ecosystem.

On the topic of climate change, it should be remembered that natural and agricultural areas play a significant role in the global carbon cycle, and thus on the problem of the greenhouse effect. The primary sector is a net emitter of greenhouse gases, generated by the enteric fermentation of livestock, the defecations of these same animals, the physical-chemical and biological processes that occur in agricultural soil, by rice paddies and by the combustion of agricultural waste. According to the national inventory of greenhouse gas emissions[35], in 2007 agriculture was responsible for introducing into the atmosphere 37.2 million equivalent tons of $CO_2$ ($MtCO_2eq$), equal to 6.7% of Italy's total greenhouse gas emissions, for an increase of 1.6% over 2006 (when the figure was 36.6 $MtCO_2eq$), making agriculture the second leading sector in terms of quantity of greenhouse gas emissions, after the energy sector (83%). On the other hand, certain modes of using and managing agricultural and forest lands make possible increases in the quantities of $CO_2$ temporarily fixed through the conservation or expansion of stocks of carbon in forest ecosystems or agricultural soils. This possibility is tied to the ongoing development of the sector, and, therefore, to policies of agriculture and rural development, as well as energy and climate poli-

[35] *Italian Greenhouse Gas Inventory 1990-2007. National Inventory Report 2009.* ISPRA Report 98/2009, Rome - Italy



cies that influence the procedures for managing the land, as well as the sector's capacity for "spontaneously" reacting to the process of climate change.

According to the inventory cited earlier, the sector of Land Use, Land Use Change and Forestry (LULUCF[36]) accounted for the capture of 70.9 $MtCO_2eq$, equal to 12.8% of the total national emissions of greenhouse gases, marking a reduction of 36.8% compared to 2006 (when the fixing capacity was estimated at 112.2 $MtCO_2eq$). It should also be noted that local activities geared towards mitigating the greenhouse effect can generate social, economic and ecological benefits, as well as income for the owners and managers of the land involved.

There is controversy over the role of activities tied to agriculture as causes of impact on the natural heritage. On the one hand, agricultural areas are subject to the negative impacts of other activities and other spheres of production, given that they frequently are affected by urbanisation, illicit dumping of waste and industrial pollution. At the same time, agricultural activities themselves are frequently identified as one of the main causes of water pollution, loss of stability of terrains and soil pollution, as well as of increases in the greenhouse effect, loss of biodiversity and simplification of the landscape.

*Agricultural areas are subject to the negative impact of other economic activities, while, at the same time, they can cause pollution and loss of biodiversity.*

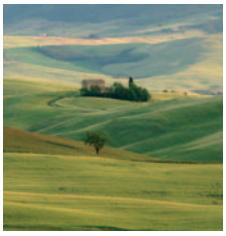
In Italy, the main impacts on the environment and biodiversity directly traceable to agriculture are tied to use of fertilisers and plant care products.

*In Italy, the main impacts on the environment and biodiversity directly traceable to agriculture are tied to use of fertilisers and plant care products.*

The distribution in agricultural soil of synthetic fertilisers, the spread of runoff from livestock enterprises and small agro-food companies, the distribution of sludge from purification operations are all key factors in the pollution of surface and underground water bodies, as well as marine coastal habitats, plus the eutrophication of waters, all with consequences on human health, not to mention the flora, the fauna and the sum total of the ecosystems to which they belong.

What is more, numerous studies indicate that a decrease in agricultural biodiversity (meaning a decrease in the varieties of the species grown, in the "buffer" strips of unfertilised grass and in

[36] LULUCF: *Land Use, Land Use Change and Forestry*



the hedgerows along waterways and ditches to meet the internal production concerns of the enterprises), together with the abandonment of crop rotation and of marginal, uncultivated zones, can have specific consequences on the migration of nutrients and other pollutants towards the surrounding watersheds.

*Surface and underground waters frequently present concentrations of plant care products in excess of the legal limits.*

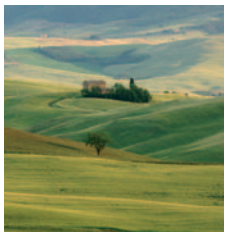
An ISPRA survey on the contamination of surface and underground waters from plant care product residues placed in the environment, involving the analysis of 11,703 samples by the regional governments and by the ARPA's, point to surface water contamination of 57.3%, highlighting that, in 36.6% of these cases, the concentrations exceed the limits set under the law for drinking water. In underground bodies of water, on the other hand, the level of contamination is 31%, with the concentrations exceeding the legal limits in 10.2% of the cases. The figures for Italy's primary watersheds show that, in the course of a century, the average concentration of nitrogen in the water rose threefold, with the level increasing ten times over in certain Italian rivers that run through heavily cultivated areas, such as the Po Valley Plain, where over 50% of the fertilisers sold are concentrated.

*During the years 1998-2007, there was an increase of 22.1% in the quantity of fertilisers placed on the market.*

On the subject of fertilisers, it should be noted that the quantity placed on the market in Italy, after a slow but continuous decrease that began in the 70's, returned to an upward trend in the period 1998-2007, registering growth of 22.1% (ISTAT, 2007). The national figure for the year 2007 moved above the 5.4 million ton mark, with more than 3 million tons consisting of mineral fertiliser, of which the most widely used type are those based on nitrogen.

*The quantity of plant care products placed on the market fell by 8.2% during the period 1997-2007, but rose by 3% between 2006 and 2007.*

As far as plant care products are concerned, the quantities placed on the market in the period 1997-2007 shrank by 8.2%. In 2007 more than 153,000 tons were sold, for an increase of 3% compared to the previous year, with 76.5% of the total consisting of "unclassifiable" products, and the remaining 23.5% including those products classified highly toxic, toxic and harmful, which, being the most dangerous from a toxicological, eco-toxicological and chemical-physical point of view, are subject to special restrictions in terms of their sale and preservation. Compared to 2006, the unclassifiable products were practically unchanged, while the toxic and highly toxic products decreased by approximately 242 thousand tons, though this decrease was more than offset by the noteworthy increase in harmful products (more than 4,700 tons). Taken as a whole, there-



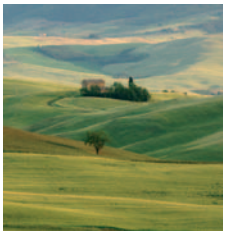
fore, the most dangerous products increased by 14.3%.

## The main initiatives for protection

As already noted, the preservation of biodiversity often conflicts with man's models for putting resources to use. Efforts to reconcile its defence as best as possible with the demands of society frequently result in agreements and legislative instruments, key elements that prove indispensable when it comes to combining the need for conservation with economic, social and cultural concerns, as well as those of local populations. Italy has endorsed numerous conventions and international agreements designed to safeguard biodiversity. Especially worthy of note, give its strategic importance on a global scale, is the Convention on Biological Diversity[37], signed in Rio de Janeiro on 5 June 1992 during the United Nations World Summit on the Environment and Development[38]. The CBD sets three specific objectives: 1) the preservation *in situ* and *ex situ* of biological diversity; 2) the sustainable use of the components of biological diversity; 3) an equitable distribution of the benefits produced by the use of genetic resources. In Italy the CBD was ratified with Law no. 124 of 14 February 1994. Later, on 16 March 1994, the CIPE (Inter-Ministerial Committee for Economic Planning) approved the document "Strategic Guidelines and Preliminary Program for the Implementation of the Convention on Biological Diversity in Italy". The CBD acknowledges the importance of the ecosystem approach as a strategy for the integrated management of the territory, of water and of living resources, in such a way as to promote their conservation and sustainable, equitable use; the application of the ecosystem approach favours a balanced approach to pursuing the three objectives of the CBD. The ecosystem strategy is based on the application of suitable scientific methodologies focussed on levels of biological organisation that include key processes, functions and interactions between the organisms and their environment. It acknowledges that human beings, with all their cultural diversity, are an integral part of ecosystems.

*Italy has endorsed numerous conventions and international agreements geared towards safeguarding biodiversity, such as the Convention on Biological Diversity.*

[37] Convention on Biological Diversity - CBD
[38] United Nations Conference on Environment and Development - UNCED

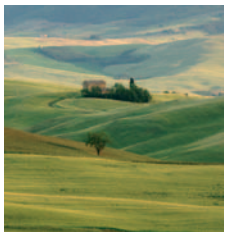


*The "Siracusa Charter on Biodiversity".*

Also worthy of note among the international agreements is the recent "Siracusa Charter on Biodiversity", signed by the Ministers of the Environment of the G8, in concert with the ministers of other countries and with the international organisations taking part in the meeting held at Siracusa on 22-24 April 2009. The Charter calls for a series of initiatives to be taken regarding interconnections between biodiversity and the climate, the economy, ecosystem services, science, research and politics. Based on these initiatives, a shared path is proposed towards the post-2010 context, taking into consideration the following elements:

- the need to intensify efforts to conserve and manage in a sustainable manner both biodiversity and natural resources;
- the need for appropriate programs and timely actions designed to reinforce the resilience of the ecosystems, seeing that a loss of biodiversity or a non-sustainable use of the same can give rise to noteworthy economic losses;
- the need to give due consideration, in establishing the context to follow the 2010 objective, to the numerous elements that can cause a loss of biodiversity or generate a medium or long-term threat to biodiversity, as these elements are identified through scientific research;
- the need for a far-reaching communications strategy that fully involves all the sectors, as well as the stakeholders, the local communities and the private sector, so as to emphasise participation and determine responsibilities;
- the need for a reform of environmental governance at all levels, of key importance to integrating biodiversity and ecosystems services in political procedures, so as to transform what are currently weaknesses of economic systems into opportunities, while supporting sustainable development and employment, with particular consideration for the conditions in which the developing countries find themselves.

The EU is deeply committed to defending nature and biodiversity. The strategic topics of the EU Environmental Action Plan for policies in defence of Nature are highly integrated in both the Strategy for Sustainable Development and the objectives of the Lisbon Treaty, as well as in the policies for the individual sectors, including agriculture, fishing, industry, energy and transport.

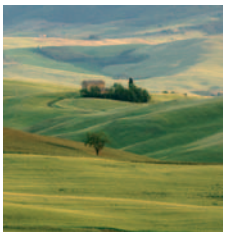


*The two cornerstones of EU policies for the conservation of nature and biodiversity are the Birds Directive and the Habitat Directive.*

*In Italy, the Nature 2000 Network currently consists of 597 SPAs, with a surface area of 4,377,721 hectares, equal to 14.5% of the national territory, plus 2,288 SCIs, with a surface area of 4,530,866 hectares, equal to 15% of the national territory.*

The cornerstones of EU policies on the conservation of nature and biodiversity are two key directives: the Bird Directive (79/409/EEC) on the protection of wild birds and the Habitat Directive (92/43/EEC) on the preservation of the natural and semi-natural habitats of wild flora and fauna. The specific objectives of the Habitat Directive include the creation of a cohesive European ecological network entitled Nature 2000 and consisting of Special Areas of Conservation (SACs) and Special Protection Areas (SPAs), with these last being determined in accordance with the provisions of the Bird Directive. The Bird Directive was transposed into national legislation with Law 157 of 11 February 1992, while the list of Italy's SPAs was published as part of a Ministerial Decree issued on 25 March 2005. The Habitat Directive was fully transposed into Italian law under Presidential Decree no. 120 of 12 March 2003. Later the lists of the Sites of Community Importance (SCIs) were published for the Alpine Bio-geographic region (Ministerial Decree of 25 March 2004), for the Continental region (Ministerial Decree of 25 March 2005) and for the Mediterranean region (Ministerial Decree of 5 July 2007). At present, Italy's Nature Network 2000 consists of 597 SPAs, with a surface area of 4,377,721 hectares, equal to 14.5% of the national territory, and of 2,288 SCIs, with a surface area of 4,530,866 hectares, equal to 15% of the national territory (*Databank of the Nature Network 2000*, Ministry of Environment, Land and Sea, 2009). In order to correctly interpret these data, it should be remembered that some SCI's and SPA's overlap, either partially or totally.

Another fundamental reference for the conservation of biodiversity in Italy is Framework Law no. 394 of 6 December 1991 on protected areas, an act that "lays down the underlying principles for the establishment and management of natural protected areas, in order to guarantee and promote, in a coordinated manner, the preservation and optimal use of the country's natural heritage". Accompanying the law are a series of measures meant to protect fauna and flora, regulate hunting, protect marine species and regulate fishing, in addition to safeguarding forest resources. Taken as a whole, the legislation approved has made it possible to carry out a number of different initiatives that attempt to safeguard and improve the conditions of our natural heritage. According to the 5$^{th}$ EUAP – Offi-



*There are 772 protected areas in Italy, occupying a terrestrial surface area of almost 3 million hectares (9.7% of the national territory).*

*Of particular importance among the protected areas of the sea are the Marine Protected Areas (MPA's), as well as the "Pelagos" Marine Mammals Sanctuary.*

*Law 394/1991 introduces the "Plan for the Park", which, by subdividing the territory into areas under different levels of protection, guarantees ongoing efforts to preserve biodiversity through reconciliation with activities of human origin.*

cial List of Protected Areas (2003) – there are 772 protected areas in Italy, occupying a terrestrial surface area of almost 3 million hectares (9.7% of the national territory)[39]. More recent data, not yet made official through issue of the 6th EUAP, which is currently being approved, indicate that there are 875 protected areas in Italy, making for a terrestrial protected surface area of almost 3,095,000 hectares (10.3% of the national territory)[40].

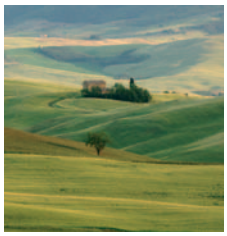
Of particular importance among the protected areas of the sea are the Marine Protected Areas (MPAs), consisting of marine environments made up of the waters, sea bottoms and the portions of coastline running along them and proving to be of significant interest, in light of their natural, geo-morphological, physical and biochemical characteristics, especially as regards marine and coastal flora and fauna, as well as their scientific, ecological, cultural, educational and economic importance. In Italy, MPAs can be established if they have been previously identified as *areas foreseen by law*. Laws 979/82, 394/91, 344/97, 426/98 and 93/01 provide a list of 50 areas as above; to date, 25 MPAs have been established, including the two underwater parks of Baia and Gaiola called for under Law 388/2000. The MPAs simultaneously meet the dual objective of safeguarding biodiversity and maintaining and developing the local economy through three levels of differentiated protection (A, B and C Zones).

Finally, mention should also be made of the "Pelagos" Sanctuary for Marine Mammals, which, being an international protected pelagic area established under an agreement between France, the Principality of Monaco and Italy, has been subject to different administrative procedures and is currently governed by measures for maintaining the good state of conservation of the populations of marine mammals and prohibiting offshore speedboat races.

The same Law 394/1991 referred to above introduces the "Plan for the Park", which, by subdividing the territory into areas under different levels of protection, guarantees ongoing efforts to preserve biodiversity through reconciliation with activities of human origin. In the course of its complex regulatory development, this key instrument for the management of areas with a priority need

[39] 5th EUAP, Ministry of Environment and Defence of the Land, 2003

[40] *Le sfide ambientali. Documento di sintesi sullo stato dell'ambiente in Italia.* Ministry of Environment, Land and Sea, 2009



for conservation has encountered numerous problems. For example, the current framework, which regards 24 Italian national parks and is based on official regulatory provisions, shows that 7 of these parks (29%) have still not initiated any procedure for the formulation of the Plan for the Park, while 8 (33%) are in the phase of preparing and enacting the Plan, 5 (21%) are in the phase of public consultation and only 4 (17%) actually have the Plan in place. It should also be stressed that, despite the timing forecast under the law for carrying out the procedure leading to the Plan (roughly 30 months), the Park that completed the process more rapidly than the other Parks took 8 years to do so, well beyond the upper limit indicated above.

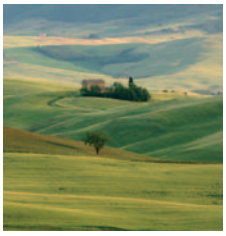
Completing the overview of nature areas subject to protection in various forms, and for various reasons, it should be remembered that, thanks to Italy's endorsement of the Ramsar (Iran) Convention of 1971 on wetlands of international importance, 51 sites of major ecological importance, covering a total surface area of approximately 58,800 hectares, are protected.

Figure 2.7 shows the regional distribution of the protected areas, as per the provisions of the legislative instruments illustrated earlier.

*Thanks to Italy's endorsement of the Ramsar Convention, 51 wetland sites of major ecological importance are protected.*

In compliance with the international conventions on the protection of biodiversity, as well as the European Community directives on birds and habitats, plus national laws on protected areas and the preservation of fauna, a number of different "Action Plans" have been implemented for threatened species of fauna, while "Guidelines" have been drawn up to limit species that damage native fauna and natural habitats. The Action Plans and Guidelines were drafted by the former National Institute for Wild Fauna (currently ISPRA), on assignment from the Ministry of Environment, Land and Sea. Participating in the work, depending on the specific case, were the leading experts for each species (selected by the Ministry of Environment, Land and Sea, by the main research agencies, by the Italian Zoological Union and/or by the most significant non-government associations), as well as the national authorities (national parks, the State Forestry Corps) or local authorities (protected areas, regions, provinces) territorially responsible for undertaking the actions found in the Plans.

*In Italy a number of different "Action Plans" have been implemented for threatened species of fauna, while "Guidelines" have been drawn up to limit species that damage native fauna and natural habitats.*



*14.5% of the surface area of Italian territory holds SPAs, 15% holds SCIs and 9.7% contains protected terrestrial areas.*
*There are also 25 Marine Protected Areas and 51 Ramsar sites.*

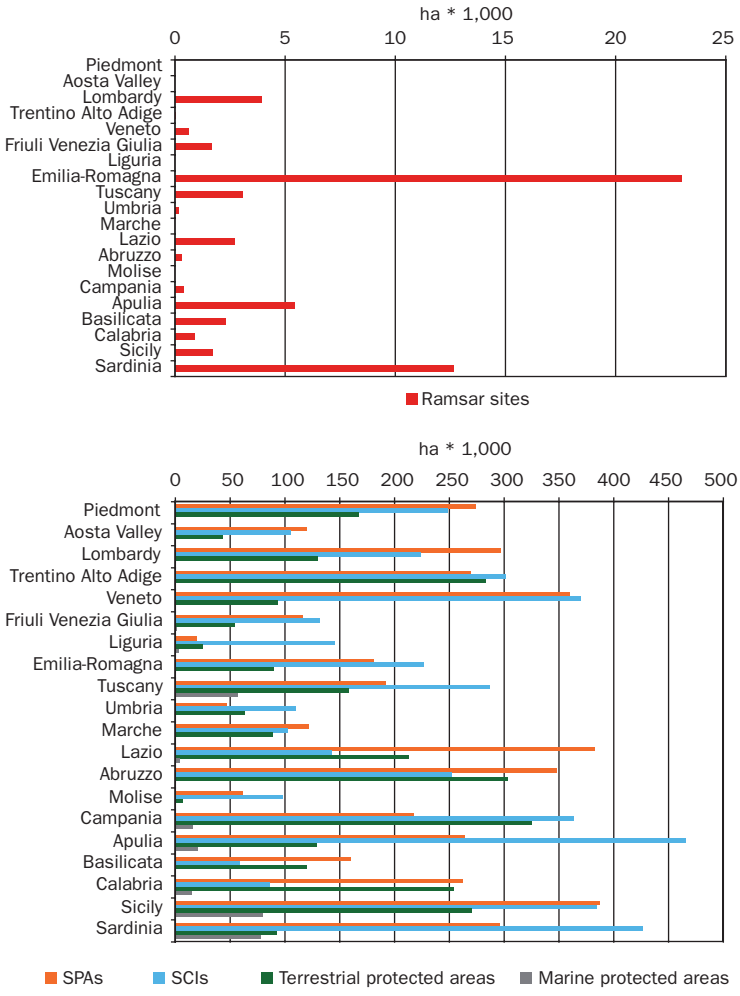
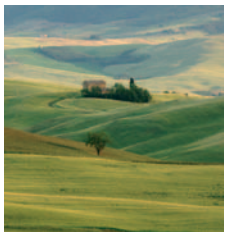



**Figure 2.7: Regional distribution of protected areas [41] (Marine Mammals Sanctuary not included)[42]**

[41] Source: for terrestrial protected areas: see *Official List of Protected Areas,* Ministry of Environment and Defence of the Land, 2003; for marine protected areas: ISPRA processing of data from the *5th Official List of Protected Nature Areas,* Ministry of Environment and Defence of the Land, 2003, Managing Authority of the "Plemmirio" Marine Protected Area, Managing Authority of the "Bergeggi Island" Marine Protected Area, Managing Authority of the "Regno di Nettuno" Marine Protected Area; for the Ramsar Areas: Ministry of Environment, Land and Sea, 2008; for SCIs and SPAs: ISPRA processing of data from the Ministry of Environment, Land and Sea (respectively updated to 30 July 2009 and to 18 August 2009)

[42] The surface area of the SCI and SPA found in the Gran Paradiso National Park, a portion of which lies inside the Aosta Valley Region and a portion in Piedmont, was distributed under a criterion that attributed the majority of the areas to Aosta Valley. The SPA surface area of the Gran Sasso-Monti della Laga National Park, which falls within the territories of Abruzzo, Lazio and Marche, was assigned primarily to Abruzzo. The SPA surface area of the Abruzzo National Park, portions of which are found in Abruzzo, Lazio and Molise, was attributed in full to Abruzzo

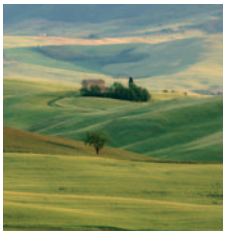


As is true for agriculture, which we shall address further on, the fishing sector is one of the areas of responsibility shared by the European Union and its member states. The instrument used by the EU to manage all the different aspects of fishing and aquaculture (biological, environmental, economic and social) is the Common Fisheries Policy (CFP). The current CFP is based on a reform implemented in 2002, the underlying principles for which were laid out in the Council's Regulation (EC) no. 2371/2002 on the conservation and sustainable exploitation of fishing resources under the Common Fisheries Policy, which provides the legal framework for all subsequent legislation approved by the European Community. The Policy introduced a precautionary approach designed to protect and conserve resources while reducing the impact of fishing on ecosystems to a minimum and attempting to find responses to certain specific problems in areas such as the conservation of living marine resources, the preservation of the environment, the management of the fleet, the organisation of markets, systems of control etc. From a structural perspective, the European Fisheries Fund (EFF) constitutes the financial component and is based on seven-year programs (2007-2013). Once of the most significant measures introduced under the CFP is the setting of maximum limits on catches (in the Mediterranean, this involves red tuna); there are also technical measures, such as the minimum size of the mesh on the net, the use of selective fishing equipment, prohibitions against fishing in certain areas and during certain periods, the minimum sizes of fish that can be unloaded; reduction in accessory or accidental catches; limitation on fishing efforts in terms of capacity (draught, engine power and days spent at sea); reduction in illegal, undeclared and unregulated fishing.

*The Common Fisheries Policy (CFP) is the instrument used by the EU, and therefore its member states, to manage all the different aspects of fishing and aquaculture: biological, environmental, economic and social.*

Despite the progress made under the CFP in ensuring the environmental and socio-economic sustainability of fishing, the reality of the sector is a fragile one. The objectives set for the reduction of fishing capacity have not been reached, fishing stocks are commonly subjected to over-fishing while catches and profitability both decline. Though the environmental and economic aspects of fishing can clash in the short term, they should be considered inseparable in taking a farsighted approach to the management of fishing resources. This is why a revision of the CFP was initiated: the process is currently in the consulting phase, following publication

*The CFP is currently being revised, in order to expand it beyond its current role as a principle of precaution and a mean of pursuing sustainability, as part of an "ecosystem approach".*

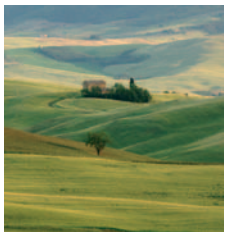


by the Commission, in April of 2009, of a *Green Book on the Reform of the CFP* (COM(2009)163). This revision should expand the CFP beyond its current role as a principle of precaution and a mean of pursuing sustainability, making it an "ecosystem approach" that treats fish stocks as individual elements of complex networks of connections and interdependencies, of which human activities are a full and integral part. Seen in this light, the CFP is part of the European Union's new integrated maritime policy, which posits as the lynchpin for implementation of the ecosystem approach the recent framework directive for the strategy on the marine environment (2008/56/EC), whose objective is to reach a good environmental state for Europe's marine waters by 2020, as well as the Habitat Directive referred to earlier (92/43/EEC).

*Many other initiatives, including some undertaken on the regional and local levels, are focussed on the monitoring of the species and habitats, on environmental reclamation and restocking, on the creation of ecological networks, on the implementation of criteria of sustainability in the various production sectors, on the certification of products and on environmental education.*

Many other initiatives, some of them taken on the regional or local levels, focus on the study and monitoring of species and their habitats, as well as efforts of environmental restoration and restocking, plus the creation of ecological networks, the introduction of criteria of sustainability in the various production sectors, product certification and environmental education. Many of these efforts are directly or indirectly controlled by the series of programs carried out on the local or national levels by public or private bodies, as well as by universities and other organisations. Monitoring plays an important role in the preservation of biodiversity, and it is approached as monitoring not only of the components of biodiversity, but also of the categories of activities that can prove detrimental to biodiversity. The Chart of Nature, established under the aforementioned Framework Law no. 394/1991 on protected nature areas, the monitoring networks of the Agencies System and the reporting activities involving environmental data, such as the ISPRA Environmental Data Yearbook, are direct offshoots, or are closely tied to, the objectives found under art. 7 of the CBD.

An applied example worthy of note is the indicator referred to as "Ecological Value" and calculated under the Chart of Nature on a scale of implementation of 1:50,000. The "Ecological Value" is understood as being a natural strength and is calculated as a set of indicators traceable to three different groups. The first group regards the so-called institutional values referred to in Community directives; the second takes into account the components of biodiversity; and the third considers indicators typical of the ecology of the countryside.

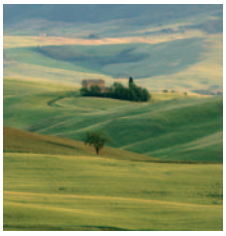


The “Ecological Value” is significant (high and very high) in 62% of the territory of the Aosta Valley, in 54% of Friuli Venezia Giulia, in 34% of Veneto, in 26% of Sicily and in 16% of Molise, seeing that these are the regions in which the Chart of Nature has already been fully implemented.

Efforts of preservation *in situ* include not only the establishment of protected areas, as illustrated above, but also the identification of areas for the implementation of special measures of conservation. Falling under this objective are the measures of protection contemplated for areas adjoining the protected areas, as well as the various initiatives - noteworthy examples of which can be observed within the national territory - for the establishment of ecological networks, both terrestrial and marine.

On the subject of the ecological network, which plays an extremely important role in guaranteeing the ecological connection between the different ecosystems and the territorial zones, it is interesting to observe the extent to which it has become a part of ordinary planning. In fact, references to the ecological network can be found in 88.2% of the Territorial Plans for Provincial Coordination (PTCP) approved, enacted or in the drafting stage. Of those being drafted, almost a quarter do not present references to the ecological network, while it is much more likely to be found in the plans that have been enacted and approved. It remains to be seen whether this less frequent presence in the plans being drafted, meaning the more recent ones, should be interpreted as a sign of decreased interest towards the subject in general or as the result of difficulties encountered in achieving operational integration of the ecological network with the normal planning instruments.

The Italian Network of Germoplasm Banks for the *ex situ* preservation of wild flora (RIBES) is another major initiative for the preservation of germoplasm, as well as an incentive for studies on the subject (art. 9 of the CBD). As part of an initiative recently undertaken by ISPRA, together with BIOFORV (the workgroup on Forestry and Nursery Biodiversity) and RIBES, a document was drawn up summarising the situation of *ex situ* conservation of wild and cultivated plants in Italy. The document, which is currently under publication, presents the state of the art with regard to the *ex situ* conservation of the different categories of plants and in the individual

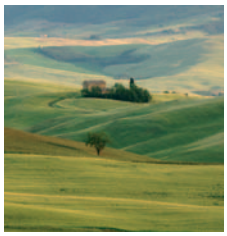


research sectors, though it also throws light on the critical problems and lists the main actions to be taken to resolve the more serious ones. Among those actions, note should be taken of the special nature of on-farm conservation, a form of *in situ* conservation that involves continuing to grow and raise local varieties and races, meaning those populations of crop or livestock species arrived at after centuries of natural selection by the environment, by farmers and by raisers of livestock within a given territory, confirming the key role of agricultural enterprises in conserving biodiversity.

As for the objective of the long-term use of biological components (art. 10 of the CBD), it includes initiatives designed to encourage the habitual use of biological resources, in accordance with traditional cultural practices that prove compatible, with one option for their implementation being the involvement of the local populations in the planning of actions for the restoration of biodiversity, together with improved cooperation between government authorities and the private sector. Major steps in this direction are the enactment of the 21 Agendas, plus efforts focussed on participation and access to information, as well as environmental certification and seals of quality for local products, with various examples of the application of such efforts on the local level found throughout the national territory. The Environmental Impact Assessment (EIA), Strategic Environmental Assessment (SEA) and the assessments of the incidence of plans and projects, as well as surveys meant to gauge environmental damage, are all actions contemplated under art. 14 of the CBD and designed to assess, and therefore minimise, impacts that can prove harmful to biodiversity. Last but not least are the activities of research and training in the environmental sector (art. 12 of the CBD), as well as those of instruction and dissemination to the public (art. 13 of the CBD). In the case of these last programs, the Ministry of Environment, Land and Sea, together with the Ministry of Education, has carried out the program of the INFEA initiative on information, training and environmental education of 1995, a noteworthy effort of coordination meant to channel experiences and isolated initiatives on a local level in such a way that they can contribute to national programs and structures.

*Of note in the forestry sector is the promotion of a series of partnerships and*

An initiative of note in the forestry sector is the promotion of a series of partnerships and collaborative efforts between the public and private sectors, for the primary purpose of favouring actions



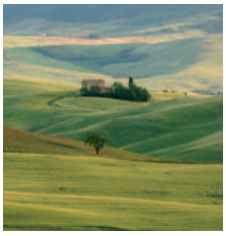
designed to spread information, heighten awareness and increase the use of voluntary instruments for the promotion of responsible forestry management, as well as, in more general terms, the development of practices centred around the social responsibility of businesses and opposition to illegal procedures. These instruments include: compensating investments by companies that intend to offset, at least in part – for example, through the restoration of deteriorated natural areas or through reforestation initiatives – the impacts of their activities; forest certification, involving not only the management of forests on a national scale, but also the chain of custody, and, therefore, the use of certified raw materials by transformation enterprises in the wood/paper sector. Nationally, two alternative systems of forest certification can be identified: the PEFC (Pan-European Forest Certification, promoted by owners of forests and the forest industry) and the FSC (Forest Stewardship Council, drawn up by environmentalist organisations and in operation for a longer period of time). With the first Italian forest certification (FSC) having been awarded to the Magnificent Community of Fiemme (Province of Trento) in 1997, as of 31th October 2009, a total of 748,065 hectares of the national forest area had obtained this recognition, meaning more than 8.5% of all Italian forest area. In addition to the Alpine regions, which hold the majority of Italy's certified forest areas, numerous zones in the central and southern Apennines have also been certified. A further development of note was the first certification of an Italian cork oak forest (FSC), in Tempio Pausania (Province of Sassari), in 2005. Under both systems, certification of private forest holdings is predominant, but certification of public property is on the rise as well.

In the agricultural sector, after decades of policies of rural development centred around the specialisation and intensification of agriculture, with the primary objective of increasing agricultural productivity, in the nineties, the Community Agricultural Policy (CAP) was geared towards integrating the objectives of environmental policy with the agricultural policies of the marketplace and rural development, in part to correct the impacts on the environment caused by the agricultural strategies followed in earlier years. In 2003, a reform of the CAP for the medium term introduced a

*collaborative efforts between the public and private sectors, for the primary purpose of favouring actions designed to spread information, heighten awareness and increase the use of voluntary instruments for the promotion of responsible forestry management, as well as, in more general terms, the development of practices centred around the social responsibility of businesses and opposition to illegal procedures.*

*8.5% of the total hectares of national forest area is certified.*

*Starting with the medium-term reform of the CAP in 2003, and to an even greater extent with the Health Check of 2008, spending on rural development in Italy and other countries of the EU shifted from market measures towards forms of*



*income support for farmers, not only in their role as producers of food, fibre and wood and non-wood products, but, even more importantly, because of their contribution to the conservation of the countryside and the environment.*

system of support for agricultural operators no longer based on the types of crops grown and the quantities produced, but rather on the exercise of agricultural activities and on the awarding of a "single payment for each enterprise", on the condition that a number of obligatory operating criteria are met in the areas of environmental defence, as defined in the environmental directives regarding natural habitats, flora and wild fauna (based on the Directives on birds and habitats), as well as water (based on the Directives on nitrates, underground waters and purification mud), food safety, the wellbeing of animals and biodiversity, as established under the Lisbon Agenda of March 2000 ad in line with the interests and expectations of society.

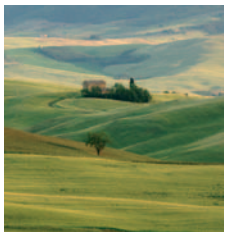
In November of 2008, the Ministers of Agriculture of the EU reached agreement on a *Health Check* for the CAP. The objective of the Health Check, a revision of the medium-term reform initiated in 2003, was to respond more effectively to six "new challenges", which include Climate Change, Bio-Energy, the Management of Water and Biodiversity. On that occasion, the Ministers also decided to increase the modulation and to transfer funds from the direct payments to agricultural operators to the financing of policies involving the market (Pillar I of the CAP) and Rural Development (Pillar II). The *Health Check* did not regard the set-aside measures.

In revising the Community Strategic Orientations (Decision 2009/61/EC of the Council of 19 January 2009), the objective of defending biodiversity was reinforced, with identification of a slowing in the decline of biodiversity as one of the most important Community objectives to be reached. With this in mind, rural development plays a strategic role, seeing that the concept of biodiversity is unquestionably linked to and dependent on agriculture and forestry growing as well.

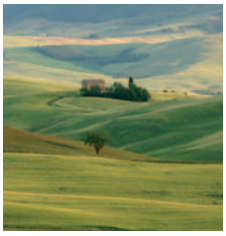
To this end, many regions, during the revision of the program of rural development for 2007-2013, decide to utilise a wide range of measures to reinforce the defence of biodiversity.

An analysis of the financial resources of the Health Check (and of the Recovery Package) allocated under the Rural Development Plans of the Regions to the six «new challenges» shows that 158.3 million euro, or 20.4% of the total were concentrated on the challenge of "biodiversity", while 140,8 million euro, or 18,2%, was allocated to "climate

*During the revision of the planning for rural development in 2007-2013, many regions have opted for measures reinforcing the defence of biodiversity.*



change"; and "management of waters" received 173.7 million euro, accounting for 22.4% of the total. Seventeen regions decided to reinforce this priority, primarily through agro-environmental measures, in particular measure 214, "agro-environmental payments", which was reinforced by 13 regions, and measure 216, "non-production investments", used by 4 regions. The types of operations to be funded with the agro-environmental payments are all geared towards safeguarding genetic biodiversity, conserving types of vegetation with a wide range of species, protecting and maintaining grassy formations, protecting birds and other wild fauna, improving the network of biotypes, reducing the presence of harmful substances in the surrounding habitats and conserving protected flora and fauna. Furthermore, considering the high level of interdependence between biodiversity and a number of the challenges of the Health Check, in particular climate change, bioenergy and the management of water, many of the measures taken under the regional plans will also prove as measures in defence of biodiversity, though they do not address the topic directly. Examples of such measures are the initiatives meant to favour the adaptation of forest and agricultural ecosystems to climate change, the reconstruction of dry walls and tree and hedge rows to favour the control of water and erosion, as well as measures taken to diversify the rural economy and support family-run agricultural enterprises and agrotourism undertakings. In terms of maintaining or increasing the dimensions of the UAA nationwide, it should be noted that no specific objectives are set under either international or national legislation, though the last two European Action Programs in the field of the environment, as well as the 21 Agenda, set a number of general objectives, such as the sustainable use of the territory, the protection of Nature and biodiversity and the maintenance of the levels of production. These objectives are reiterated in the resulting thematic strategies, in the associated legislative proposals and in the numerous existing legislative measures. Community policies for agriculture and the environment call for incentives promoting production systems featuring low environmental impact, such as integrated and biological agriculture, as well as increased extensive production, safeguarding of habitats of elevated naturalistic value, maintenance of biodiversity and the low-intensity management of pasturelands. Equally important are the national guidelines, geared towards promoting a generational turnover, together with



*In Italy the surface areas involved in or being converted to biological agriculture were equal to 1,002,414 hectares in 2008, representing roughly 8% of the national UAA.*

economic and social development of agriculture, in addition to providing incentives for the reconstitution of farmlands and farming enterprises. Within this framework of measures and facilitations, particular attention is focussed on Italian biological agriculture (often referred to as "bio"), which constitutes a genuine success story for European agriculture. As shown by Figure 2.8, in 2008 the surface areas involved in or being converted to biological agriculture were equal to 1,002,414 hectares (-12,8% compared to 2007), representing roughly 8% of the national UAA. The majority of the "bio" surface area is used in growing grain, as permanent meadows and for the cultivation of trees and green forage from seed crops. At the end of 2008, the number of operators was 49,654, for a decrease of 1.2% compared to 2007. The largest number were found in Sicily, while Molise is the region that registered the largest increase in operators compared to earlier years. Sicily, followed by Calabria, has the most producers. Calabria, followed by Basilicata, leads in terms of the number of producers per UAA. Within the EU, Italy ranks in terms of biological agricultural, with regard to both the number of enterprises and the surface area utilised, and in light of the evident advantages as regards the quality of the soil, the fixing of carbon, the reduction of greenhouse gas emissions, the conservation of biodiversity and reduced introduction into the environment of residues of pesticides and fertilisers.

*Following a decrease on the mid 2000's, the surface area and number of biological enterprises in Italy has stabilised, representing a major success story on both the national and European levels.*

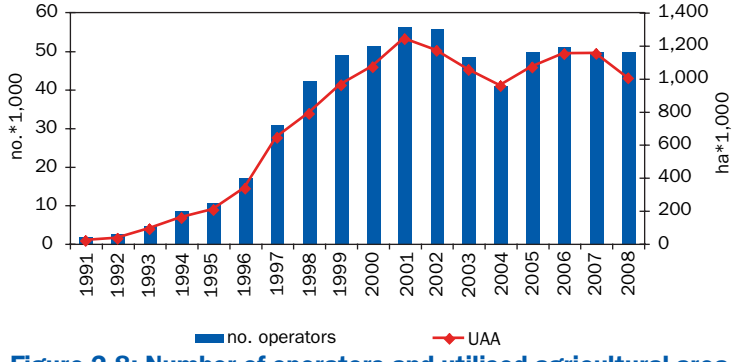
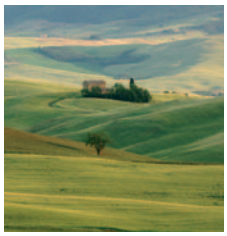



**Figure 2.8: Number of operators and utilised agricultural area (UAA) according to the biological method[43]**

[43] Source: SINAB



The various actions listed up to this point to safeguard nature and biodiversity can be effectively applied only if they are supported with adequate funding. An examination of the available data, supplied by ISTAT[44] shows that spending by different government bodies (grouped by COFOG)[45] on the defence of biodiversity and the countryside totalled 4.357 billion euro in 2007. In 2000, total spending on such efforts was 2.864 billion euro, making for growth of approximately 52% during the period and confirming the attention placed on the sector under public policies.

*In 2007, government bodies spent more than 4,0 billion euro on defending biodiversity and the countryside, for an increase of 52% compared to 2000.*

As seen, there are various responses to the unceasing loss of biodiversity, as well as various modes for safeguarding natural and agricultural areas. These efforts definitely including increasing designation of new protected areas, but also further reinforcement of existing instruments of conservation, especially in terms of increased application and spread of controls, availability of more financial resources, attention focussed on new and emerging problems, such as the spread of alien species and global climate change. A key role shall also be played by increasingly widespread practice of sustainable management and conservation on both land and sea natural environments that are not classified as protected. Italian agriculture also holds a key role at this juncture, being called on to make difficult choices between the growing demand for both "conventional" and "new" products (first and foremost bio-fuels) and the need to safeguard biodiversity and the environment through activities such as bio-remediation, carbon sequestration etc.: all valid solutions to specific, highly relevant problems.

*Apart from direct conservation, a key role in responding to the problem of losing biodiversity will be played by the sustainable management and conservation of natural environments, on both land and sea, not strictly classified as protected.*

[44] Spending of government bodies by function, level II, Years 2000-2007
[45] Classification Of Function Of Government: a classification draw up on the international level by the leading institutions involved in national accounting