Addressing Italian Official Statistics to the measurement of Climate Change impacts and adaptation options on Agriculture

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ABSTRACT

The accelerating pace of Climate Change (CC) is having significant consequences on Italian agriculture in terms of impacts and adaptation options. Weather heavily affects crop production trends, yields and quality variability with impacts that can vary by region. Measuring and enhancing the relationship between Agriculture and CC is complex. To develop the analysis of CC effects on agriculture in a comprehensive way, an urgent need of CC related statistics (CCRS) has been recommended by international institutions (UNECE, IPCC, Eurostat, OECD) in recent years. National Statistical Offices are called for actions aimed to improve the usefulness of existing statistics and to develop new statistics, filling information gaps. To appropriately address official statistics to the measurement of CC impacts on agriculture new methodologies need to be adopted, enhancing multidisciplinary approach and expertise, linking datasets across domains, reviewing existing classification systems, geo-referencing data, developing partnerships among different producers. This work mainly aims i) to present current official statistics production in Italy, highlighting data gaps in CC analysis; ii) to describe operating actions needed to better measure CC impacts on agriculture; iii) to integrate results provided by the Istat surveys on agricultural and meteo-climatic phenomena. Statistical innovations are addressed to enhance the availability of new relevant data, necessary for the analysis of CC impacts on agriculture at the national and local scale. In this study the relationship among meteorological factors, crop yields, water resources used in agriculture compared to water used in other sectors have been presented. Our work highlights the need to strengthen collection and use of several data sources by integrating data from surveys with administrative data. To this aim, the cooperation and the awareness of all agencies and institutions operating in the National Statistical System are essential to exploit the existing information assets and to develop new statistics coherent and consistent with the statistical international framework.

Keywords: Climate Change, Impacts and Adaptations, Official Statistics, Agriculture and Water statistics.

1. Introduction

After Paris agreement and other international initiatives, the demand for high quality statistics related to CC keeps growing. CC is a global multidimensional phenomenon that affects almost every aspect of human life and interactions between human and natural systems. National Statistical System (NSS) and National Statistical Offices (NSO) are called to enhance their contribution in the production of official statistics related to climate change to best satisfy user needs.

In 2014, the Conference of European Statisticians (CES) published a set of Recommendations on Climate Change-Related Statistics[1] (CCRS) to help ensure that information needs are effectively met. The work is an important step towards taking data needs related to CC more fully into account in NSSs, improving the contribution and involvement of official statistics in measuring CCRS. The CES recommendations define CCRS as "environmental, social, economic data that measure the human causes of CC, the impacts of CC on human and natural systems, the efforts of humans to avoid the consequences as well as their efforts to adapt to the consequences". They are organized into five conceptual areas: drivers, emissions, impacts, mitigation and adaptation.

The primary drivers of CC are anthropogenic emissions of greenhouse gases (GHG) from production and use of fossil fuels, agricultural and forestry practices and manufacturing processes. The efforts to mitigate CC are aimed at changing production and consumption patterns. To the extent that mitigation fails, the ensuing impacts and human efforts to adapt to CC will be heavily felt by the economy and society. It's clear that CCRS involve a wide range of interlinked statistical domains.

In this contest, agriculture plays a dual critical role, on one side as a cause of CC as producer of GHG emissions, on the other agriculture is threatened by CC impacts, by the increasing demand rising from population; by the increasing pressure of natural resources; by extreme events and disasters impacts. Improving sustainable agricultural productivity has become a global challenge.

The UN's new Sustainable Development Goals (SDG)[2] include a series of targets related to CC and agriculture. Goal 2 of SDG addresses to "End hunger, achieve food security and improved nutrition and promote sustainable agriculture". In particular the target 2.4 declaims: "By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality". Goal 13 addresses to "Take urgent action to combat climate change and its impacts". In particular the target 13.1: "Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries". Climate-related hazards and natural disasters can threat agriculture. They can be caused by CC, as extreme weather events such as floods, landslide, extreme temperatures, cyclones and other natural consequences that provoke environmental degradation (desertification, salinization, acidification, insect infestation) or they can be caused by other natural or man-made hazards, that provoke direct or indirect damages (pollution, contaminations, etc).

In 2015, an UNECE Task Force (TF) on Measuring Extreme Events and Disasters[3] has been defined to clarify the role of official statistics in providing data related to extreme events and disasters and to identify practical steps how NSOs, in coordination with national agencies responsible for disaster management, can support disaster management and risk reduction. The work takes into account the relevant issues raised in the context of SDGs and Sendai Framework[4]

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[1] http://www.unece.org/stats/publications/ces_climatechange.html
http://www.unece.org/fileadmin/DAM/stats/documents/sustainable_development/Growing_need_for_official_statistics_in_measuring_climate_change.pdf
[2] https://sustainabledevelopment.un.org/?menu=1300
[3] http://www.unece.org/statistics/statstos/task-force-on-measuring-extreme-events-and-disasters.html
[4] https://sustainabledevelopment.un.org/frameworks/sendaiframework

for Disaster Risk Reduction 2015-2030. A first objective of the TF is the international harmonization of terminology in connection with the Open-ended Intergovernmental Expert Working Group on Indicators and Terminology Relating to Disaster Risk Reduction[5].

The demand for high quality statistics to measure and describe all this interlinked dimensions is evidently expanded. Global and local analysis are needed, as well as statistics at national and sub regional level. There's a huge amount of data already available from several producers (inside and outside NSS) that suffer lack of standardization and quality standard. The role of official statistics in this contest is to guarantee the production of statistics meeting user's needs and to ensure high quality levels standards, in order to obtain relevant, consistent and comparable statistics and indicators. Referenced frameworks among the several national and international initiatives have the advantage of structuring the over whelming amount of information produced providing standardization of definitions, methods, classifications and ensuring homogeneity and comparability. UNSD-FDES[6], 2013 and its methodological 2014-2016 developments, is based on a multi-purpose conceptual and statistical approach, defining standardized concepts, definitions and methodologies. The System of Environmental Economic Accounting 2012 – Central Framework (SEEA-CF[7]) provides the first international statistical standard for environmental-economic accounting.

The work of the UNECE task force highlights how NSOs already produce data potentially relevant to CC, but that have been collected and produced with other purposes. This data should become usable for CC analysis. To do so, NSOs are recommended to facilitate access to data that already exists; improve geo-spatial analysis; improve linking between socio-economic and environmental data. Furthermore NSOs should develop new statistics based on a review of key data needs.

The aim of this work is to describe the current production of data potentially useful for measuring CC impacts ad adaptation options in agriculture, through a review of the main data sources available in Italian national institute of statistics (Istat). Then, the work will present a critical analysis of the data gaps in which the NSOs should improve the efforts, in order to fill the statistical information required.

2. Climate Change and Agriculture

CC variability has effects on socio-economic and natural environment. Agriculture and water resources are expected to be the most sensitive. Global warming and changes in rainfall and temperature patterns affect water resources availability and crop water requirements. As CC will alter water cycle, the pressure on water resources will increase. Being water resources one of the major inputs for a sustainable agricultural development, CC may have adverse impacts on crop production systems. Increasing pressures impose a sustainable use of irrigation water supported by specific policy actions. In particular, measuring the relationship between water resources used for irrigation and meteo-climatic and hydrological variables is crucial.

In this context, official statistics may provide a solid basis to know quantitative aspects referring to multi-dimensional phenomena related to the analysis of CC impacts on agriculture such as: weather conditions variability, out of season events, water resources availability, trend of different crops yields, quality of agricultural products, water resources required by crops, pressure exerted on irrigation water by crop and by area, abandonment of less-favored farming areas.

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[5] http://www.preventionweb.net/drr-framework/open-ended-working-group/
[6] http://unstats.un.org/unsd/environment/fdes.htm
[7] http://unstats.un.org/unsd/envaccounting/seea.asp

To develop empirical CC impacts analysis, data adequately spatialized, provided at a high degree of disaggregation and on yearly basis, are needed. In a context characterized by uncertainty inherent in climate variability, the role of policy is crucial in managing the water resources efficiently across space and time to prevent agricultural yield fluctuations causing welfare loss. For this purpose, policy makers need standardized tools to define optimal policies and measures for a sustainable agricultural development and water resources management and to monitor objective achievement.

In Italy, country located in the heart of Mediterranean basin, CC is in place in the last decades (as confirmed by meteo-climatic and hydrological official statistics) and affects either water resources demand and many crop products through decreasing yields and quality and livestock management. On the basis of Istat statistics, the data collected by meteorological stations located in the region capital municipalities have recorded a “warming” during the last fifteen years, because in the period 2001-2014, the average annual temperature was equal to 15.1°C, with an increase of about 1°C with respect to the long-term average for the 30-year period 1971-2000[8]. In the same period the meteorological stations located in the Italian regional capital municipalities registered a change in rainfall pattern, because the average annual precipitation was equal to 740.8 mm, with a reduction of about 1.1% compared to 1971-2000 mean value.

Negative impacts of CC are more common than positive ones in our country where irrigated agriculture is the major water user accounting for more than 47 % of total use.

Italian agricultural production is characterized by a wide range of high quality products, typical Mediterranean crops and IGP-DOP products. Many agricultural products need suitable microclimatic conditions otherwise decreasing yields and quality mainly due to changes in rainfalls and in minimum temperatures patterns. Not only quantity and quality of such crops, but also the choice of species and varieties that will be possible to grow and the location of the production, can be seriously compromised by CC effects. The increasing likelihood and severity of extreme weather events will considerably increase the risk of crop failure in Italy. Italian crop production system faces and will cope deep changes of weather conditions and water resources availability, intensifying problems of water scarcity and irrigation requirements especially in the South of Italy and increasing drought risk and heat stress. Moreover, CC effects could lead to inefficiency in the agricultural production also linked to the sector structure including many small firms, with a low capability to adapt themselves to a new situation.

As CC affects many dimensions, official statistics on different thematic issues need to be integrated and harmonized to provide a solid and consistent basis for empirical analysis on CC impacts. A poor integration between regulations relating to specific subject areas of environmental and agricultural statistics have been carried out in recent years. The role of official statistics is to produce and disseminate statistical information needed for any type of study for modelling, making scenarios and elaborating adaptation policies, related to all relevant dimensions, such as: crop yields, water availability and use, irrigated areas, areas under organic farming, use of fertilizer, seeds and pesticides, temperatures and precipitation patterns, extreme weather events (heat waves, drought, floods , storms, fire forest, etc.).

As a substantial delay with respect to the information needs emerges, strengthening production of CCRS, hydrological and meteo-climatic statistics, agricultural and water statistics is essential to ameliorate the analysis of CC impacts on water resources and agriculture in order to provide official data, useful also to policy decisions. By evaluating the adaptive capacity of the Italian agricultural system to deal with external influences, implementing optimal CC mitigation-adaptation strategies by policy makers is needed.

[8] http://www.istat.it/it/archivio/giornata+mondiale+acqua

Considering official statistics currently issued on these dimensions, short or medium run CC effects empirical analysis are bounded by the availability of some variables at an adequate level of disaggregation and of long time series for all the variables considered, as it would be appropriate for modelling. Official statistics show several data gaps and some points of weakness summarized in the following points:

- *volumes of irrigation water* would be crucial in the analysis (as input in the production function) to evaluate CC effects on crop production. The scarce availability of official statistics on irrigation water has forced to use over the years the variable *irrigated areas* as proxy. For the first time, statistics on irrigation water in Italy were issued by VI Agricultural Census 2010. Strengthening the production of official statistics on irrigation water means improving the analysis on the demand of water resources and water use efficiency in presence of CC;
- *meteo-climatic variables* are a measure of CC, the need emerges updating on regularly basis time series of *all meteo-climatic and hydrological statistics* both for recent years and at a high degree of spatialization, thus being suitable to study the connections between climate and agriculture at local scale too;
- *agricultural statistics* need to be strengthened also homogenizing the scale (temporal and spatial) and the disaggregation level at which data are provided to develop analyses on CC effects on agriculture at the national and local level. For example, it would be necessary to strengthen statistics on harvested production disaggregated by type of crops, inputs used disaggregated by crop meteo-climatic statistics spatialized and suitable updated for a medium-term CC effects analysis;
- *data on mitigation policies* undertaken by Italy, in accordance with EU Policy related with CC would be useful in the analysis.

To this aim, in recent years, some methodological innovations have been developed and introduced in the national structural sampling survey on agriculture (*Farm structure Survey*) and new domains have been detected in the 2013 and 2016 edition such as: volumes of irrigation water by crop, technique of irrigation, water resources used by source of abstraction of, organic farming production, use of plant protection, use of energy products for current production, production of energy from renewable sources.

Goals to achieve are represented by strengthening administrative archives, integration of different data sources, enhancing the production of statistics and new data crucial in this type of analysis, expanding temporal and spatial scale and disaggregation level at which data are provided, update all meteo-climatic statistics suitably spatialized.

3. Climate change, agriculture and water statistics in Istat

Warmer temperatures, changes in precipitation levels and patterns, extreme weather events are already impacting all human and economic activities. Agriculture, in particular, is extremely dependent on weather and climate events in order to produce the food necessary to sustain human life. CC is here and now. CC is expected to negatively condition both crop and livestock production in most part of the world, although some regions may actually take advantages from the changing conditions. The natural ecosystems are responding to change. So, for example, some fruits grow faster, others slower, changing so the normal length of their life cycle. The biological (phenological) responses to CC are very often unpredictable and their management becomes then increasingly difficult.

Overall, productivity levels may changes as CC consequences, for example increase of actual evapotranspiration and crop water requirements, decrease of water availability and quality. Substantial reductions in the impact that CC could generate on global agricultural production, and therefore food security, could be obtained thanks to a better understanding of the dynamics of the phenomenon.

Quantifiable indicators of the environmental sustainability of agriculture are a fundamental tool for monitoring current conditions, identifying trends, setting goals, evaluating progress and comparing performances among different regions and countries. This set of indicators is useful for policymakers, farmers, businesses, and civil society to better understand the state of the art.

The current statistical production, based on both official and non-official sources, even if already consistent, does not always allow at the moment the construction of timely, solid, comparable agri-environmental indicators that can respond to the needs of those who monitor CC in all its declinations and its essential relationships with the agriculture. There is doubtless a lack of integration of the various regulations, also at European level, relating to the different subject areas of the environment and agricultural statistics. The presence of missing data, the difficulty of integrating different data sources, the lack of long time series, make it extremely difficult to produce a connecting framework between the CC and Agriculture statistics.

Although many efforts have been initiated for a better performance of the official statistical production, the challenge is to continue to evolve the core suite of official statistics. Internally and externally, NSOs have to explore increased linkage of datasets, creating value from data, with the aim to give the society a plausible and consistent point of view, and more importantly, as the counterfactual for scenario analysis.

Agriculture and Water statistics will be deepened in the following paragraphs.

Considering the important role that agriculture has always played in the Italian economy, Istat regularly collects, checks, analyses and disseminates statistical data on agriculture. Istat production covers a wide range of subjects and several surveys are organized by the Institute in this matter, to comply with European regulations and to satisfy needs expressed at the national and local level.

Even if the information collected are periodically enriched, following the emerging information demand, the current production is not always prepared to adequately meet the requirements coming from the CC analysis needed.

In the next we will identify, analyse and profile the landscape of existing data sources, indicators, and datasets relevant to verify the environmental sustainability of agriculture.

The list of the main Istat activities, with features that could be used in an integrated approach directed at climate change and agriculture perspective in Italy, includes:

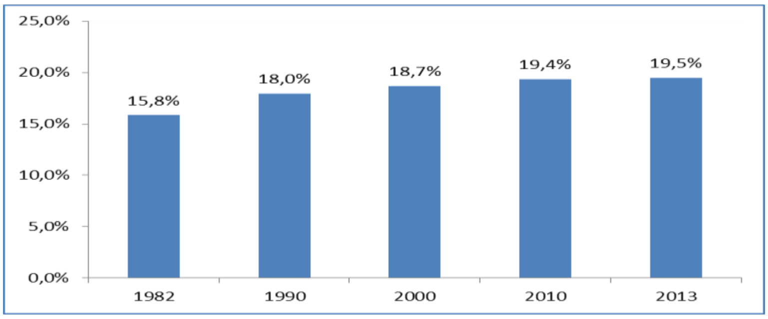
- **Agriculture Census[9],** periodically conducted in an European framework, provides in Italy since 1961, and every ten years, a statistical portrait of agricultural and livestock system at national, regional and local level. The data emerging from the Census have impact on the development of national and Community agricultural policies. The Census also absolve the disclosure obligations established by the Regulations on structural agricultural statistics, with the aim to homogenize the data collection and to disseminate comparable indicators. Census information useful for a CC lecture refer to crops, area cultivated, irrigable and irrigated area, organic farm, livestock, number of working days, volume of water of irrigation use (only for the 2010 edition).
- **Estimate of crops, flower and pot plant production and area,** that is a survey that allows currently to estimate cultivated area, harvested production, yields.
- **Farm structure survey[10]**, a sampling survey that every three years allows to identify the main transformations of the agricultural world and that disseminates data on irrigated

[9] http://www.istat.it/it/archivio/138962

[10] http://www.istat.it/it/archivio/167401

area, number of working day, irrigation by crop and system, production of energy from renewable sources, water supply sources, use of energy products for current production, organic farming, techniques of application of livestock effluents.

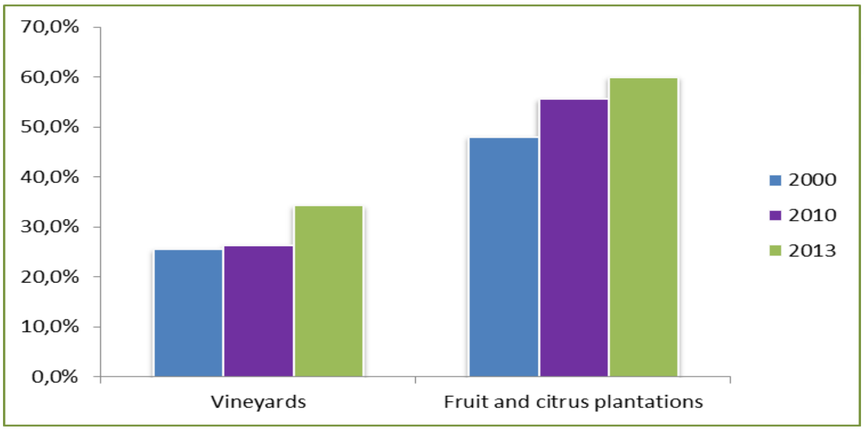
- **Survey on the fertilizers supply for agricultural use (chemical fertilizers, soil conditioners and improvers)**, that allows to observe the fertilizers supply distribution and the nutrients in fertilizers.



Source: Istat - Agriculture Census

Figure 1: *Share of irrigated area on the total utilized agricultural area (percentage values)*

Figure 1 shows about the share of total utilized agricultural area that has been irrigated in the period 1982-2013, more than thirty years. This indicator assumes always more importance due to the strong variation of water availability, that in some period of the year determines a condition of water scarcity.



Source: Istat - Agriculture Census (2000, 2010), Farm structure survey (2013)

Figure 2: *Share of irrigated area for some typical crops (percentage values)*

Figure 2 shows the share of irrigated area for some crops particularly representative of the Italian agriculture and typical of the Mediterranean area: vineyards, fruit and citrus plantations. In the period 2000-2013 the presence of the irrigation practice has increased for both crops especially during the warmest season.

Water is the main element through which CC influences the ecosystem and subsequently the livelihood and well-being of societies. Higher temperatures and changes in extreme weather conditions affect the availability and distribution of rainfall, snowmelt, river flows, groundwater and further damage water quality.

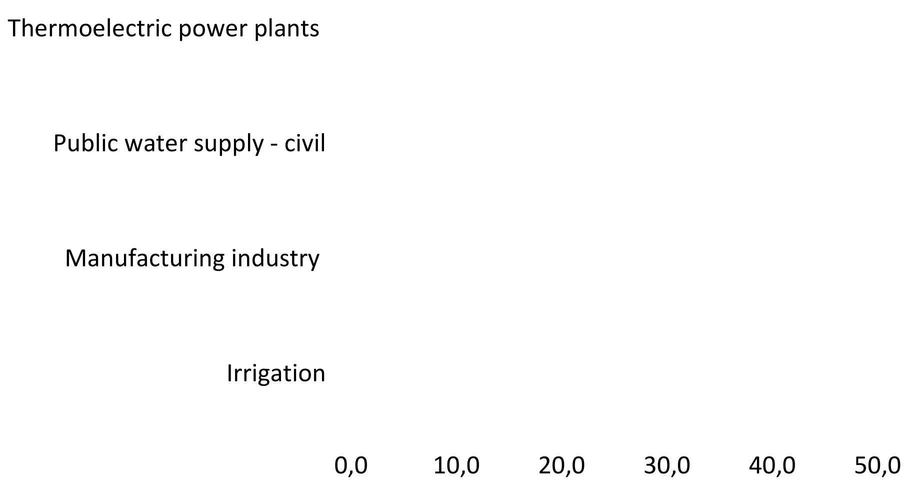
Water statistics represent, then, a fundamental card in the construction of our mosaic, playing a pivotal role in the adaptation process to CC.

In Italy there is a lack of uniform estimates on the amount of water abstracted, supplied, discharged and treated for different uses. Available data suffer from a large fragmentation of information, data heterogeneity and lack of standardization. To improve national knowledge on Water Statistics, several activities have been carried out following the guidelines of the EU relating to the Water Framework Directive (WFD, 2000/60/EC) and Eurostat initiatives on Water Statistics and Water Accounts.

The main activities carried out by Istat are:

- **Meteo-climatic and hydrological survey**: implementation of a geographical data-warehouse with meteorological, agro-meteorological and hydrological daily values measured since 1951. The thermo-pluviometric monitoring network has about 6,200 stations and the hydrometric one about 950 stations.
- **Urban water census:** since 1951 Istat has been periodically collected information on water resources for domestic use through a specific census. Data collected are referred to water abstraction and transmission, public water supply network, public sewerage and urban wastewater treatment plants.
- **Use of water resources**: estimation of water used in manufacturing industry, production and distribution of electricity, agriculture.

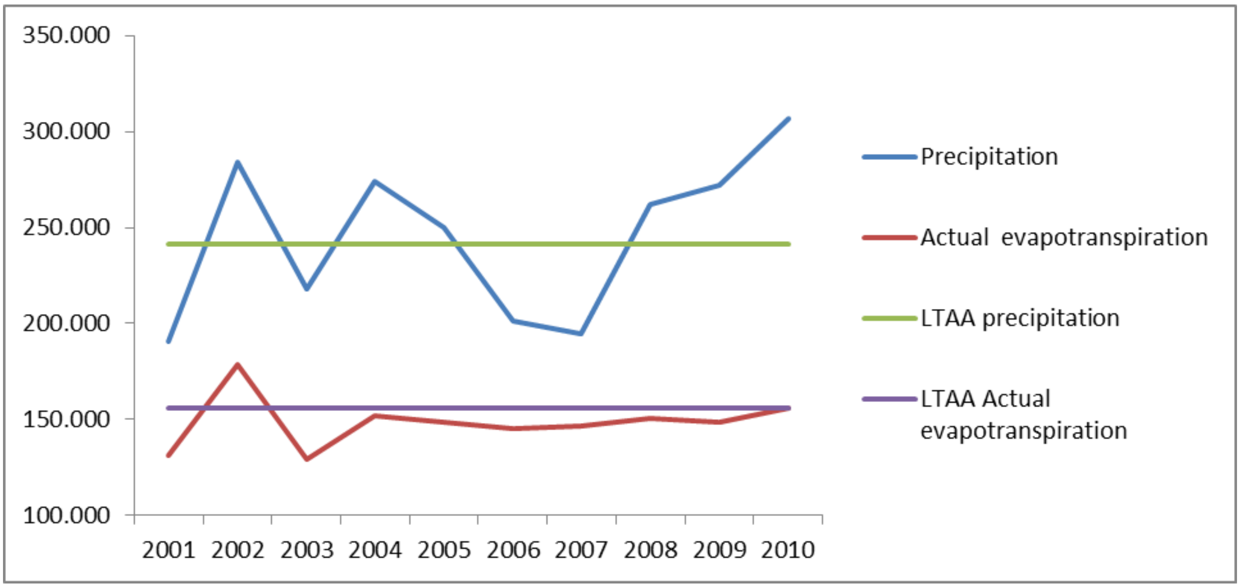
The integration of data coming from these sources allows to compare the use of water by sector: irrigation water, public water supply, manufacturing industry, thermoelectric power plants cooling (for process and cooling of inland water, without sea water). At the national level, in the crop year 2009-2010 the total volume of irrigation water amounted to about 11.6 billion of cubic meters. In 2012, water supplied by the public water supply system amounted to 5.2 billion of cubic meters; the total volume of water used as input by Italian manufacturing industry amounted to 5.5 billion of cubic meters; the volume of inland water used for cooling and process of thermoelectric power plants amounted to 2.2 billion of cubic meters (Figure 3). Summing the four values, the estimation of water used for the sectors included in the equation is equal to 24.5 billions of cubic meters. But this value does not represent the entire volume of water used, as for example the estimation of water used for livestock.



Sources: Istat - Meteo-climatic and hydrological survey, Urban water census, Use of water resources

Figure 3: *Water used by sector. Year 2012, crop year 2009-2010* (billion of cubic meters)

Water use represents the demand of water from the "environment to economy", where renewable freshwater resources statistics are fundamental to evaluate the stocks of water availability[11]. The Istat Meteo-climatic and hydrological survey has disseminated information at national, regional and river basin level, from 1971 to 2010; this has allowed the estimation of the indicators needed for the assessment of water balance.



Source: Istat, Meteo-climatic and hydrological data

Figure 4: *Trend of annual precipitation and actual evapotranspiration (2001-2010) compared to the value of Long-Term Annual Average (1971-2000). Values in billion of cubic meters*

Table 2: *Temperatures and precipitations, Year 2014 (average Celsius grade, average mm)*

	Gen	Feb	Mar	Apr	May	Jun	Jul	Ago	Sep	Oct	Nov	Dic
Temperature maximum (average 1981-2010)	7,7	8,7	11,9	15,0	20,1	24,1	27,2	27,1	22,7	17,9	12,2	8,5
Temperature maximum 2014	9,2	10,4	13,1	16,5	19,4	25,1	25,0	25,8	22,8	20,2	14,5	10,0
Temperature minimum (average 1981-2010)	1,2	1,2	3,7	6,5	10,9	14,5	17,1	17,2	13,8	10,2	5,5	2,2
Temperature minimum 2014	3,3	3,9	4,5	7,9	10,0	15,3	16,3	16,6	14,3	12,6	8,4	3,8
Precipitation (average 1981-2010)	57,3	50,1	56,8	71,0	64,0	52,5	40,0	48,6	76,5	89,8	95,5	77,2
Precipitation 2014	133,0	121,3	75,0	76,3	56,4	62,6	89,6	50,7	64,5	47,0	157,0	75,0

Source: Istat, Meteo-climatic and Hydrological *survey*

Data availability on an annual basis provides a first assessment; but to fully understand the vulnerability of the resource, the temporal and spatial variability is essential. Precipitation and temperatures (minimum, average, maximum) on a monthly basis, allow an evaluation of the yearly oscillations (Table 2). Furthermore, specific climate extremes indexes[12] such us the number of frost,

[11] 2014 Eurostat Regional Environmental Questionnaire (REQ 2014)
[12] http://etccdi.pacificclimate.org/

summer or icing days, the number of tropical nights or the precipitation intensity index, could highlight changes in climate that can affect agriculture. Climate extremes indexes have been processed currently only for the thermo-pluviometric stations of region capital municipalities, while the analysis should be extended to the rural areas for the purposes of agriculture.

4. Conclusions

This work highlights how there is still a strong need of multidisciplinary statistical information for the study and analysis of interactions of all dimensions of CC impacts, to conceive adaptation strategies and to evaluate their effectiveness. Several international initiatives promote to enhance the production of high quality consistent, robust, relevant and international comparable statistics. The role of official statistics in the contest of NSS is recognized as crucial.

Existing statistics should become more usable for the analysis, investing in building and implementing harmonized methods and definitions, adequately transforming the overwhelming amount of statistical data available from several sources into comparable statistics; new statistics should be developed ensuring a coherent system at national and international level, suitable to meet the statistical information demand. NSOs have an important role in this contest; improving knowledge and awareness on emerging themes, providing internationally agreed guidelines and frameworks.

NSOs should strengthen their efforts to meet information needs. Proceeding step by step NSOs should make a review of their relevant data available adopting an integrated approach, considering all their sources of data both from surveys and registers. This relevant data should be organized in an combined mode. Istat already produces relevant data for the analysis of CC impacts and adaptation option in agriculture. Data are produced by the agricultural Census and by several surveys belonging to different statistical domains. It needs, immediately, an enlarged view of information, which no longer considers the various aspects individually, but that integrates information collected for different purposes. A global and integrated perspective is essential to approach multidimensional phenomena such as CC impacts and adaptation in agriculture. The most relevant areas refer to agricultural, hydrological, meteo-climatic statistics, but additional statistical domains could be relevant to explain all dimensions of the phenomenon. Besides the global and national scale, regional scale and georeferenced data are essential for the comprehension of the dynamics of the phenomena. Upstream planning of data collection, a review of the surveys, an exploration of the content of administrative archives, a joint activity between the various institutions that in various ways will have an active part in the construction and implementation of a CC Strategy, are certainly necessary activities so that - in the long run - the statistical offer could be considered robust, with an high social value.

REFERENCES

Fdes (2013) Framework for the Development of Environment Statistics (http://unstats.un.org/unsd/environment/fdes.htm)

Istat (2016) Le statistiche dell’Istat sull’acqua (http://www.istat.it/it/archivio/giornata+mondiale+acqua)

Istat (2015) La struttura delle aziende agricole http://www.istat.it/it/archivio/167401

Istat (2014) Utilizzo della risorsa idrica a fini irrigui in agricoltura

6° Censimento Generale dell'Agricoltura

http://www.istat.it/it/archivio/138962

IRDR Integrated Research on Disaster Risk (2014)

Peril Classification and Hazard Glossary

http://www.irdrinternational.org/2014/03/28/irdr-peril-classification-and-hazard-glossary/

Eurostat (2008)

Data Collection Manual for the OECD/Eurostat Joint Questionnaire on Inland Waters

Angela Ferruzza, Giovanna Tagliacozzo, Angelica Tudini (Istat)
Effetto serra ed effetto terra: il processo di costruzione dei dati ufficiali
Dodicesima Conferenza nazionale di statistica
http://www.istat.it/it/dodicesima-conferenza/programma

Roberto Gismondi, Francesco Truglia, Loredana De Gaetano, Donatella Vignani (Istat)
Sabrina Auci (Università di Palermo)
Effetti dei cambiamenti climatici nelle coltivazioni agrarie
Dodicesima Conferenza nazionale di statistica
http://www.istat.it/it/dodicesima-conferenza/programma

Seea (2012) System of Environmental-Economic Accounting 2012 - Central Framework
United Nations New York, 2014
(http://unstats.un.org/unsd/envaccounting/seeaRev/SEEA_CF_Final_en.pdf)

Giovanna Tagliacozzo, Simona Ramberti, Stefano Tersigni, Donatella Vignani (Istat)

A cross-reading of official statistics production to improve the analysis of Climate Change related phenomena

Rome 2015 – Science Symposium on Climate

http://www.rome2015.it/

Giovanna Tagliacozzo, Simona Ramberti, Stefano Tersigni, Donatella Vignani (Istat)

Il Censimento delle acque per uso civile in Italia (Anno 2012)

Il rapporto generale sulle acque: obiettivo 2020

Utilitalia 2015

Unece (2014) Recommendations on climate change related statistics
(http://www.unece.org/stats/publications/ces_climatechange.html)