

## **CLIMAGRI Project**

### **Agriculture and Climate Change**

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#### **Introduction**

Environmental changes and climatic variations, which involve the whole planet, are scientific object of research and have an important impact on political and economical sectors: they affect life quality and human activities that, on the other hand, can generally affect climate itself.

Recent studies have shown that global heating is not homogeneous: increasing temperature areas alternate to decreasing ones.

In Italy, during the late years, extraordinary climatic events (like draught, floods etc.) were more frequent than the past.

Forecasting future climatic scenarios show a variation of climatic trends with temperature increase, variation of precipitation distributions, variation of pluviometric trends and, to go into detail, a frequency increase and an intensity change of extraordinary events.

#### **Effect of climatic change on agriculture**

The evaluation of the vulnerability of Italian territory due to climatic change indicates that processes of soil degradation, hydrologic ruin and changes in agricultural and forestry ecosystems are consequences of climatic change.

In spite of the technological innovation, weather and climate still represent key factors for agriculture productivity so that their impact on primary sector is significant.

Two are the main effects of climatic change:

- Variations of productivity and quality of culture due to temperature modifications, to changes of pluviometric trends and insolation
- Raising of sea level that can reduce the extension of agricultural coast areas and can increase the salinity of water-bearing stratum.

# CLIMAGRI Project

CLIMAGRI project is an agrometeorological research having the main goal to constitute the first operational step of a national program of safeguard of the atmosphere. The project is co-ordinated by UCEA, under the Italian Ministry of Agricultural and Forestry Policies (MiPAF). Its most important objective is to obtain a climatic analysis of the national territory, evidencing climatic anomalies and changes in action or hypothesis with a specific impact on Italian agricultural sector. Climatic changes might also have an impact on other socio-economic sectors and, in particular, on the control of water resources. Therefore CLIMAGRI takes in consideration, beyond the agricultural sector in a generalized manner, also some problems of water use and management which are strongly related to climatic variations. Finally, CLIMAGRI project must be considered as a scientific program but with an operational component. It means that it will propose methodologies in order to disseminate, with appropriate modalities, the information and the result in an effective way to various users in the agricultural sector.

Research activities carried out within CLIMAGRI project will create the optimal frame to acquire important knowledge of the physical phenomena which are linked to the climate variability and change and that have a direct influence qualitatively and quantitatively on the agricultural productions and therefore on the emissions of greenhouse gases. The knowledge has a great role to play in the safeguard of the atmosphere and in attaining sustainable development.

Its main objectives are:

- Improvement of knowledge of climate change
- Setting of future climate scenarios
- Impact of climate change on Italian agriculture
- Weather forecast for Italian agriculture:
  - short term
  - seasonal
- Water reserves
- Exchanging information

# Project frame

## **SUBPROJECT 1: Climate analysis and future scenarios**

(to acquire knowledge on the reliability upon climate variations and possible future scenarios in Italy)

### **1.1 Acquisition, analysis of Italian secular meteorological series for the examination the climate variations (M. Maugeri – Institute of Physics, University of Milan)**

Acquisition, analysis and homogenizing data of 38 historical (secular) Italian series: the study of the monthly averages of temperature, precipitation and barometric fields will evaluate the evolution of the Italian climate and the different causes determining its trends.

### **1.2 Survey on probable variations in the structure of meteorology and Italian pluviometric trends. (D. Vento – Central Office of Agricultural Ecology, Rome)**

Survey about the structure of Italian precipitation distributions and pluviometric trends through the analysis of extraordinary rainfalls and the comparison of the evolution of rainfalls between rural and urban areas in the last decades.

### **1.3 Definition of climate change scenarios to evaluate the possible effects on the Italian agriculture. (G. Zipoli - Institute of Biometeorology/CNR, Florence)**

Through a whole analysis related to the national territory and the forecasted climate situation, it'll be possible to realize future climatic scenarios with an high resolution and to study their effects on the Italian agriculture

## **SUBPROJECT 2: Italian agriculture and climate change**

(in order to evaluate the significance of climate change for Italian agriculture and to develop, if necessary, new strategies)

### **2.1 Climate and soils evaluation for crops suitability in the land assessment (L. Perini - Central Office of Agricultural Ecology, Rome)**

Interdisciplinary analysis of the variability and relationship of the complex system vegetation-soil-climate: considering the variability of the climate parameters will be possible to define the connection between cause/effect which regulate the extension and spreading of the crops. The first Italian agro-pedo-climate book of maps will be realised

### **2.2 Individuation of the agricultural areas and crops at high risk, due to climate change. (P. Duce - Institute of Biometeorology/CNR, Sassari)**

Individuation of index of climate risks and setting up of an analysis method for the evaluation of the sensibilities to climate change in the test areas of some arboreal and herbaceous crops with the aim at achieving supporting tools in matter of agricultural planning of the territory.

### **2.3 Impact of climate change on frost risk (early and late frosts) and on chilling unit accumulation for fruit crops. (F. Zinoni – ARPA/Regional Agrometeorological Service of Emilia-Romagna, Bologna)**

Evaluation of the effects of climate change in act in particular meteorological situations, which may cause heavy damage to the agricultural sector; moreover the redefinition, for some typical Italian agricultural areas, of the probability of early or late frost, related to the cycles of development of the main crops predicted on the basis of future scenarios.

## **2.4 Effects of climate change on the environmental impact of cropping systems in the hilly lands (of Central and Northern Italy). (P. Roggero - Dep. of Agricultural Biotechnology, Università. di Ancona)**

Creation of a supporting tool for the integrated planning of agricultural production in the hill territory, in the test areas considering the future climate scenarios

## **2.5 The active role of agriculture on the mitigation of global climate change. (A. Benedetti – Experimental Institute for Plants Nutrition, Rome)**

Study of the impact of different types of soil management on the carbon cycle and on CO<sub>2</sub> emission from the ground by means of the quantification of the phenomenon for different types of soils and different types of climatic conditions. The goal is to identify a mathematical-statistic model which could provide a deeper knowledge about the mineralization of organic carbon and therefore about the reduction of the atmospheric CO<sub>2</sub>.

## **2.6 Seasonal forecasts. (A. Navarra – National Institution of Geophysics and Vulcanology, Rome)**

Trough the simulation of an operating process it will be possible to verify if, in agriculture, seasonal forecasts are reliable and exact for Italian territory. The input data will be different from those of the European Center of Reading

## **2.7 Definition of a statistical downscaling method of global models of seasonal forecast for agrometeorological applications. (C. Cacciamani – ARPA/Regional Agrometeorological Service of Emilia-Romagna, Bologna)**

The aim is to estimate if seasonal forecasts realized with the models of general circulation of the atmosphere can be downscaled for a better localization in Mediterranean areas and to Italian territory for an exact planning of the cultivations. The input data of are those of the European Center of Reading.

## **2.8 Analysis and cataloguing of long-term agronomic tests productivity and carbon cycle. (G. Zerbi - Dep. of Vegetable Production, University of Udine)**

Relationships between some variable components of agro-ecosystems and climate change will be investigated. This will be carried out by long term data sets, agronomic tests and also by productivity data analysis after the filtration of spurious events or phenomena.

## **SUBPROJECT 3: Drought, desertification and management of water supplies.**

(to improve the knowledge of some matters connected with possible situations of lack of water supplies)

### **3.1 Crops drought monitoring and desertification processes in South Italy. (A. Brunetti - Central Office of Agricultural Ecology, Rome)**

Different areas of South Italy will be studied trough the monitoring of crops dryness/wetness state and a satellite remote sensing. The main goals are: to create some instruments to reduce environmental, social and economic costs on the agro-ecosystem due to drought and to define a sustainable development strategy for the areas mainly affected by desertification processes.

### **3.2 Water managements and climate change. (M. Mastrorilli – Exsperimental Agricultural Institute, Bari)**

Climate change will act on the water supply qualitatively and quantitatively. The aim of this research is to calculate for the main crops (tomato, wheat, maize, sorghum...) of the Mediterranean region, water needs and irrigation amount under different climate scenarios to see how crops growth and development could be influenced.

### **3.3 Simulation model to forecast the impacts of the temperature and solar ultraviolet radiation on zooplanktonic populations in aquaculture. (M. Severini – Institute of Atmospheric Sciences and Climate /CNR, Rome)**

Definition of a diagnosis and forecast method of the impact on some zooplankton populations due to a possible increase of the air temperature and ultra-violet radiation. This method will allow to give a warning on environmental changes and, at the right time, will give the possibility to decided for some interventions to keep the productivity and the sustainable environmental development of fishing industry up.

### **3.4 Statistical estimate of some experimental cloud seeding cases. (F. Gallo - Dep. of Statistics, University "La Sapienza", Rome)**

Statistical estimate re-analysis of the experimental cloud seeding called "Progetto pioggia" ("Rain Project") carried out to get rain enhancement in South Italy during the period 1991-1994.

### **3.5 Impact of climate change on Agriculture indicators of drought tolerance. (E. Brugnoli – Institute of Agro-environmental Biology/CNR, Porano TE)**

The aim is to identify indicators of tolerance to drought and elevated temperature, the correlations among the isotope  $^{13}\text{C}/^{12}\text{C}$  and  $^{18}\text{O}/^{16}\text{O}$  ratios in plants, the water-use efficiency and climate and to investigate the influence of elevated temperature and drought on phenology, photosynthesis and growth parameters. The awaited results will be a classification of species as a function of their sensitivity to drought and climate change and a Conceptual Model of the impact of global change on phenology and productivity.

## **SUBPROJECT 4: Exchanging information**

### **4.1 Computerized diffusion of the data and the results of CLIMAGRI project. (G. Dal Monte - Central Office of Agricultural Ecology, Rome)**

Realizing of tools for information exchange and diffusion of the data and the results of CLIMAGRI project outside and within the project with the realization of an Internet site of CLIMAGRI (Web, FTP) and a thematic CD-Rom about the project.

### **4.2 Improvement of Data Assimilator Limited Area Model of meteorological forecast of the Italian Agriculture Ministry (MiPAF). (A. Buzzi - Institute of Atmospheric Sciences and Climate/CNR, Bologna)**

Several improvements will be introduced in DALAM (Data Assimilator Limited Area Model) which is the meteorological forecast model of the Italian Agriculture Ministry by means of a new microphysics scheme, new data assimilation technique and a finer resolution of about 10 KM. Such improvements should increase forecast performances especially for what concern agro meteorological products.

### **4.3 CLIMAGRI has planned a cooperation with FAO to spread data, results and methodologies, in particular towards some Mediterranean countries. (R. Gomme - FAO, Roma)**

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