### STUDENTS LEARNING PHENOLOGY FOR BECOMING CITIZEN SCIENTISTS: AN EXAMPLE OF ITALIAN HIGH SCHOOL STUDENTS AND CNR



### RESEARCHERS TEAMWORK EXPERIENCE

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BY

CARLA CESARACCIO, ANNALISA CANU, GRAZIA PELLIZZARO, PIERPAOLO MASIA, AND MARIA LEONARDA FADDA CNR IBE, INSTITUTE OF BIOECONOMY, NATIONAL RESEARCH COUNCIL, SASSARI, ITALY

E-MAIL: carla.cesaraccio@ibe.cnr.it



Citizen science is the scientific research that involves the participation of the public assisting professional scientists. This typically occurs in helping to data collection and/or data analysis. An increasingly popular use of citizen science is the collection of phenological data, like wildflowers blooming in summer or leaves changing color in fall. Studying the life cycles of plants (phenology) reveals some consequences of climate change.

The PCTO (*Percorsi per le Competenze Trasversali e per l'Orientamento*) is a school-work alternation program and represents an innovative teaching method, introduced in 2015 by the Italian Ministry of Education, University and Research. This program, through practical experience, helps to consolidate the knowledge acquired at school and to enrich the student training. The school-work alternation is compulsory for all the Italian students of the last three years of high school (15-17 years age). This program is a cultural change that incorporates good European practices, aimed at creating a synergy between school and work in order to encourage students to follow program learning inside of a public/private company.

The National Research Council of Italy is a partner of this program and each year students from high school-Work

learning program dedicated exclusively to Phenological and Pollen monitoring to groups of students of the environment and skills at work, they learnt to implement the specific protocols of a scientific project. These experiences increased their awareness of the essential role they can play by acquiring new knowledge of the environment and skills through scientific tools of citizen science.

In the future, citizen scientists can provide reliable observations when following scientific methods and standardized protocols. Phenological monitoring programs based on volunteers support will become increasingly important in providing open-access, standardized data sets capable of supporting the process of answering ecological and global change questions.

## Methodologies for monitoring shrub and tree plant species in a natural environment were presented and discussed in the team group.

### Discussion key points:

- ✓ Importance of the observations of the phases of the development cycle of spontaneous plants.
- ✓ Flowering that marks the beginning of spring as a very important signal of the climate effects on plant ecosystems.
- Recognition and monitoring of plant species through observation and data collection: phenological calendars.
- Advances or delays in the appearance of the phenophases and their relationships with the meteorological patterns.
- ✓ The relationships between the flowering phase/emission of pollen/dispersion into the atmosphere in relation to the seasonal meteorological trend.
- ✓ Importance of methodologies for determining the vegetation moisture content during the growing seasons in relation to fire risk.

### **Learning Objectives**

- raise awareness of the problem of protecting natural species and biodiversity from climate change impacts;
- \* highlight the importance of pollen calendars to enhance the allergy prevention campaign;
- understand the relationship between the water state of vegetation and the risk of starting forest fires;
- boost the capacity of analysis through direct observation;
- recognize and represent the fundamental elements for the recognition of species;
- apply the methodology for phenological monitoring by using simplified detection keys;
- the discriminating elements to be photographed and make digital photographs;
- acquire competence for cataloging the collected data and create database.

### Monitoring plant species - Activities

- 1. Phenology: how to observe vegetation development and growth.
- 2. Forest Fire: the importance of determining the moisture content of the plant material (live fuel) in relation to forest fire risk.
- 3. Aerobiology: monitoring flowering and type/amount of pollen dispersed in the atmosphere, and pollen grain morphology.

## Observations BBCH 56 Flower pedicel elengating; separat clased; single flowers separating BBCH 67 Flowers gen BBCH 68 End of flowers gen BBCH 68 Flowers gen BBCH 68 Flowers gen BBCH 67 Flowers gen BBCH 81 Beginning of Flowers gen BBCH 82 Flowers gen BBCH 81 Beginning of picking BBCH 87 Fruit ripe for of fruit BBCH 87 Fruit ripe for picking

### **SUMMARY OF PROGRAM STEPS**

- (1) Themes overview & background: discussion and share ideas with students
- (2) Practice: experimental data and vegetation samples collection
- (3) Handling data: how to process collected data using spreadsheet program (recording image & data, calculations, charts)
- (4) Understanding data: how to realize a research product using a presentation programs (reports, graphics, multimedia content)

# FOREST FIRE — Fuel moisture monitoring Live fuel moisture monitoring Cistus monspellensis Juniperus phoenicae O 100 200 300 400 Doy of the year

