WHERE SCIENCE MEETS SOCIETY: CITIZEN SCIENCE AS AN EMERGING TOOL TO EXPAND RESEARCH HORIZONS

Summary

This document reports the structure and the main outputs of the training course “Where science meets society: citizen science as an emerging tool to expand research horizons” held in Erice (Italy) from the 26th November to the 1st December 2018.

An innovative solution was adopted to combine frontal lessons to work-in-group sessions, giving to the participants the opportunity to engage with the main issues related to citizen science from a theoretical as well as practical point of view. Their response, evaluated through two questionnaires, was encouraging, providing insights for the organization of further courses in this field.

Andrea Sforzi & Cristina Castracani

Report of the COST training course held in Erice from the 26th November to the 1st December 2018
Purpose of the course
Over the past decades, there has been a rapid increase in the diversity and scale of Citizen Science (the involvement of volunteers in science). Initiatives range from crowd sourcing activities, in which the time and effort of large numbers of people help to solve a problem or analyse a large dataset, to small groups of volunteers, collecting and analysing environmental data and sharing their findings. When correctly planned and executed, Citizen Science can increase scientific knowledge and raise people’s awareness of their environment. It can be beneficial to both people and researchers. The main purpose of the course was to provide insights of specific cases/projects/experiences, with the aim of giving to the participants the opportunity to investigate best practices and lessons learned in a very dynamic and promising field.

The COST Action – 15212: To promote creativity, scientific literacy, and innovation throughout Europe gave the opportunity to activate a collaboration with two working groups that cover the main topics of the course:

**Working group 1: Ensure scientific quality of Citizen Science**
This working group focuses on the outcomes of CS projects for scientists. The main objective is to provide a sound understanding of current practices involving the collection, description, and validation of data gathered and analysed by citizens.

**Working group 4: Enhance the role of CS for civil society**
This working group focuses on issues that are relevant to the volunteers in citizen science. The objectives of this working group are to raise awareness of the volunteers’ aims, needs and requirements from citizen science and the results that citizen science contributions have in their lives, as well as the implications for developing social innovation interventions. In particular, the school focused on Task 2: Review practices of participation in CS involving volunteers.
Trainers

Most of the speakers of the school are leading important citizen science projects in their countries or have developed experiences on different approaches to CS projects, both from the scientists (data quality) and people (motivation) points of view. This dual remit was an essential contribution to the course, whose main purpose was to provide the participants with in-depth insights of several aspects of this emerging field.

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<td>Andrea Sforzi</td>
<td>Maremma Natural History Museum, ITALY</td>
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<td>Cristina Castracani</td>
<td>University of Parma, ITALY</td>
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<td>Rick Bonney</td>
<td>Cornell Lab of Ornithology, New York, USA</td>
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<td>Paul Flemons</td>
<td>Australian Museum Research Institute, Sydney – AUSTRALIA</td>
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<td>Frederic Bartumeus</td>
<td>Theoretical and Computational Ecology Group, CEAB-CSIC &amp; CRAIN, Barcelona – SPAIN</td>
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<td>Gregoire Loïs</td>
<td>Musee National d’Histoire Naturelle, Paris, FRANCE</td>
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<td>Artemis Skarlatidou</td>
<td>UCL – University College, London, GREAT BRITAIN</td>
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<td>Bálint Balázs</td>
<td>Environmental Social Science Research Group ESSRG Ltd., HUNGARY</td>
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<td>Pen-Yuan Hsing</td>
<td>Department of Biosciences at Durham University, GREAT BRITAIN</td>
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<td>Magdalena Sorger</td>
<td>North Carolina Museum of Natural Sciences &amp; North Carolina State University, USA</td>
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Structure of the course

The Directors of the course (Andrea Sforzi, Cristina Castracani and Rick Bonney) designed the course, to create a unique opportunity to combine theoretical aspects, case studies and practical activities. The selection of teachers and co-defined structure of the course were carried out to allow trainees to take the most from the time spent during the activities and outside the training sessions. The solution was a programme that alternated plenary talks (followed by open discussion for sharing ideas and visions), case studies and working group sessions (followed by outputs sharing by the working group leaders and a collective discussion of the results). Teachers engaged in case studies were encouraged to find original and diverse types of activities, ranging from educational card games to on-line projects creation, from project evaluation to DIY experiments.

Venue

The course was settle in Erice (Italy) and hosted by the Ettore Majorana Foundation and Centre of Scientific Culture (http://www.ccsem.infn.it). The organization and the facilities of the Centre enhanced the Course, helping to create a very collaborative mood and favoring a free flow of ideas. As described directly by the Centre management “... what distinguishes Erice the most is the spirit that animates all participants, both students and docents. The primary objective is to learn. No diplomas or degrees of any type are given out. Like nine hundred years ago. The student listens to the lesson and then, after a break for lunch, the fun part begins. The student can ask the lecturer any question. Even the most banal. It is in everyone’s interest to know the thoughts of young brains upon their exposure to scientific findings about which they had, presumably, already imagined many details and specifics, but rarely the same ones that are mixing around in the head of the docent. For a single problem, there are many different approaches. This is the whole point of discussion groups. When a group of scientists gathers to address themes of great scientific novelty, almost anything can happen. One time the Scientific Director of the Zurich branch of IBM came to this School. On his return to Zurich, he resigned from his directorship in order to dedicate himself to an idea that came to him during the courses at Erice. That idea led him to discover high-temperature superconductivity: he was awarded with the Nobel Prize. We are talking about Alex Müller. This is one example of how new ideas can be born at Erice...”

(The History of EMFCSC - http://www.ccsem.infn.it/em/history/index.html)
Programme

26th November 2018 - Arrival Day

27th November 2018 - Day 1

9:00 Welcome address by Stefano Parmigiani (Director of the Erice International School of Ethology)

9:20 Andrea Sforzi and Cristina Castracani: Introductory Remarks

9:45 Participants’ presentation: introducing themselves, their skills, motivation and expectations.

10:15 Andrea Sforzi: Education vs research: how many different approaches and definitions for citizen science?

‘Citizen Science’ is a broad term that encapsulate a range of different activities; in its essence, it partners professional scientists with volunteers in the shared aim to study the physical and biological world. It spans subjects from competing in a multiplayer online game to discover protein structure models to identifying simple morphological classifications of galaxy shapes, etc. Several projects have been mainly developed to enhance the public’s capability to contribute to scientific activities. Following this approach, the education purpose has sometimes overwhelmed the research questions that should underlay any scientific project, opening reflections on the approaches that might guarantee the double remit of this promising field of scientific endeavor.

11:00 open discussion – sharing ideas and visions

11:30 Coffee break

12:00 Paul Flemons: CASE STUDY 1: The Challenges and Benefits of Crowdsourced Citizen Science for Building Research based citizen science projects

12:45 open discussion – sharing ideas and visions

13:00 Lunch

14:30 ACTIVITY 1: working group session (splitting into groups). The working group session will enable each of the four groups to design and build their own prototype online citizen science project using the DigiVol.org platform. Prototypes will be developed in hard copy form that demonstrate what is required to build an online project and then how to review and analyse the outcomes. One or more existing online DigiVol citizen science projects will be used to explore the issues relating to project design, volunteer engagement and support and data quality.

Using provided materials students will be required to define a research question, identify the data requiring collection, and build a data collection template in the DigiVol format. They will then assess an existing DigiVol project and explore issues relating to data quality and analysis.

15:15 Sharing results. Feedbacks from the working group session (working group representatives) and discussion of the results (plenary).
15:30 Tea break

16:00 Rick Bonney (Skype): The research challenge: from an educational-inspired to a research-driven approach to citizen science

16:45 open discussion – sharing ideas and visions

17:30 End of Day 1

28th November 2018 - Day 2

9:00 Gregoire Loïs - CASE STUDY 2: Working with different types of public. The experience of Vigie Nature

The topic concerns very much conception and feasibility of citizen science programs aiming at feeding research in macro-ecology. There will be reported different experiences, from easy ones to some “pushing to the limits”, encountering some participatory and scientific success. Some fails encountered will be also presented.

10:00 ACTIVITY 2: working group session (splitting into at least four groups). The activity will focus on "how to design a CS program that will meet scientific objectives and success in participatory terms". Expected outputs to be identified during the feedback session could be the identification of objectives (that in general are not restricted to research), burdens due to mismatch with foreseen target, technical limits, scientific limits, etc.

10:45 Sharing results. Feedbacks from the working group session (working group representatives) and discussion of the results (plenary).

11:15 Coffee break

11:45 Artemis Skarlatidou (Skype): Designing for citizen science to meet volunteers’ needs and requirements. Although hundreds of citizen science applications exist, there is lack of detailed analysis of volunteers’ needs and requirements, common usability mistakes and the kinds of user experiences that citizen science applications generate. Due to the limited number of studies that reflect on these issues, it is not always possible to develop interactions that are beneficial and enjoyable. In my talk I will present research in this area from the field of environmental digital citizen science and conclude with some guidelines that may inform the design and development if these applications. I will make reference to Human-Computer Interaction and User Experience methods that may help participants to evaluate their own applications and improve interaction. I will also refer to a recent special issue that I am leading as editor in this topic and a book we are planning in this topic with the support of the COST Action WG4.

12:45 open discussion – sharing ideas and visions

13:00 Lunch

**14:25** Activity 3. Intro exercise: Brainstorming a school-based citizen science project.

**14:40** Group exercise “Classroom citizen science challenge” Part 1

**14:55** Cristina Castracani: *School of Ants – Italy: a bridge between researchers and educators.* The talk will be centered on the structure of the project that Cristina is leading in Italy and on how the project was able to involve Italian teachers and students.

**15:25** Discussion “Classroom citizen science challenge”- Part 2

**15:40** Tea break

**16:10** Magdalena Sorger: *The Ant Picnic Project – Working with K-12 teachers to design citizen science curriculum*

The talk will introduce Students Discover (studentsdiscover.org) and the Ant Picnic project including a selection of the different activities Magdalena is working on, highlighting pro and cons, potential applications and, specifically, stressing the research approach behind the different experiences.

**16:40** Group Exercise: Designing a school-based citizen science project

**17:25** Magdalena Sorger: *A win-win: How citizen science could improve students’ data literacy skills.* A big focus of Magdalena’s work has been to incorporate a data analysis aspect into the curriculum that was designed for the Ant Picnic project. She will introduce the activities and some preliminary results from study on the impact of citizen science on teachers and students.

**17:40** Feedback & wrap-up

**18:00** End of Day 2

**29th November 2018 – Day 3** Half day Excursion / computer based activity.

The morning will be dedicated to the visit of some Greek temples ruins in the surroundings of Erice. In the early afternoon we’ll be back to Erice to perform a primarily computer based activity. The activity will be leaded by Paul Flemons. It basically will involve what has been developed during his session devoted to DigiVol, taking it to the next level and actually creating an online crowdsourcing project on the DigiVol platform Testing site. The aim is to demonstrate what is involved and participate in the process of creating a crowdsourcing project. DigiVol is an open access platform for running crowdsourcing projects and so the students can leave the course with the knowledge of what is required to run their own crowdsourcing citizen science project.

**30th November 2018 - Day 4**

**9:00** Frederic Bartumeus - CASE STUDY 4: *Mosquito Alert: the efficacy and challenges of citizen-science based research and vector control on invasive mosquitoes.* Mosquito Alert involves citizens, schools and public health practitioners in the surveillance and population control of two invasive and vector mosquitoes in Spain. Through this case study participants will get a deep understanding of how Mosquito Alert has involved the public health sector in the project and the opportunities and
challenges of involving decision makers and public managers in a citizen science project. There will be an overview of the project, a small introduction on the biology and ecology of invasive and disease vector mosquitoes and citizen science and finally, through a real case study, participants will know the IT and other technological elements and resources of the project and how these have helped to integrate the public health sector in the project but also posed several challenges difficult to overcome.

10:00 ACTIVITY 4: working group session

Recently, the Mosquito Alert project has triggered the discovery of a new invasive and vector mosquito species in south Europe. The region now is obliged to carry a field surveillance program and is encouraged to combine traditional monitoring practices with citizen science. This poses a great challenge for the project: the need to offer a fast solution to incorporate citizen science in a traditional monitoring program, without changing any of its IT infrastructure and with a very limited budget. Flexible, imaginative and low cost solutions are often needed in citizen science projects, when the unexpected happens. In this session, groups will be given a set of resources and tools (personnel, budget, etc.) and a set of constraints and will have to propose, through role playing, “out of the box” ideas to deal with this real case challenge.

10.45 Sharing results. Feedbacks from the working group session (working group representatives) and discussion of the results (plenary).

11:15 Coffee break

11:45 Bálint Balázs: Dealing with data quality in citizen science projects: perspectives, challenges and future visions

The workshop will explore what data quality in citizen science means and why data quality is vital in citizen science. We face these issues from different perspectives of the citizen scientist, citizen science project owners, general users of citizen science data, or decision makers using citizen science data. Participants will get an overview of what they can do to ensure the highest possible data quality in citizen science data.

12:15 open discussion – sharing ideas and visions

12:30 Lunch

14:15 Pen-Yuan Hsing - CASE STUDY 5: Outputs from the MammalWeb camera-trapping project and reflections on the relationship between research and civic engagement.

The talk will summarise the MammalWeb project and the main research outputs such as understanding wild mammal distribution, capturing non-native species, feeding into national wildlife databases, and statistical modelling on how to handle noisy data (i.e. crowdsourced classifications), and the related lessons learned. This ties topics covered throughout the week into one example, which participants can both critique and learn from. Another aspect covered will be putting the MammalWeb project in the theoretical framework of contributory vs collaborative citizen science, citing examples of how citizen scientists (including local school students) have been empowered as engaged citizens rather than passive data collectors.
15:15 Activity 5: working group session (splitting into groups of two): Thinking about citizen science from the participant’s (rather than a professional scientist’s) perspective, and considering the potential of citizen science in civic engagement. In addition to an overview of examples of citizen-initiated science, participants will build their own DIY (do-it-yourself) environmental sensors based on the open hardware Arduino electronics platform. This is not only a chance to understand the importance of open science in citizen science, but also a tangible experience of what citizen science is like from the citizen’s perspective while putting it into the wider context of collaborative citizen science.

15:45 Tea break

16:15 Sharing results. Feedbacks from the working group session (working group representatives) and discussion of the results (plenary).

16:45 All. Open discussion and wrap up of the course.

18:00 End of Day 4

1st December 2018 - Departure Day
Trainees

Eighteen trainees, coming from eight different countries, took part to the training course. About 2/3 of them could take part to the course thank to a grant provided by the COST Action. This fact was an added value, that gave a truly international approach to the course and stimulated further exchange of knowledge and experience among the participants. Their background was also quite diverse; more than 50% were early career researchers.
Course evaluation

Knowledge in the field of citizen science, personal background and participant's expectations were evaluated through a simple entry module, filled in before the start of the training course. At the end of the last day, attendees were asked to fill in a final module, to evaluate their satisfaction and to gather comments and suggestions. The main results are synthetized below.

Entry module (before the course) n=16

Why did you chose to take part to this course?

- For a general interest in the subject
- To gain a deeper knowledge on a field I'm already working
- To take a topic I'm already aware of, from a different perspective
- Other

If you chose "other" please, provide details below:

- I would like to get more familiar with CS in terms of how to properly design successful projects that have a well balance mix of education and research, and at the same time are regarded as quality reliable from other scientists, while maintaining community engagement and empowerment to help tackle environmental relevant issues.
- Partnerships
- To gain some inputs that can help me to design specific actions focused on CS activities in the framework of a project proposal that I am preparing
- Partnerships, gain deeper knowledge and different perspective.
About Citizen Science:

If you chose "other", please, provide details below:

- I started CS as a subproject of my main research activity: it was aimed as a part of outreach and science communication actions of my H2020 funded fellowship
- New research approach and relationships with stakeholders
- It is a topic where I would like to start to work
- Assessing a potential for use it on my studies. Further career choices to develop these type of projects in Central and Latin America in agricultural-water contexts
- I would like it to become part of my PhD thesis.
- I would like to be part of my PhD

I know pretty well the topic of citizen science
What are you expectations from this course?

- to improve my knowledge
- Enhancing my knowledge on the state-of-the-art through the courses. In addition, I would work towards being a co-author of the paper to be published as an outcome of this School.
- To learn, share, collaborate and possibly co-design future initiatives
- Improve my knowledge about citizen science project around the world, share ideas and new possibilities for the future
- Learn about different projects and share opinions
- To understand the feasibility to write a CS project in my context
- Help inform my work, particularly methods of engaging participants in the long term
- Gather all the tools to have a proper and more comprehensive awareness and knowledge on the topic and basics to cope will all the difficult steps in order to submit a financing proposal for CS project and start with this new research field
- To learn useful lessons from existing projects and apply these to my own research
- To assess its potential for natural valuation and decision-making process
- Learn a lot about CS projects going on, possible partnerships, meeting other students and professors.
- Networking / Deeper Knowledge
- To understand the state of art of citizen science, deepen my knowledge and be involving in a network

What kind of soft skills would you like to develop during the course?

What kind of hard skills would you like to develop in the field of citizen science?
Reconsidering your knowledge on citizen science before starting the course, how do you judge it back?

If you chose "yes", please provide a simple comment (not compulsory):

- I think I reached my objective that was understand (I hope so) the good points and criticisms of CS in prospective to apply for a project.
- It was really helpful to broaden my knowledge and detail all the steps that comprises the creation of a CS project.
- I loved group activities and actually learned a lot from other projects.
- I knew a lot of new information and tools about Citizen Science project all around the world, that i didn't know before. It was a very useful course for me and for my PhD project.
- I've discovered different things from the various CS projects, Sharing ideas and opinions where always present.
- Now I am more awareness about this emerging topic.
• Showing a broad range of different citizen science projects. Good option to connect with other people running citizen science projects in different countries.

• I wanted to learn more about practical cases of CS in order to evaluate as a method to be used on my research.

• Understanding the various issues that arise in a real-life context was very valuable. Some examples include: i) user Interface design to accommodate darkness is required in the FrogID project, since most of the data collection occur during the night, ii) volunteers might actually be motivated by difficult tasks such as earth worms monitoring, iii) a student might be engaged by simply capturing a squirrel in the MammalWeb project, even though the animal itself is not of interest to the project. Therefore, each project needs to find its unique way of engaging the citizens.

• It was a very stimulating and interesting course

• I expected to learn a variety of aspects to take into account when designing a CS project and indeed I learned them but also discovered other I didn't expect to learn too.

• I found at Ettore Majorana a fruitful environment to think deeply about the opportunities and challenges of Citizen Science.

• The course met my expectations, and went beyond. I learned many things in different areas, other than the one(s) I had anticipated I would be learning. I met so many interesting people, studying and working in so many different areas, but sharing a common interest in citizen science! It also provided me with new insights about citizen science and research; I might take a slightly different pathway in the PhD, now, but a more robust one. And the feedback I got during the course and informal talks at coffee breaks or dinners, were really helpful in understanding that pathway.

• The course was interesting and provided relevant knowledge to whom want to start working in the field of CS. Also, it was a good opportunity to network.

• The lectures were very professional. I learnt a lot about big, professional Citizen Science projects. Exercises in groups were very useful for me - I had opportunity to extend my knowledge.

• I had a fantastic time, met some wonderful people, learnt a lot, and enjoyed exchanging ideas and experiences.

During the course I had the chance of...

Describe possible difficulties you encountered and/or criticisms:

• I don't have real criticisms. An interesting topic would probably have been funding possibilities for CS projects (i.e. within H2020 or beyond). We don't really know where to ask for funding at this stage.

• My only personal difficulty was my poor skills about English language.

• The Skype calls were not the best way of sharing ideas and present projects

• Validate Data and make a valid protocol
• It would be nice to have more presentation about the research in citizen science projects like volunteers’ motivation, data analysis (like in Frederic’s talk) and not only best-case examples. Would also be nice to have a more technology-mediated session (like the workshop done by pen). I would also like to share my knowledge in this field.

• As mentioned a bit overwhelmed due to successful case studies (expert levels maybe) and I missed examples in other disciplines

• It would be nice to increase the communication between the participants and the teachers through a Whatsapp group or a dedicated Twitter account. In some cases, the schedule have changed and it could be easier to keep up with the schedule had there been such a communication platform.

• It was my first workshop so I don't have a comparison. My opinion is that there were no critical issues.

• The only difficulties were on me as I was unable to attend the entire workshop.

• Sometimes, I struggled with the name of animals, plants, etc. written in English; during the group exercises, it was possible to ask my colleagues and share doubts - and that was ok! But during PowerPoint presentations, I felt I would have learned even more if I wasn't trying to understand which was what (I know pretty well what a fox, a frog or a cockatoo is, but e.g. birds names, not as much). I'd like to suggest in future courses, a link to a reference/ website with a list of species in different languages. I know Google can help! But in some occasions my Wi-Fi signal was too weak to run. Also, if this reference/ website can be provided beforehand, it is also a good opportunity for new learnings and insights. I did notice most presentations included names and photos of species, and that is something I liked a lot - the visual communication aspect.

• As inspiring as it was to hear about some brilliant and really successful citizen science projects, some examples of citizen science projects that didn’t really work would have also been useful (i.e. a guide to what not to do).

How would you define this training format?

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According to the results/competences gained, you are:

![Bar chart showing the distribution of responses.]

Do you have final comments you would like to share?

- The course was really very good: very good organizers, very good participants, talk and exercises. Personally, I would appreciate more focus on the data treatment and analysis, but I understood this could be considered a detailed expectation for ecologist, and it probably didn't met the expectations of everyone.
- No, just thanks. I am really happy I was able to take part.
- Amazing location but the food was not good. Next time could we better to organize a workshop like this during a warmer moment of the year. The organizers have done a fantastic JOB!
- I'm very grateful to the course directors. I hope to improve and implement more and more my knowledge and experience about citizen science. I appreciate a lot to work in groups and maybe it would be better to insert an field activities next time. Finally, I would like to suggest to the center that if it is possible to use less plastic. Thanks a lot.
- Thanks for the nice week. Hope to see you again!
- Thanks a lot for the opportunity and all the organization, it is definitely something very useful to have an informed opinion about CS.
- For the paper, I think it would be nice if each student writes a paragraph to describe what they have taken away from this school. I will be doing it and send you within this week. Thanks again!
- I liked the organization of the activities, the total full immersion in the topic thanks also to the sharing of meals and rooms. It was a great experience for me!
- I'd like if this was a first step of a series. There are so much to learn and to get familiarity on this topic that it'd require more than one workshop.
- I'd like to see more training schools, workshops and congress to discuss and to share experiences in Citizen Science.
- Thank you for the opportunity, it was great to be part of the course class. I'm looking forward for continuing to share and learn. I will also fill in the google form, about collaborating for the article; I wasn't sure, whether to contribute to data quality or education articles, but after the final changes that were presented last Friday, I felt my previous experience in environmental education and working with schools, could maybe help somehow. I also want to say that the course was a great opportunity to network, and knowing about new projects and resources. As I mentioned when I applied for the course, I am taking a pause in the PhD and I was struggling about the research; now I feel challenges are here but that I am more prepared in addressing them and knowing where to look for help, possible partnerships, new comments and insights. And, for a comment on cultural aspects:
maybe in the Marsala room you could also add some music (as mp3 source or other) from Italy, Sicily,...

- I recommend to send a letter of complaints/suggestions to the Ettore Majorana Centre regarding the excessive use of plastics (bottles, cups etc.), scarce availability of vegetarian/vegan options, and the convention they have with restaurants.

- I hope, there will be an opportunity for continuation of the training school for the group of PhD students, where we could extend our knowledge again and our scientific network.

- I really enjoyed the mixture of lectures and workshops, finding them stimulating, interesting and fun. The day trip was also a great opportunity to keep networking while exploring outside. It became a great extension to the citizen science learning, as we shared apps that we used to identify and record wildlife as we walked around the temple.

Final remarks
The course was a sort of “first trial” to provide training in the field of citizen science through a four full days module. Among the main remarkable aspects to be cited is the process that was followed by the Directors to ensure a balance between frontal lessons and work-in-group sessions, giving to the participants the opportunity to engage with the main issues related to citizen science from a theoretical, as well as practical point of view. As far as we know, other experiences made in this field were mainly daily courses (Rick Bonney, pers. comm.), with a quite different approach. The hosting institution (a scientific center devoted to promote courses in a large variety of scientific fields) and the location (a small, beautiful, isolated medieval village) helped attendees to create the right mood for connections. Their response, evaluated through two questionnaires, was encouraging. Living in strict contact for some days stimulated exchange of ideas and experiences among them and with the teachers. On the other side, teachers challenged themselves to find original ways to engage attendees and provide them with original and interesting activities. There were several lessons learnt, that will be elaborated further and will constitute the basis for a shared paper to be published with the collaboration of all the actors involved in this experience.

Grosseto (Italy), 6th August 2019

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