CEOS_SE

Train the trainers

July 13

Citizen Science

Funded by the European Union

WHAT IS CITIZEN SCIENCE (AND WHAT IS NOT)

Andrea Sforzi

MUSEO DI STORIA NATURALE DELLA MAREMMA

ecsa European Citizen Science Association

The evolution of science

Development of methods, foundation of the first scientific societies

Science only for specialists in Universities and research institutions

Opening of methods, software, databases, publications, etc.

Source: M.Haklay, 2016

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Citizen Science is an emerging area of research and practice, with evolving standards.

The name is used for a wide range of activities and practices.

Different stakeholders are developing methodologies, theories and techniques.

EUROPEAN CITIZEN SCIENCE ASSOCIATION

Ten principles of citizen science

Citizen science is a flexible concept which can be adapted and applied within diverse situations and disciplines. The statements below were developed by the *'Sharing best practice and building capacity'* working group of the **European Citizen Science Association**, led by the Natural History Museum London with input from many members of the Association, to set out some of the key principles which as a community we believe underlie good practice in citizen science.

1. **Citizen science projects actively involve citizens in scientific endeavour that generates new knowledge or understanding. Citizens may act as contributors, collaborators, or as project leader and have a meaningful role in the project.**
2. **Citizen science projects have a genuine science outcome.** For example, answering a research question or informing conservation action, management decisions or environmental policy.
3. **Both the professional scientists and the citizen scientists benefit from taking part.** Benefits may include the publication of research outputs, learning opportunities, personal enjoyment, social benefits, satisfaction through contributing to scientific evidence e.g. to address local, national and international issues, and through that, the potential to influence policy.
4. **Citizen scientists may, if they wish, participate in multiple stages of the scientific process.** This may include developing the research question, designing the method, gathering and analysing data, and communicating the results.
5. **Citizen scientists receive feedback from the project.** For example, how their data are being used and what the research, policy or societal outcomes are.
6. **Citizen science is considered a research approach like any other, with limitations and biases that should be considered and controlled for.** However unlike traditional research approaches, citizen science provides opportunity for greater public engagement and democratisation of science.
7. **Citizen science project data and meta-data are made publicly available and where possible, results are published in an open access format.** Data sharing may occur during or after the project, unless there are security or privacy concerns that prevent this.
8. **Citizen scientists are acknowledged in project results and publications.**
9. **Citizen science programmes are evaluated for their scientific output, data quality, participant experience and wider societal or policy impact.**
10. **The leaders of citizen science projects take into consideration legal and ethical issues surrounding copyright, intellectual property, data sharing agreements, confidentiality, attribution, and the environmental impact of any activities.**

September 2015, London

ecsa | European Citizen Science Association

Version 1, April 2020

ECSA's characteristics of citizen science

Introduction

Citizen science is a common name for a wide range of activities and practices. It is possible to understand it by considering the characteristics of those activities and practices, which are described in this document. These are found in different scientific disciplines – from the natural sciences to the social sciences and the humanities – and within each discipline, the interpretation of citizen science can be slightly different. Yet despite these differences, citizen science is an emerging area of research and practice, with evolving standards on which different stakeholders are developing methodologies, theories and techniques. It is, therefore, useful to establish some level of shared understanding, across disciplines and practices, as to what to expect from an activity or a project that is set out to be a citizen science one.

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No single definition can encompass the broad range of activities that exist under the umbrella of citizen science.

For some the term citizen science refers to **people contributing observations and efforts to conducting science**. Those holding this view may see citizen science as a new **research tool**, which facilitates larger scale research.

Still others see citizen science as including elements of **civic education** and **expanding the public understanding of science**.

For others, the term encompasses the **democratization of science**, **allowing people** outside the mainstream scientific establishment **to conduct and govern science**.

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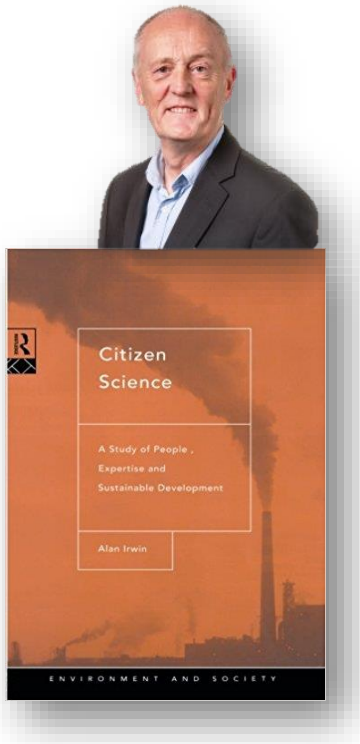
The rise of "Citizen Science"



Since1995, Citizen Science has been defined as:

- Expertize that exists among people traditionally seen as «ignorant» (Irwin, 1995);
- Research techniques that enlist the help of members of the public to gather scientific data (Bonney, 2009).

Citizen science:

«scientific work undertaken by members of the general public, often in collaboration with or under the direction of professional scientists and scientific institutions»

Oxford English Dictionary, 2014

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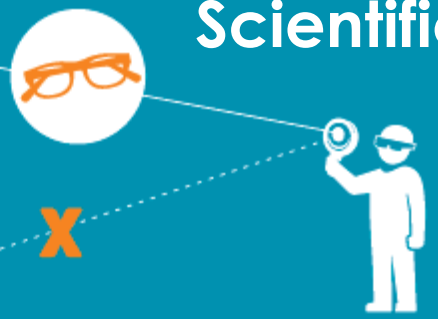
What is the value of citizen science?

Scientific

The value of citizen science is dependent on the quality of data collected. Citizen science projects can be split into two types depending on the quality assurance methods employed:

- verified citizen science, in which observations are checked by experts;
- direct citizen science, in which observations are submitted without verification



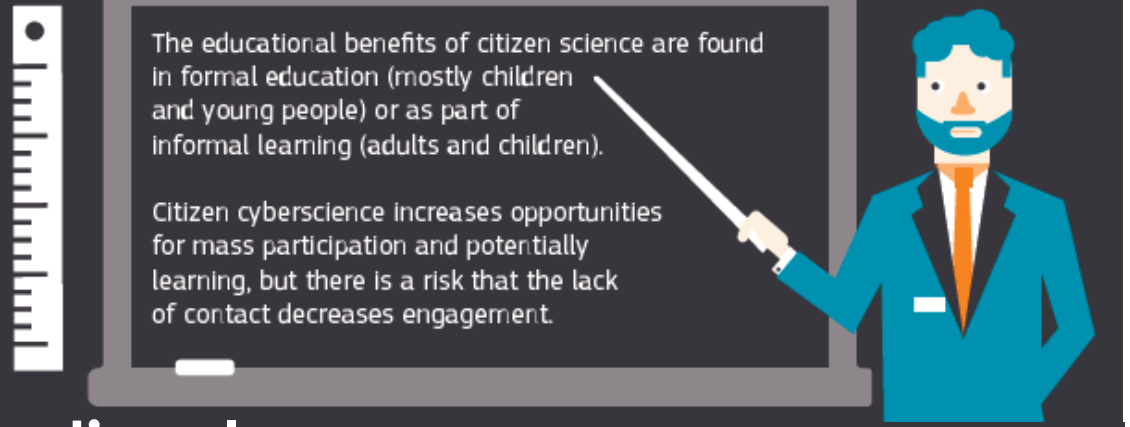
Societal

Citizen science has the potential to bring society closer to science and to nature, bringing about a sense of ownership and helping create the kind of society that works to protect its natural environment.

Educational

The educational benefits of citizen science are found in formal education (mostly children and young people) or as part of informal learning (adults and children).

Citizen cyberscience increases opportunities for mass participation and potentially learning, but there is a risk that the lack of contact decreases engagement.



Policy making

Citizen science can serve policy makers by:

- raising awareness about an environmental issue
- providing evidence

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Different approaches / levels of participation

	CONTRIBUTORY	COLLABORATIVE	CO-CREATED
Define a Question/Issue			✓
Gather Information			✓
Develop Explanations		✓	✓
Design Data Collection Methods		✓	✓
Collect Samples	✓	✓	✓
Analyze Samples	✓	✓	✓
Analyze Data		✓	✓
Interpret Data/Conclude			✓
Disseminate Conclusions			✓
Discuss Results/Inquire Further			✓

Source: Bonney *et al.* (2009)

Levels of Citizen Science

Level 4 'Extreme'	• Collaborative Science – problem definition, data collection and analysis
Level 3 'Participatory science'	• Participation in problem definition and data collection
Level 2 'Distributed Intelligence'	• Citizens as basic interpreters
Level 1 'Crowdsourcing'	• Citizens as sensors

(changed after Sonja Kreft (MfN) after Bonney et al 2009)

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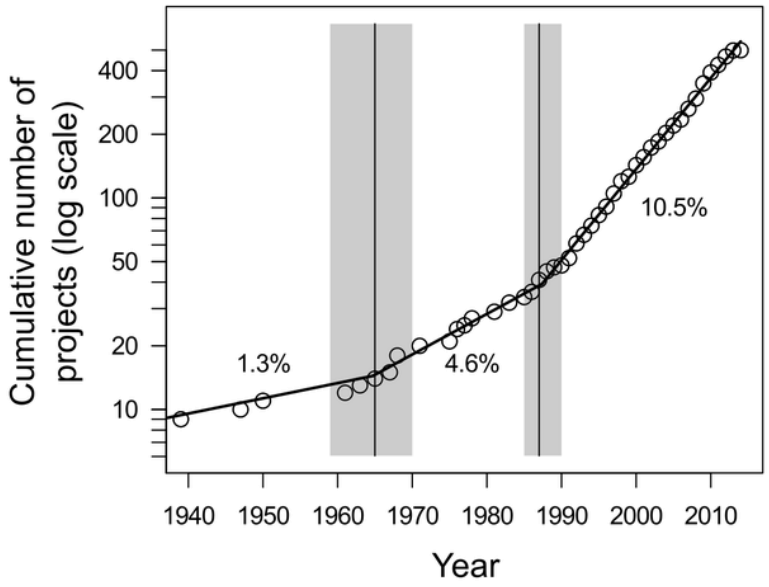
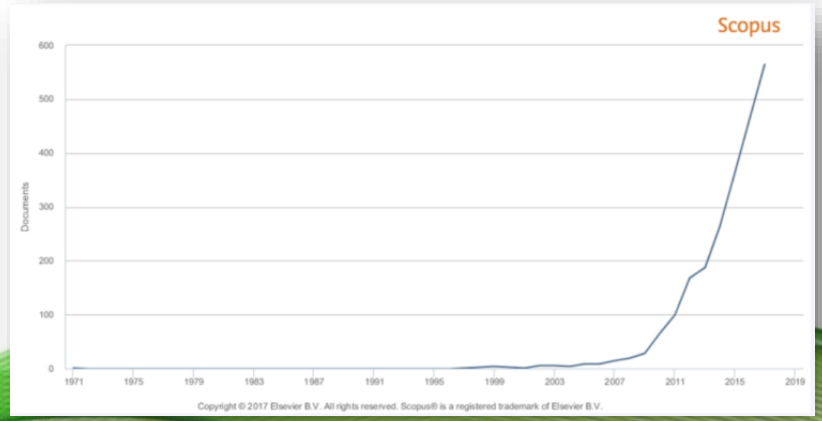
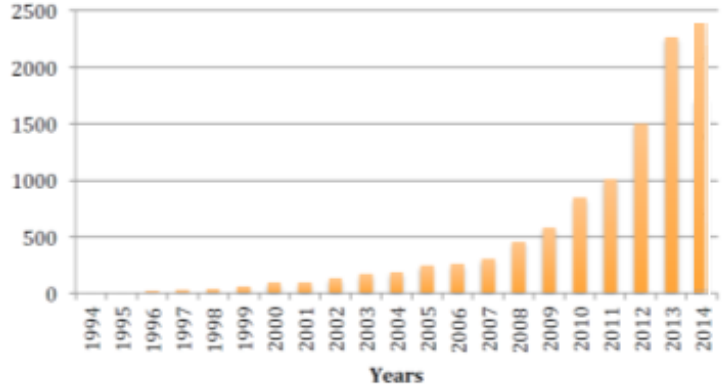
Scientific production ...



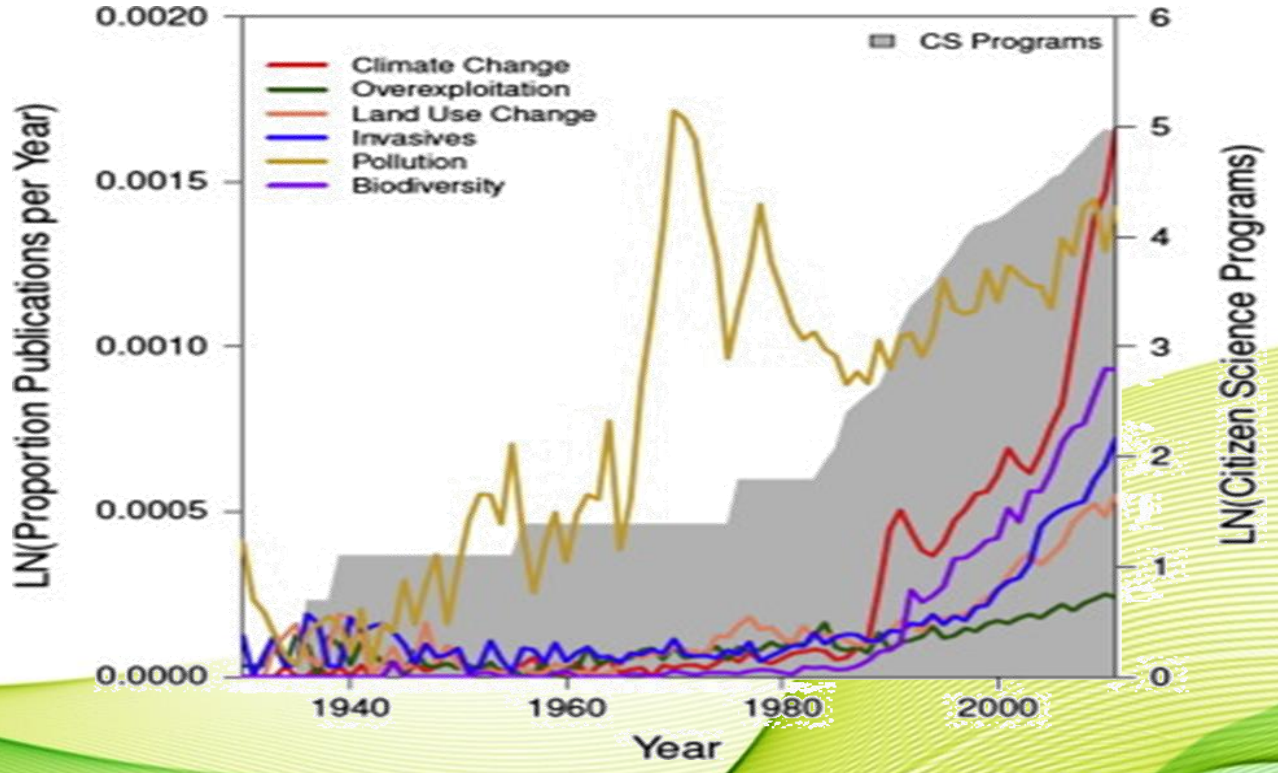
Rate of increase in the cumulative number of ecological and environmental citizen science projects as revealed by a systematic search.

Source: Pocock *et al.* (2017)





Citizen science publications trend in the last two decades, according to scholar.google.com, searching for «citizen science» + «project».



Source: Theobald *et al.* (2015)

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Why citizen science is becoming so popular?

Excellent engagement

Providing a way for people to engage with science and their environment. Participants often describe CS as fun and providing a way to contribute to something important and valuable.

Cost-effective data collection

Citizen science provides the potential to collect data at much larger spatial and temporal extents and much finer resolution than would otherwise be possible. It can be a cost-effective way of collecting data.

Technology

Over the past decade, advances in technology have made it easy to set-up and promore CS projects (data collectionvia website or apps; rapid and easy feedback.

Data can be trusted

Increasingly, the important step of data validation is taken in CS projects, to provide data of known quality. Results are increasingly published in the scientific literature.

Volunteer involvement

Volunteer involvement in science has a long history. We can learn from the successes of past activities in developing current projects.

Diversity of approaches

Different types of citizen science appeal to different people, e.g. expert volunteers, interested community stakeholders or members of the general public.

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UNEP Year Book 2014 emerging issues update

Realizing the Potential of Citizen Science

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SciTechDaily

BIOLOGY | CHEMISTRY | EARTH | HEALTH | PHYSICS | SCIENCE | SPACE | TECHNOLOGY

HOT TOPICS JANUARY 18, 2018 | NEW TECHNIQUES TO DETECT MICROORGANISMS IN EXTREME ENVIRONMENTS LIKE MARS

HOME | SPACE NEWS

Citizen Scientists Discover K2-138 System: A Near-Resonant Chain of Five Sub-Neptune Planets

TOPICS: Astronomy Cosmology MIT Planetary Science

JANUARY 17, 2018

Many declinations...

- **Passive sensing** (e.g. smartphones)
- **Partecipatory sensing**
- **Community science**
- **Volunteered computing**
- **Volunteered thinking** (citizens + scientists)
- **Environmental monitoring** (e.g. pollution, biodiversity...)

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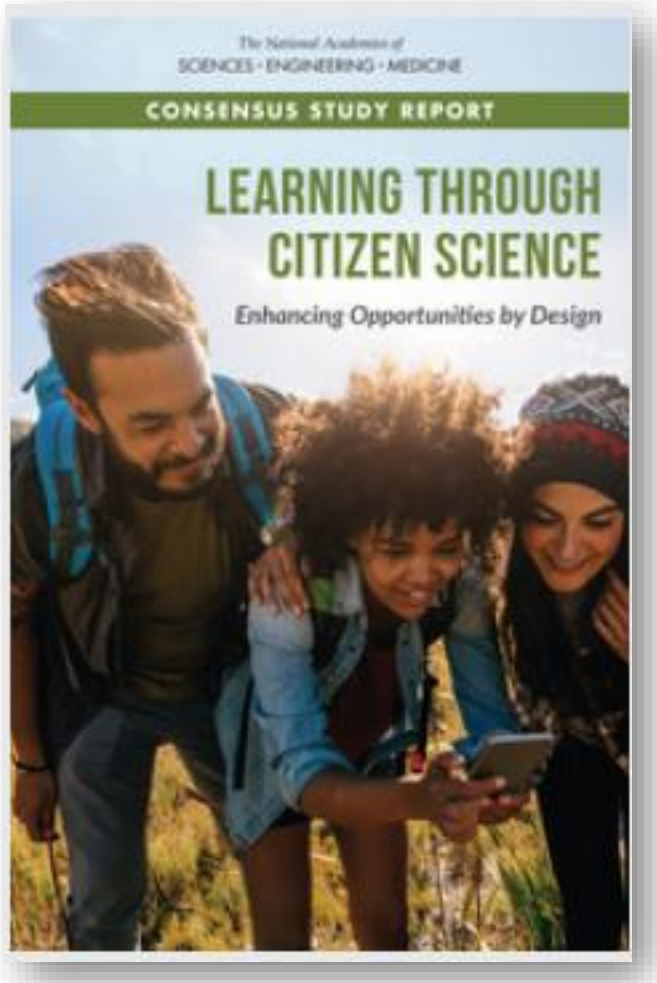

PDF available at http://nap.edu/25183

Common Traits of Citizen Science Projects

- ✓ Actively involve Participants;
- ✓ Engage Participants with Data;
- ✓ Use a Systematic Approach to Producing Reliable Knowledge;
- ✓ Participants are Primarily Not Project-Relevant Scientists;
- ✓ Citizen Science Projects Help Advance Science;
- ✓ Participants in Citizen Science Can Benefit from Participation;
- ✓ Citizen Science Projects Communicate Results.

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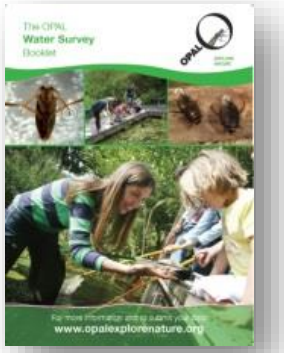
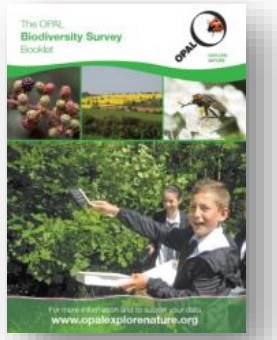
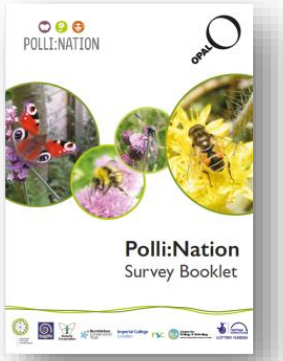
The OPAL model

1. Choose **topics** (policy relevant) appoint lead scientists
2. Define **research questions**
3. Develop **Methodology**
4. Design **Field Pack**
5. **Education and training materials**
6. Establish **national community science network** to promote, train and support local communities and schools to deliver research
7. National and local **media programme**
8. **Website** (news, events, references, resources, competitions)
9. Data – **database** with instant feedback, data analysis, share results
10. Manage to **budget, time and performance criteria**







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Environmental CS

Driving forces …

- ✓ **loss of ecosystems**,
- ✓ need for **sustainable development**,
- ✓ decline in **outdoor learning**,
- ✓ need for **public awareness and engagement**.

… and aims

- ✓ support a **change of lifestyle**;
- ✓ **spend more time outdoors**;
- ✓ **inspire new generations of environmentalists**;
- ✓ develop **activities** accessible to and enjoyed by **all ages**;
- ✓ gain a much **greater understanding** of the **state of the natural environment** for research and policy purposes.

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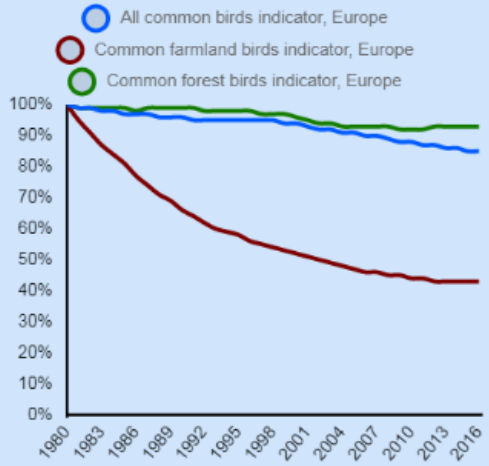
PanEuropean Common Bird Monitoring Scheme

EBCC European Bird Census Council — every bird counts

BirdLife INTERNATIONAL

168 Species
28 countries
37 years (1980–2016)



Source of the data: EBCC/BirdLife/RSPB/CSO

The latest data on European common birds shows a continued decline of European farmland birds. While the common forest birds are more or less stable over the last 10-15 years, the farmland birds show a staggering decline of 57% since 1980.

Common bird monitoring schemes in Europe

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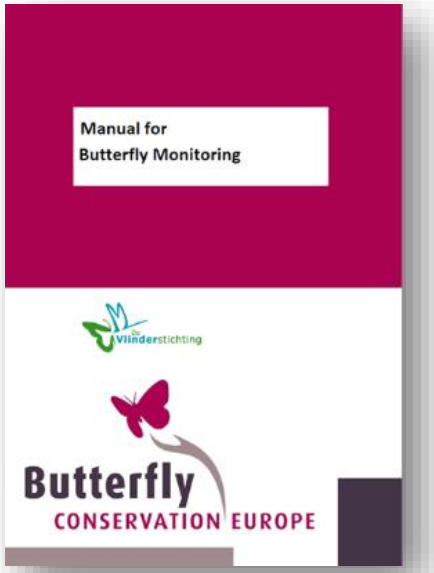
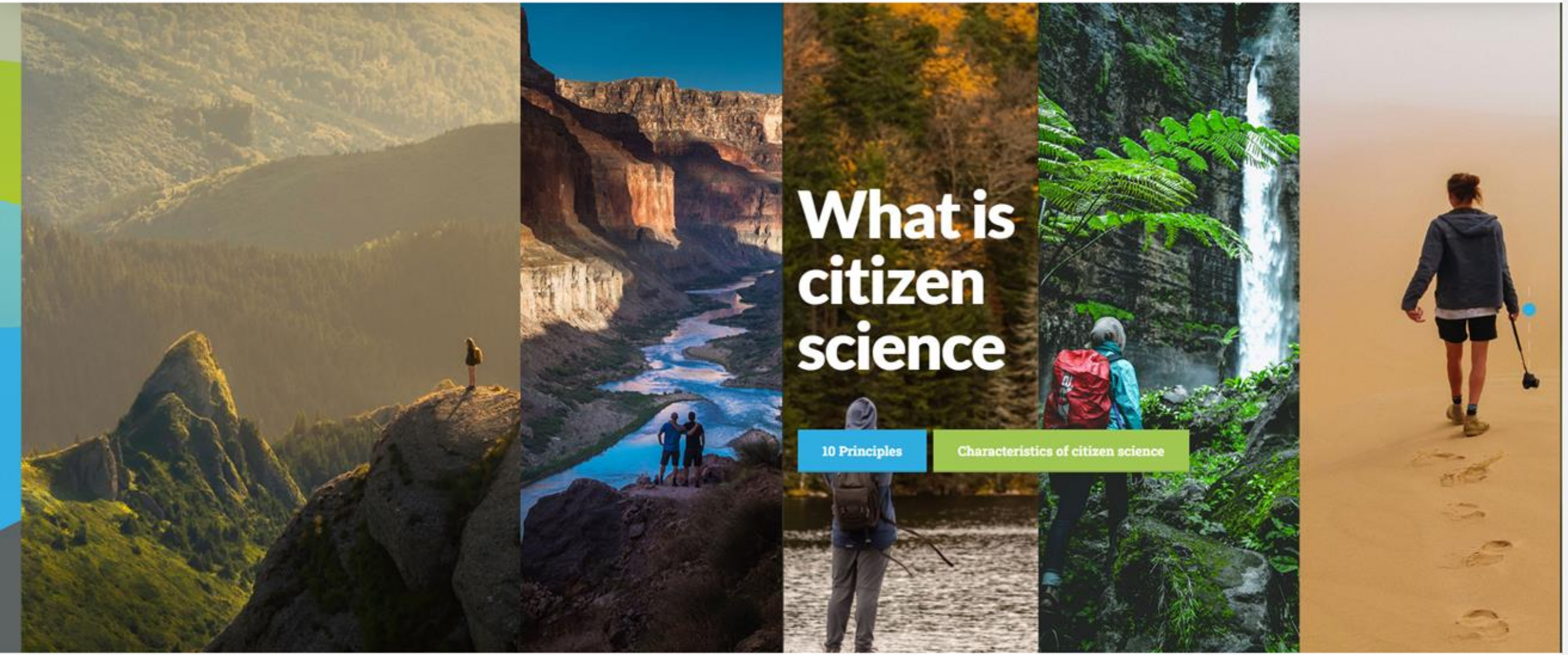
European Butterflies Monitoring Scheme

Assessing Butterflies in Europe (ABLE)



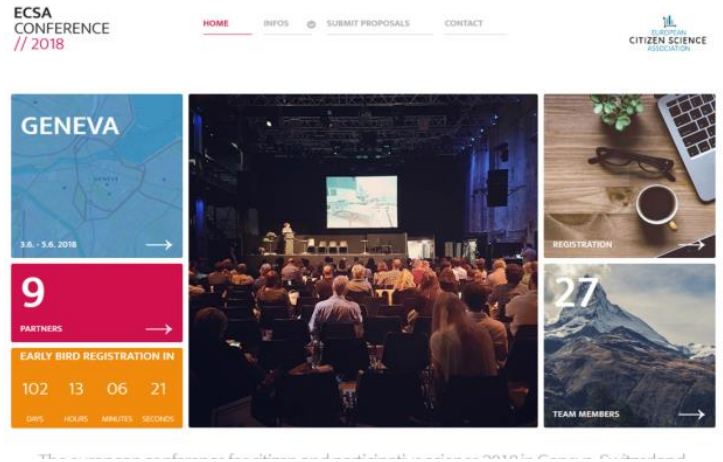

What is citizen science
10 Principles
Characteristics of citizen science

The European citizen science community

EUROPEAN CITIZEN SCIENCE ASSOCIATION

October 2013 – ECSA meeting - Bruxelles

CITIZEN SCIENCE COST ACTION



June 2013 - ECSA launch

Several other meetings

July 2012 – first meeting in London

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Mission

To connect citizens and science through fostering active participation.

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Sharing Best Practice and Building Capacity

Projects, Data, Tools, and Technology

Policy, Strategy, Governance and Partnerships

Learning and Education in Citizen Science

CS and Open Science

Global Mosquito Alert

Empowerment, Inclusiveness, Equity

BioBlitzes

Air Quality

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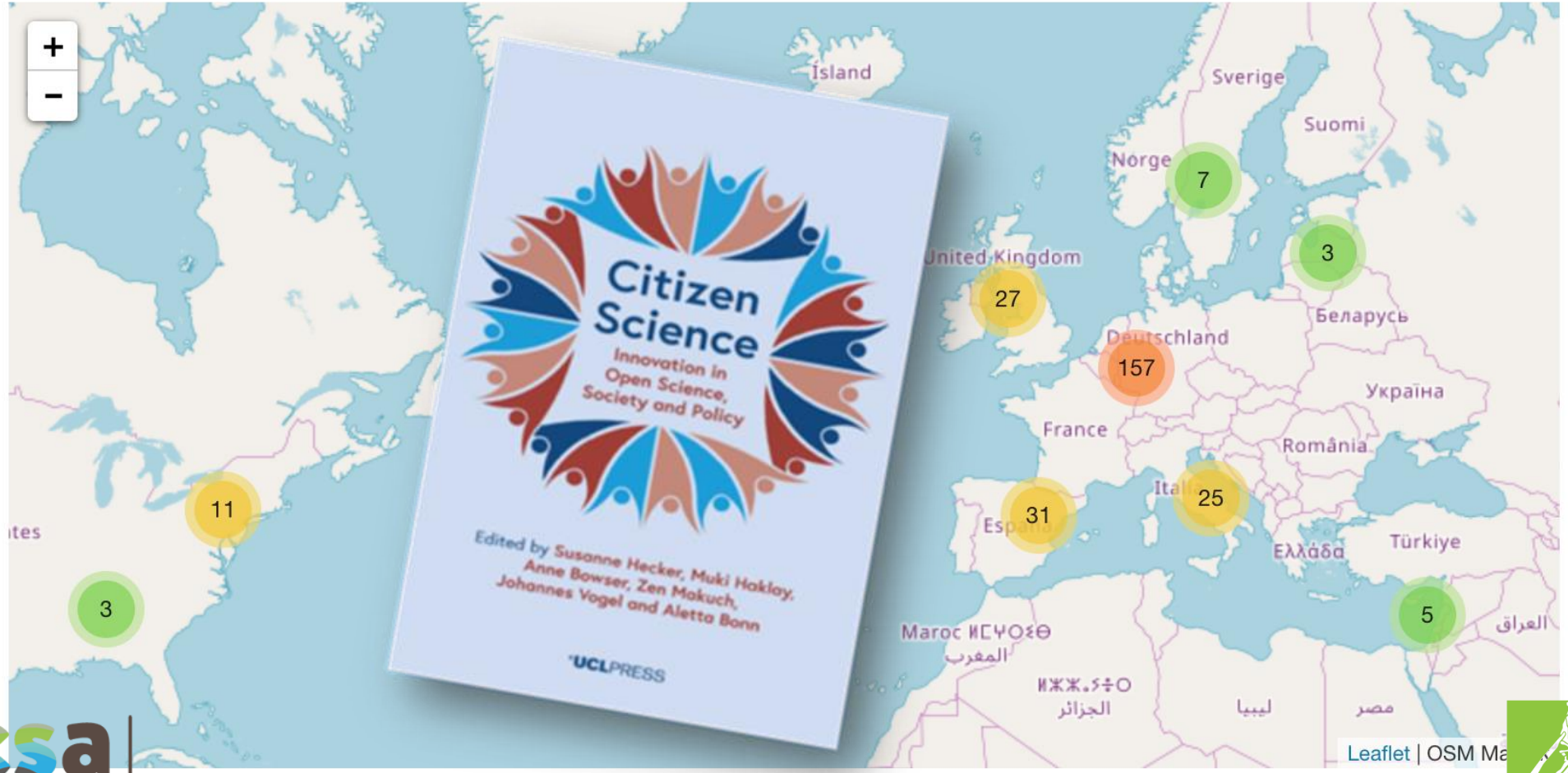

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Partnerships

Österreich forscht
www.citizen-science.at

Bürger
schaffen
Wissen
Die Citizen Science Plattform

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eu-citizen.science

Share, initiate and learn citizen science in Europe

EU-Citizen.Science has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement no. 824580.

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Citizen science works best when:

- ✓ the **project aims** are **clearly** defined and **communicated** from its outset;
- ✓ the members of the project team have the appropriate **expertise**, not just in data collection and analysis, but also **in communication and publicity**;
- ✓ evaluation is built into the project design and there is a **willingness to listen and adapt** as necessary;
- ✓ **participants** are carefully **targeted and supported**;
- ✓ **motivations** and skillsets **of all parties** (project team and participants) **are understood**, because they may vary considerably;
- ✓ **participants feel part of the team**, understand the value and relevance of their role(s) and (especially for long-term projects) gain new skills.

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Final remarks

Citizen science can be a brilliant way to undertake good science and engage people with relevant issues.

Developing and supporting meaningful, useful and successful citizen science projects is hard work, but it can also be enjoyable and very rewarding both for organizers and participants.

Questions ?

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slido
Join at
slido.com
#citizenscience

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July 13

Citizen Science

CASE STUDIES, BEST PRACTICES, MAIN HINDRANCES

Andrea Sforzi

MUSEO DI STORIA NATURALE DELLA MAREMMA

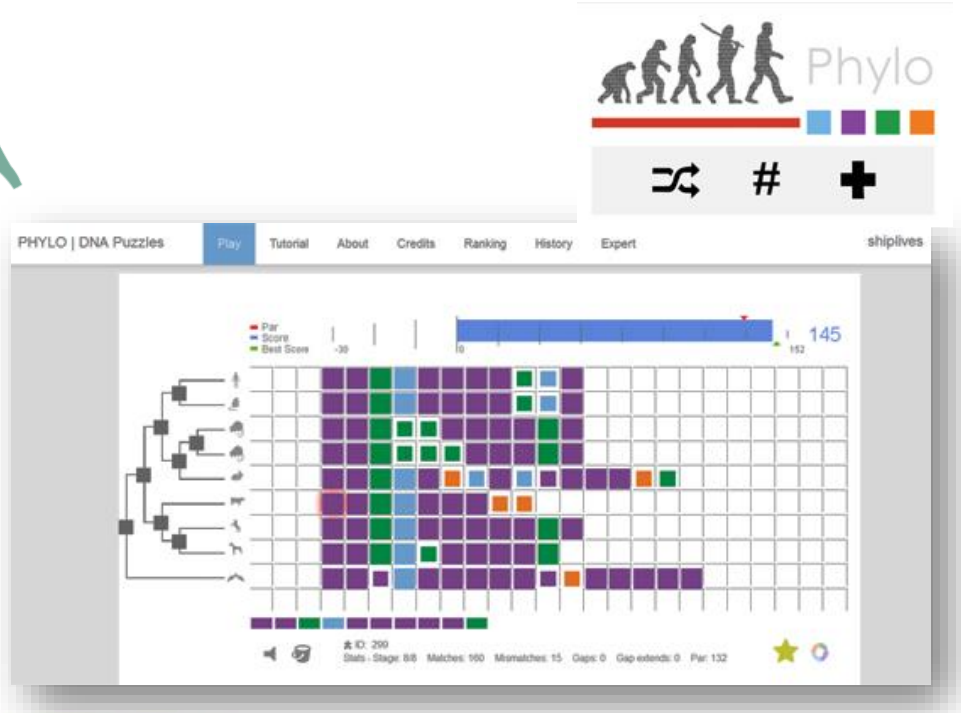
ecsa European Citizen Science Association

Different types of citizen science projects

Source: Haklay, Mazumdar & Wardlaw, 2018.

Citizen science can take many forms – from "games with a purpose," such as Phylo , to projects that have people collecting ants from their neighborhoods.

Experimental video game about multiple sequence alignment optimisation



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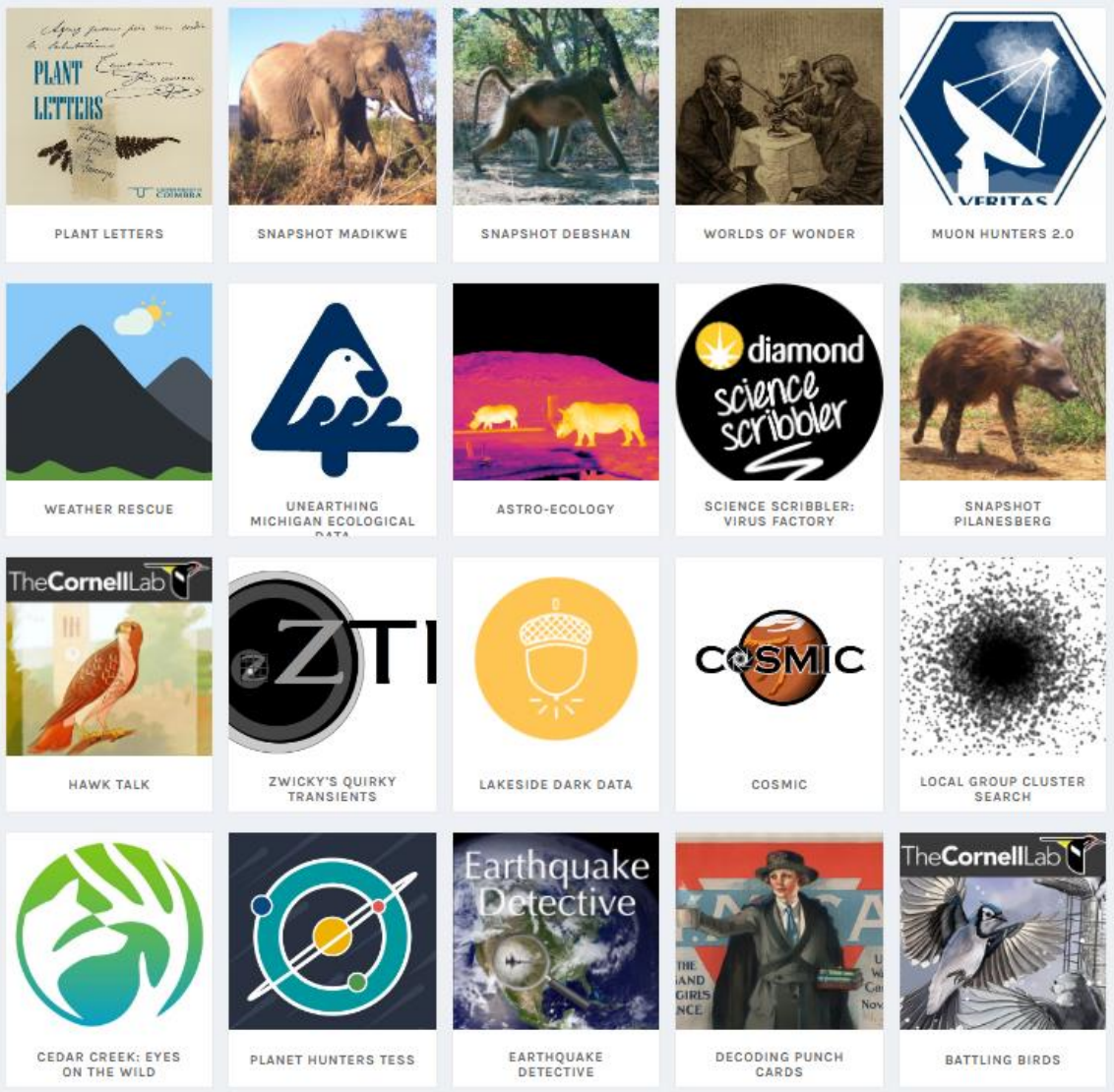
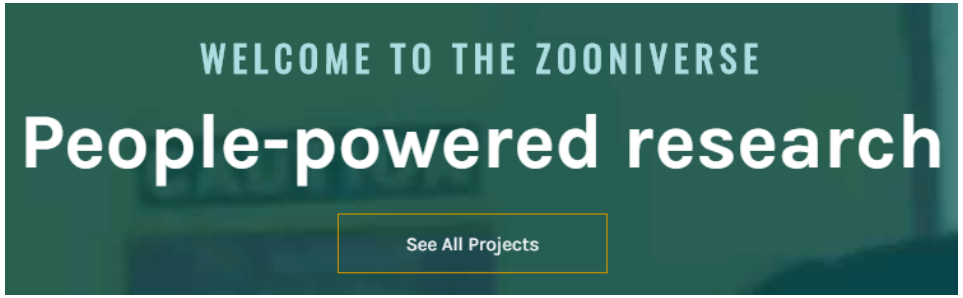
Some examples



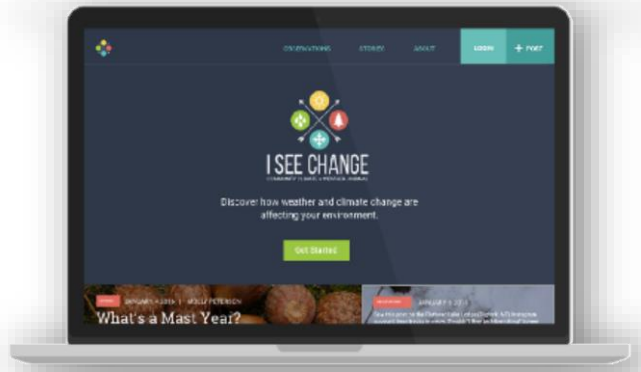


581.939.462 CLASSIFICATIONS SO FAR,
BY **2.286.529** REGISTERED VOLUNTEERS

I SEE CHANGE

Empowers communities to observe how weather and climate affect their environment.

Community Weather & Climate Journal
A national online platform for members to post about what they notice changing in the environment and the impacts.



Mobile Tracker App
A collaboration with NASA's Orbiting Carbon Observatory Mission. It allows community members to follow investigations over time and help NASA ground truth the details that earth observation satellites can't see from space.

Community Investigations
They allow local civic groups, neighborhoods, and citizen science groups to call communities into action to document specific investigations over time and sync posts with their own custom data.

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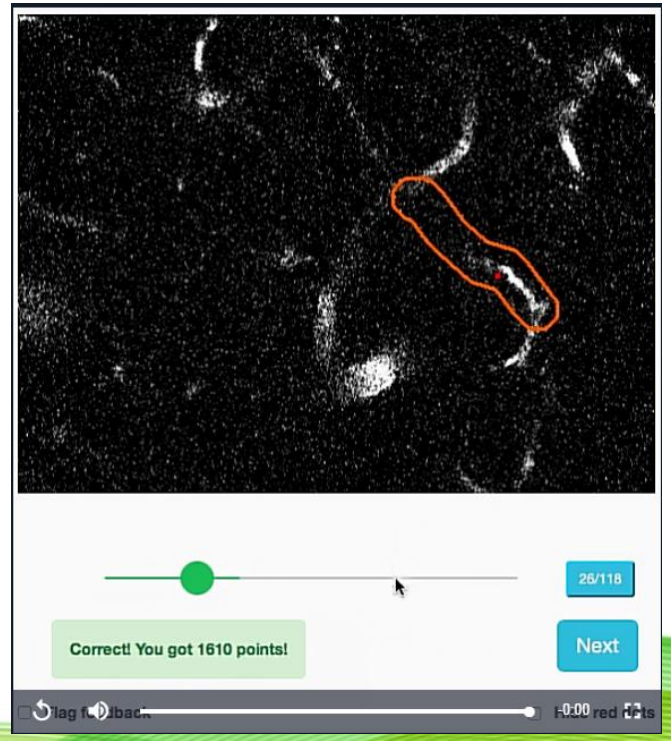
EyesOnALZ

Alzheimer's is the 7th biggest killer in the world, and there is no cure.

STALL CATCHERS

Scientists at Cornell University have discovered links between stalls - clogged blood vessels in the brain, & Alzheimer's.

Stalls can reduce overall blood flow in the brain by 30% - similar to a headrush when standing up too quickly



If we could prevent or remove stalls we could find the first ever Alzheimer's treatment.

Working together, stall catchers can do in one hour what takes researchers one week in the lab!

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The **Autumn Experiment** was born from a collaboration between researchers of the Swedish University of Agricultural Sciences at the Umeå University, Lund University and VA (Public & Science).

Overall, **over 10,000 pupils** submitted data on **more than 2,000 trees** from **378 different locations** in Sweden.

The researchers were then able to examine the differences between various tree species and regions. The scholars also compared the pupils' data with observations made 100 years ago and with satellite images.

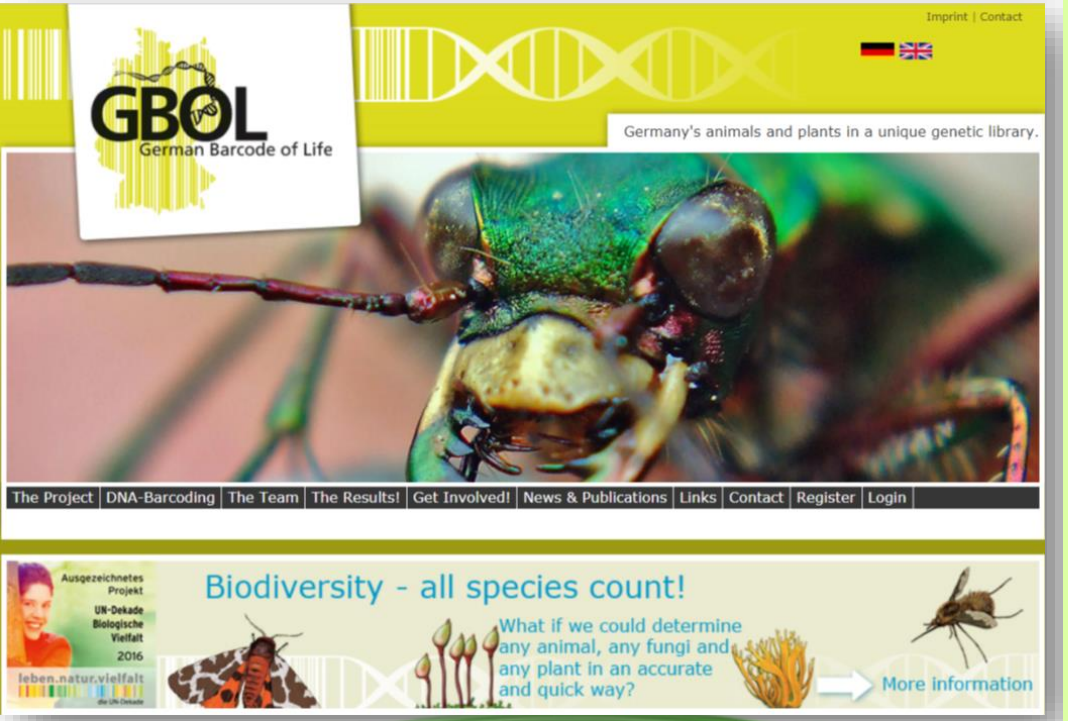
In 1989 a national Breeding Bird Survey (BBS) was launched in France and developed by the National Natural History Museum in Paris, thanks to a constant effort study led by amateur ringers.

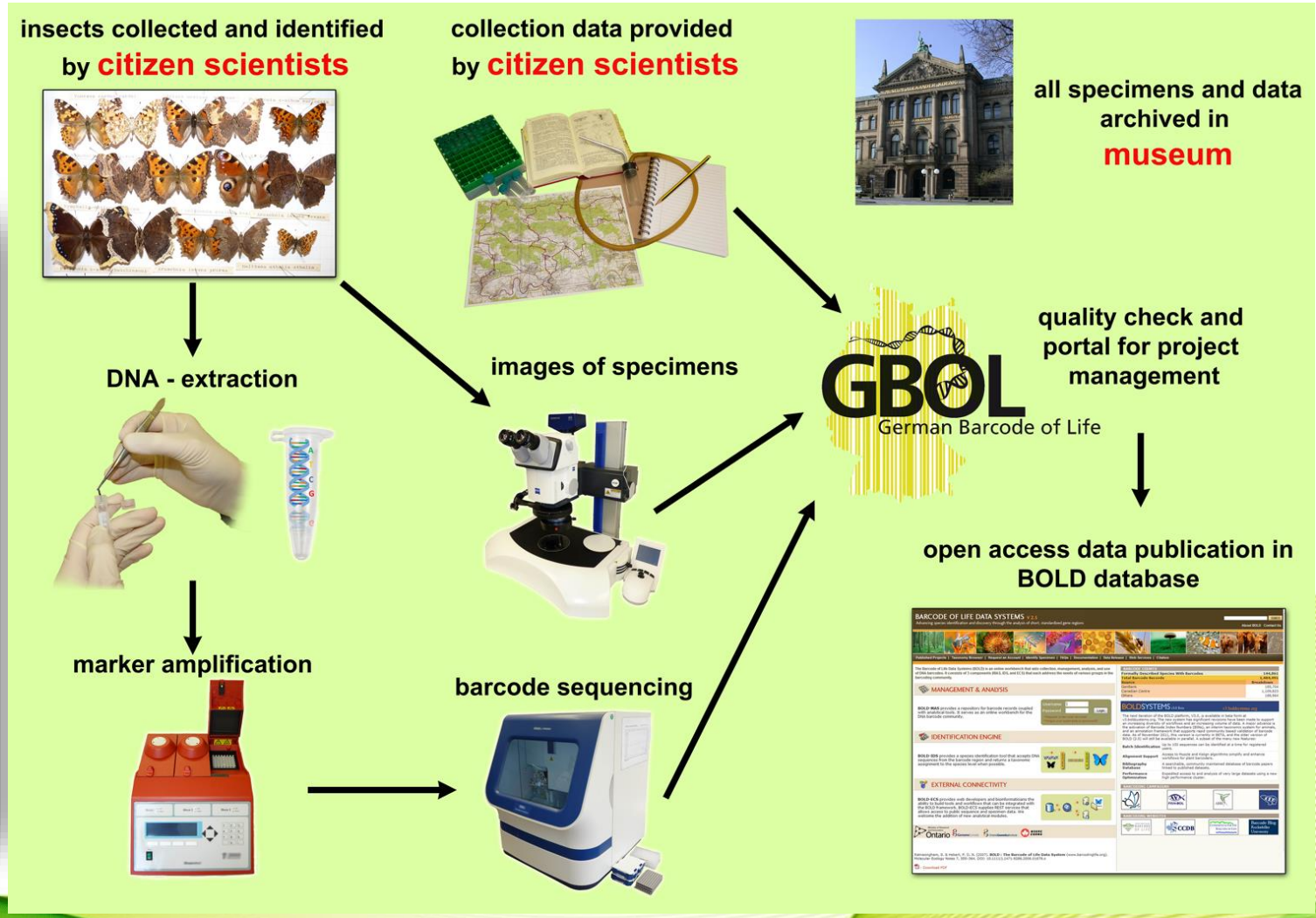
This model was then adapted to public surveys of **garden butterflies**, **snails** and **bumblebees**.

A photographic survey of **flower dwelling insects** called 'SpiPoll' and a survey of **wild plants of city streets** were also introduced.

Digital tech.-mediated cs projects

FORSCHUNGS museum KOENIG





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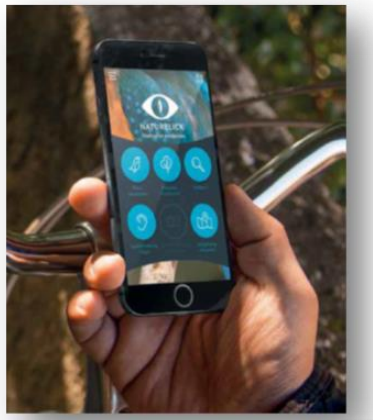
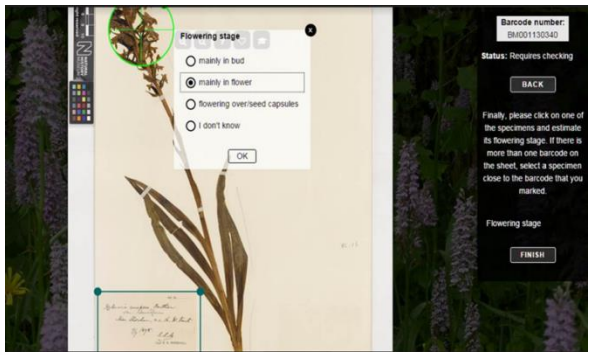
Digital tech.-mediated cs projects

museum für naturkunde berlin





Online crowdsourcing

NATURAL HISTORY MUSEUM

Miniature Fossils Magnified

At a glance

Transcribe microscope slide labels.

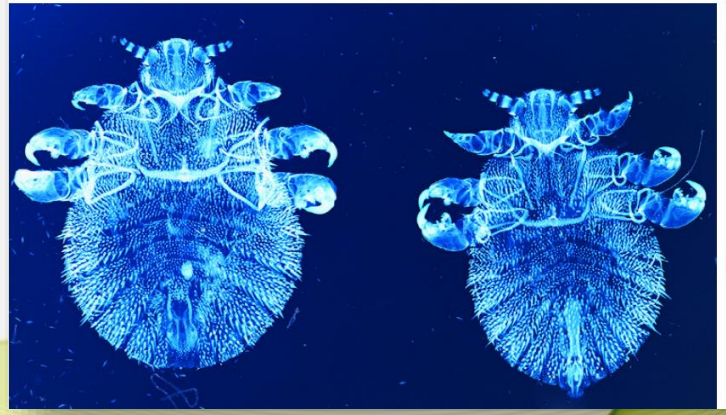
Type of activity: Online

Who can take part? Adults and students (Key Stage 4+)

When? Any time

How long will it take? Two minutes per slide

Miniature Lives Magnified



At a glance

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European Environment Agency

European Environment Agency

Topics Countries Data and maps Indicators Publications Media About us

Citizens collect plastic and data to protect Europe's marine environment

SCROLL DOWN

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UN environment assembly

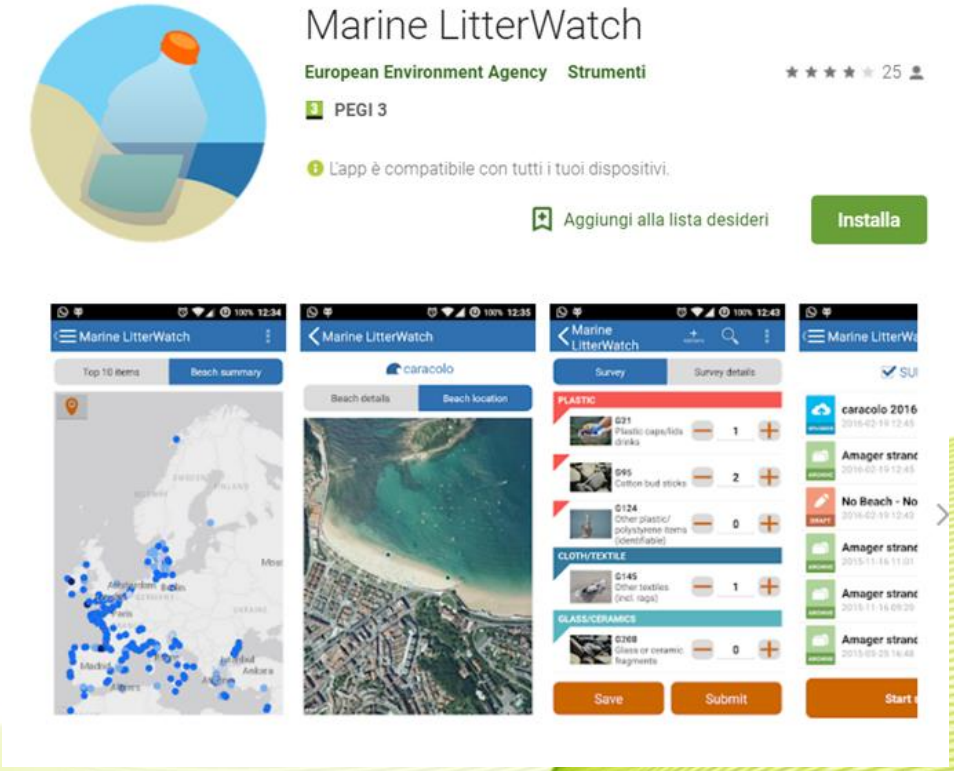
#SolveDifferent

The Assembly Documents Event Details Latest Get involved

An estimated 8 million tons of plastic waste enter the world's oceans each year.

Submitted by UNEP on Mon, 10/16/2017 - 15:18

As well as being unpleasant and unsightly, this is bad news for the economy:
clean-up costs are high and
valuable **materials** are **not recycled**.
Plastic also **damages the marine environment** and negatively affects the health of **ocean habitats**.



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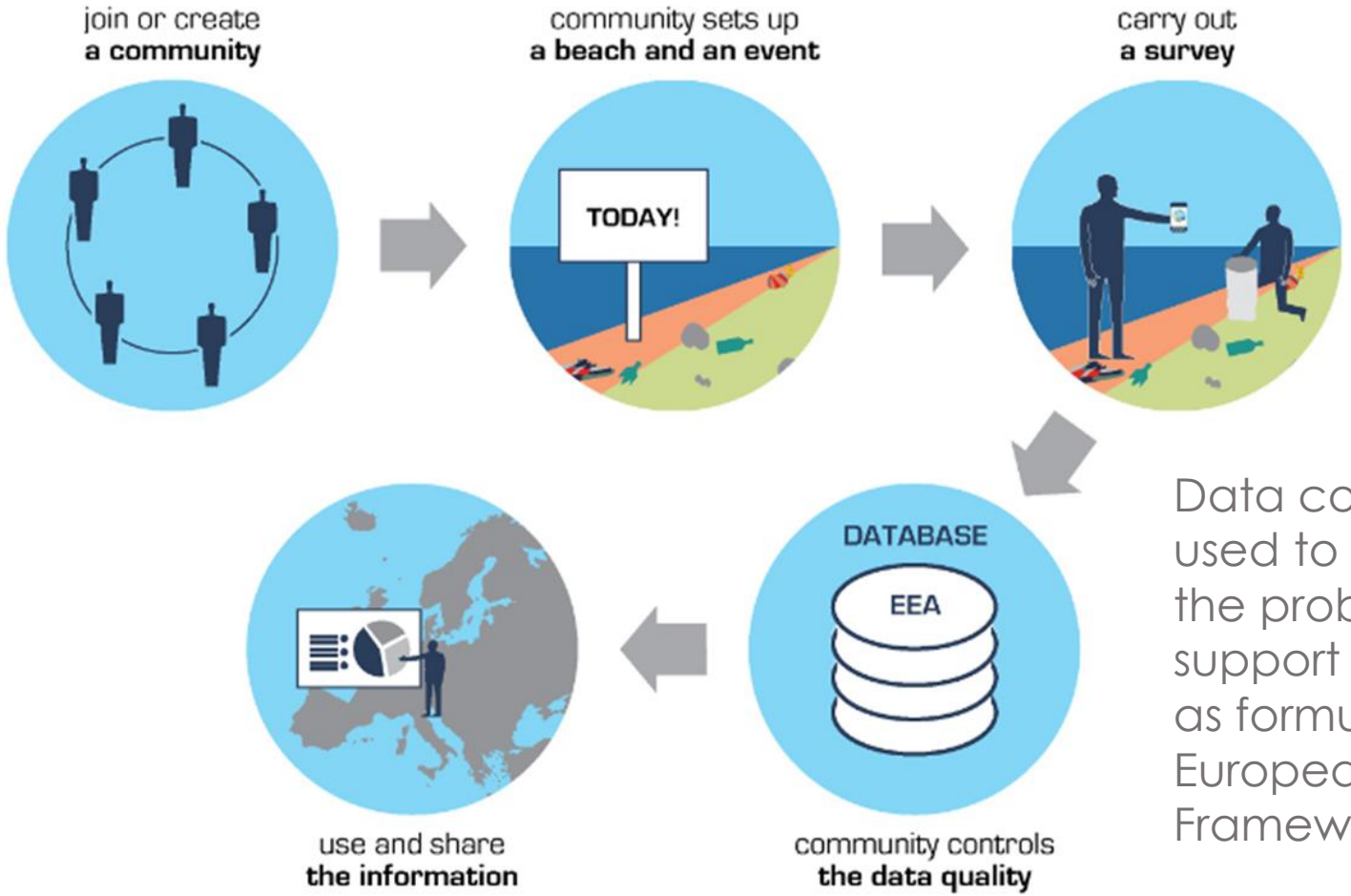
MLW, set-up in 2014 and involving non-governmental organisations and research institutions, is the only pan-European platform that members of the public can use to co-ordinate clean ups and record beach litter. It aims to complement the collection of official marine litter data by national authorities and fill data gaps.



Data collected will be used to better understand the problem, and will help support a policy response as formulated in the European Marine Strategy Framework Directive.

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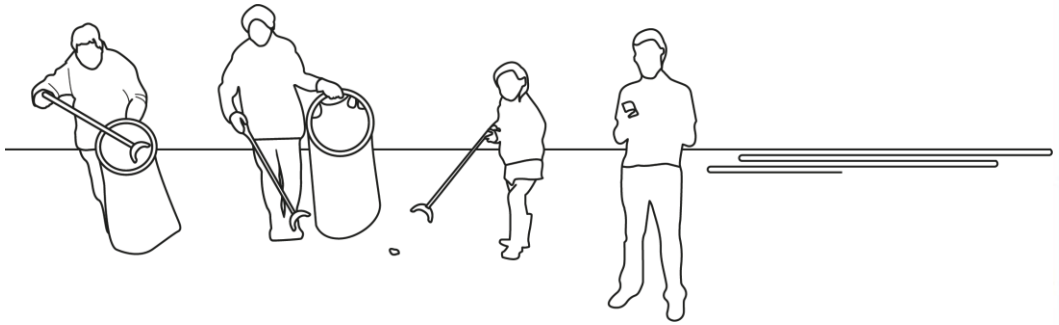
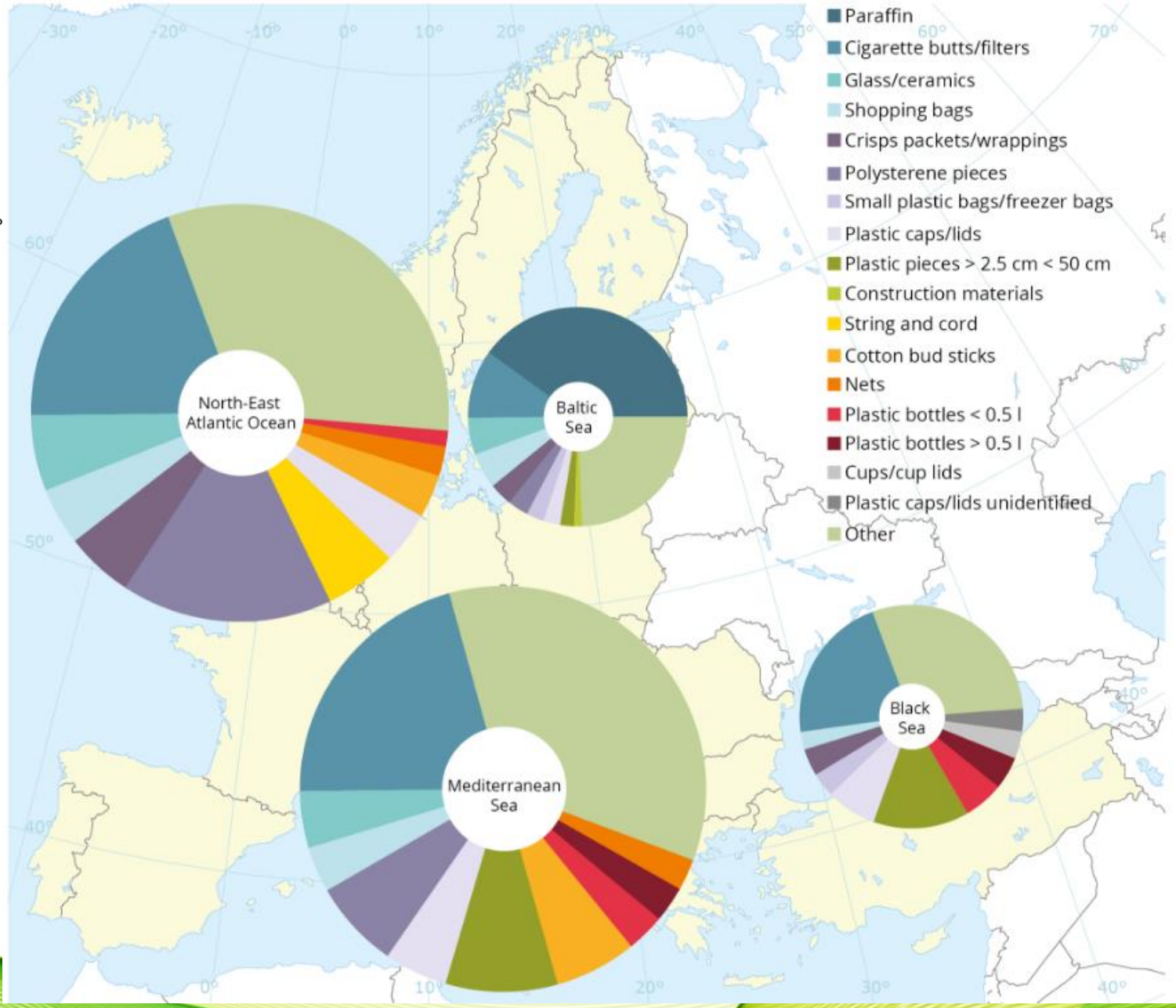


693259

Items collected

1627

beach clean-up events



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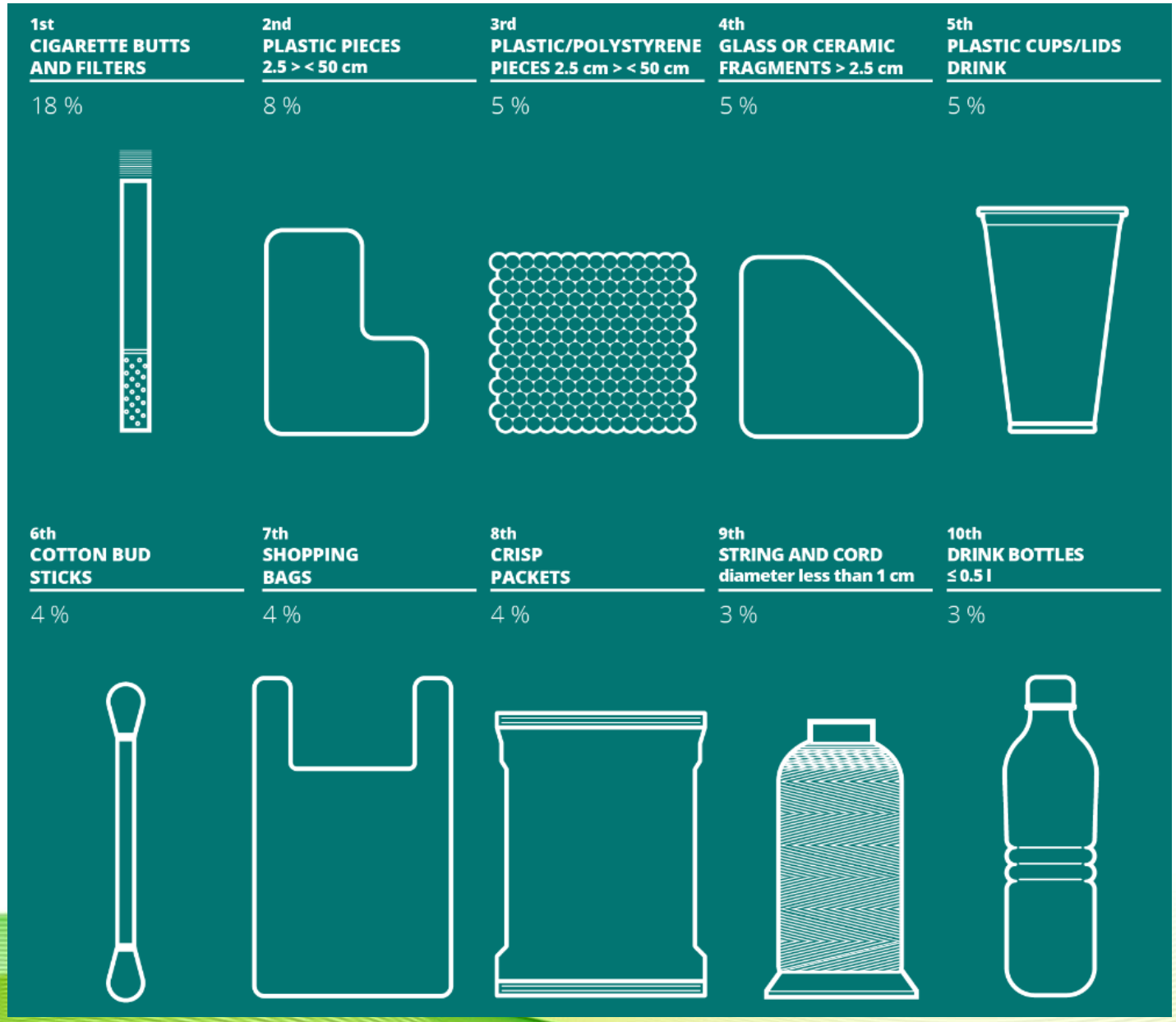
The top 10 most commonly found items on European beaches found by MLW is almost identical to that revealed by official data under the Marine Strategy Framework Directive's Technical Group on Marine Litter, the first ever Europe-wide Strategy on Plastics and other related initiatives.



This validates the approach taken by Marine Litter Watch in using citizen science to complement official environmental data. The complementary data provided by Marine Litter Watch, and the way in which it is made accessible via an online database, makes data comparability and future trend assessments reliable.

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Bioblitzes

During a BioBlitz event (from **Bio** = life and **Blitz** = something quick and intense) members of the public, professional scientists and voluntary naturalists **work together** to record as many species as possible within a delimited geographical area over a defined time period.

BIO blitz
Museo di Storia Naturale della Maremma

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Importance of Bioblitzes

BioBlitzes can make a meaningful contribution to a number of EU environmental policy areas, such as invasive alien species (IAS) and biodiversity monitoring.

The typical short time frame of this event delivers rapid datasets providing a complementary approach to long-term inventories and contributing to reporting progress towards national targets as well as informing decision-making processes.

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Il ‘field kit’ provided to participants

Pen with NSM logo

Programme

Knapsack with Bb logo

Brochure with the yearly calendar of events

Map of the Reserve and area of activities

Dedicated Block notes

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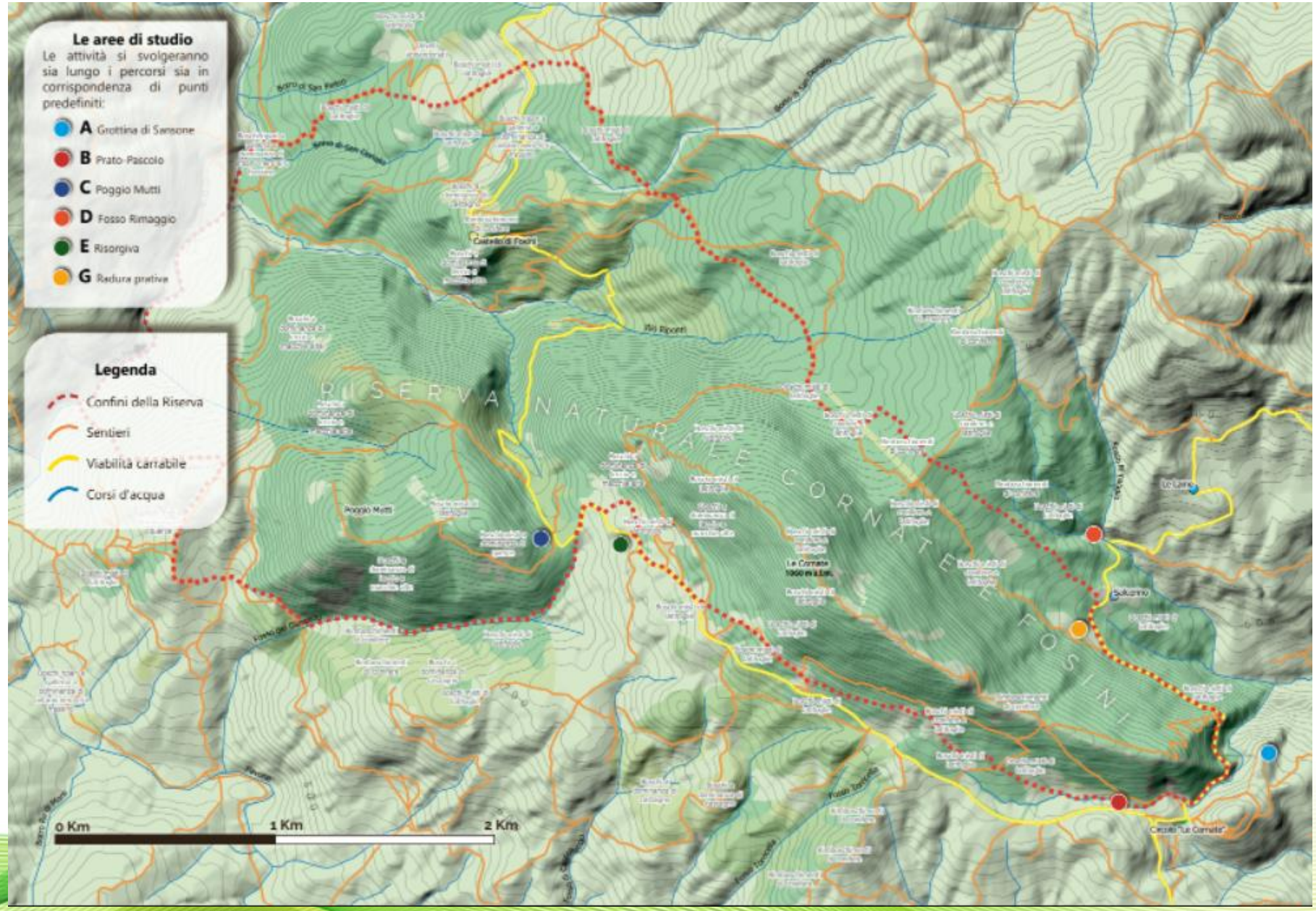

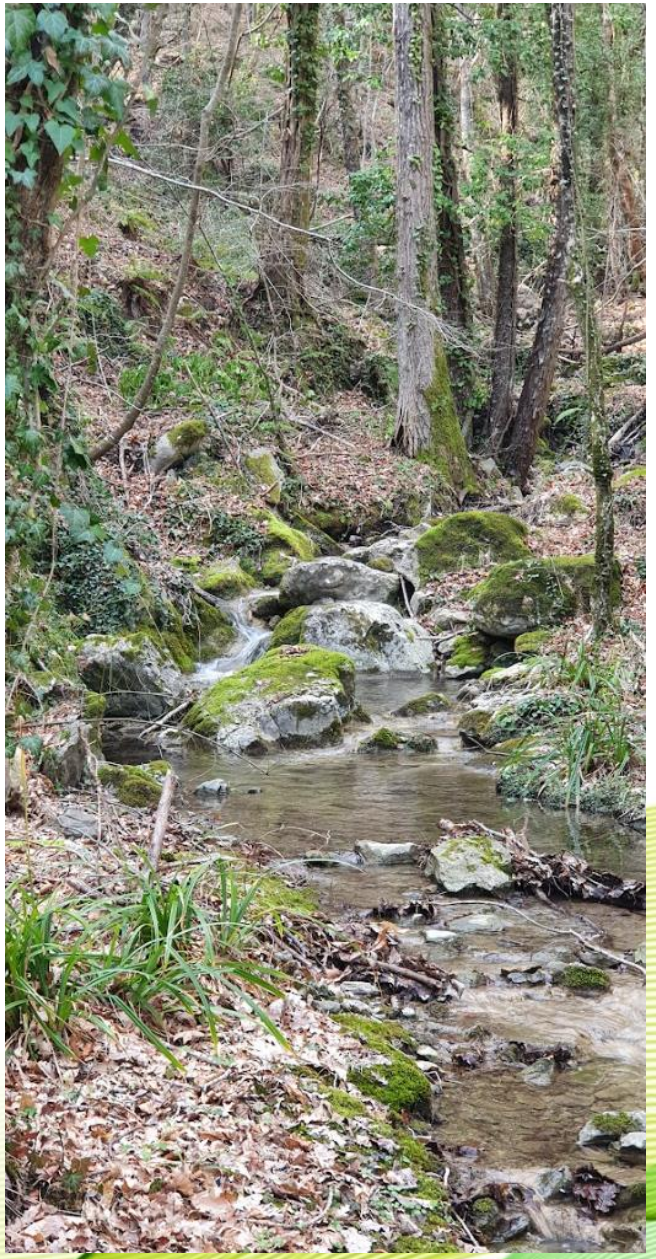

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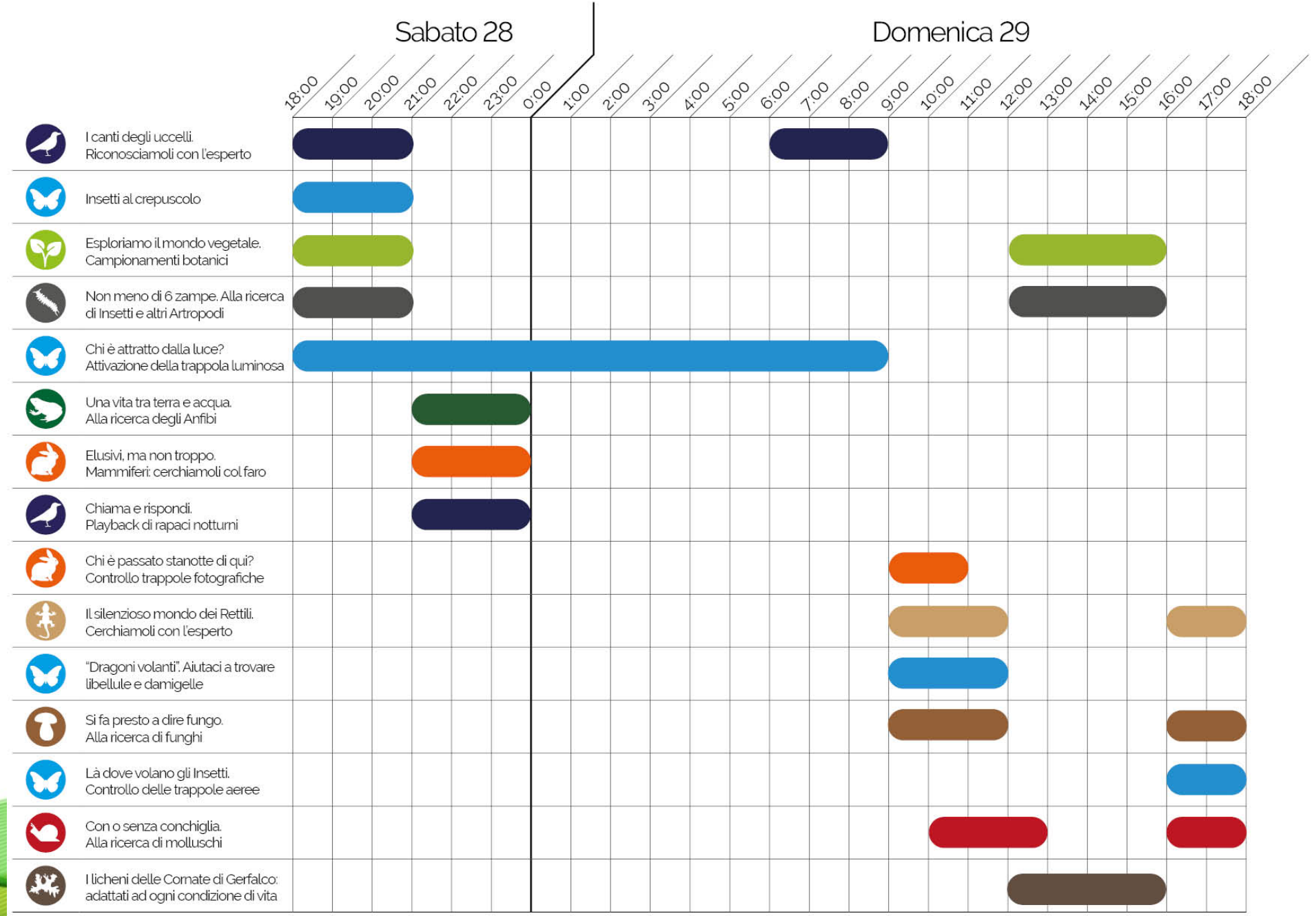

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Some examples of activities carried out at our Bioblitzes

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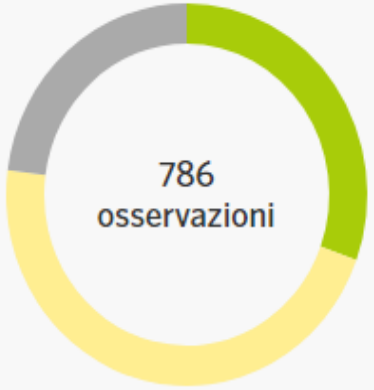
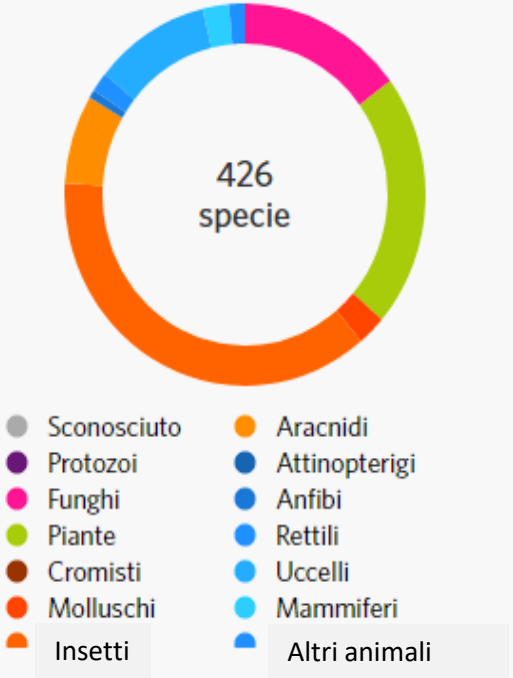
Preliminary results

Panoramica	786 OSSERVAZIONI	426 SPECIE	128 IDENTIFICATORI	28 OSSERVATORI	Statistiche

Statistiche





Most common species spotted

Cimice Verde

Palomena prasina

Cimice Delle Piante

Graphosoma italicum

Bombice Marezzata

Arctia villica

Capinera

Sylvia atricapilla

Coccinella Comune

Coccinella septempunctata

Cetoniella

Oxythyrea funesta

Centaurea triumfettii

Attelabus nitens

Pettirosso

Erithacus rubecula

Trichodes alvearius

SUSTAINABLE DEVELOPMENT GOALS

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«Citizen Science is an emerging opportunity to engage communities in monitoring the progress of the SDGs.

Through the use of simple and cost-effective technologies, citizen-generated data is filling critical gaps in environmental monitoring, improving decision-making on natural resources, and the knowledge base on the impacts of climate change.

Citizen Science continues to advance and there is a growing need to explore the unique opportunities and challenges of this approach in developing countries.».

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MUSEO DI STORIA NATURALE DELLA MAREMMA

Springer Link

Original Article | Open Access | Published: 02 July 2020

Mapping citizen science contributions to the UN sustainable development goals

Dilek Fraisl, Jillian Campbell, Linda See, Uta Wehn, Jessica Wardlaw, Margaret Gold, Inian Moorthy, Rosa Arias, Jaume Piera, Jessica L. Oliver, Joan Masó, Marianne Penker & Steffen Fritz

Sustainability Science (2020) | Cite this article

«… *results show that citizen science "is already contributing" to the monitoring of 5 indicators and that it could potentially contribute to* ***76*** *indicators…* »

«… *the main citizen science contributions concern SDG* ***15*** *Life on land, SDG* ***11*** *Sustainable cities and communities, SDG* ***3*** *Good health and well-being and SDG* ***6*** *Clean water and sanitation…* »

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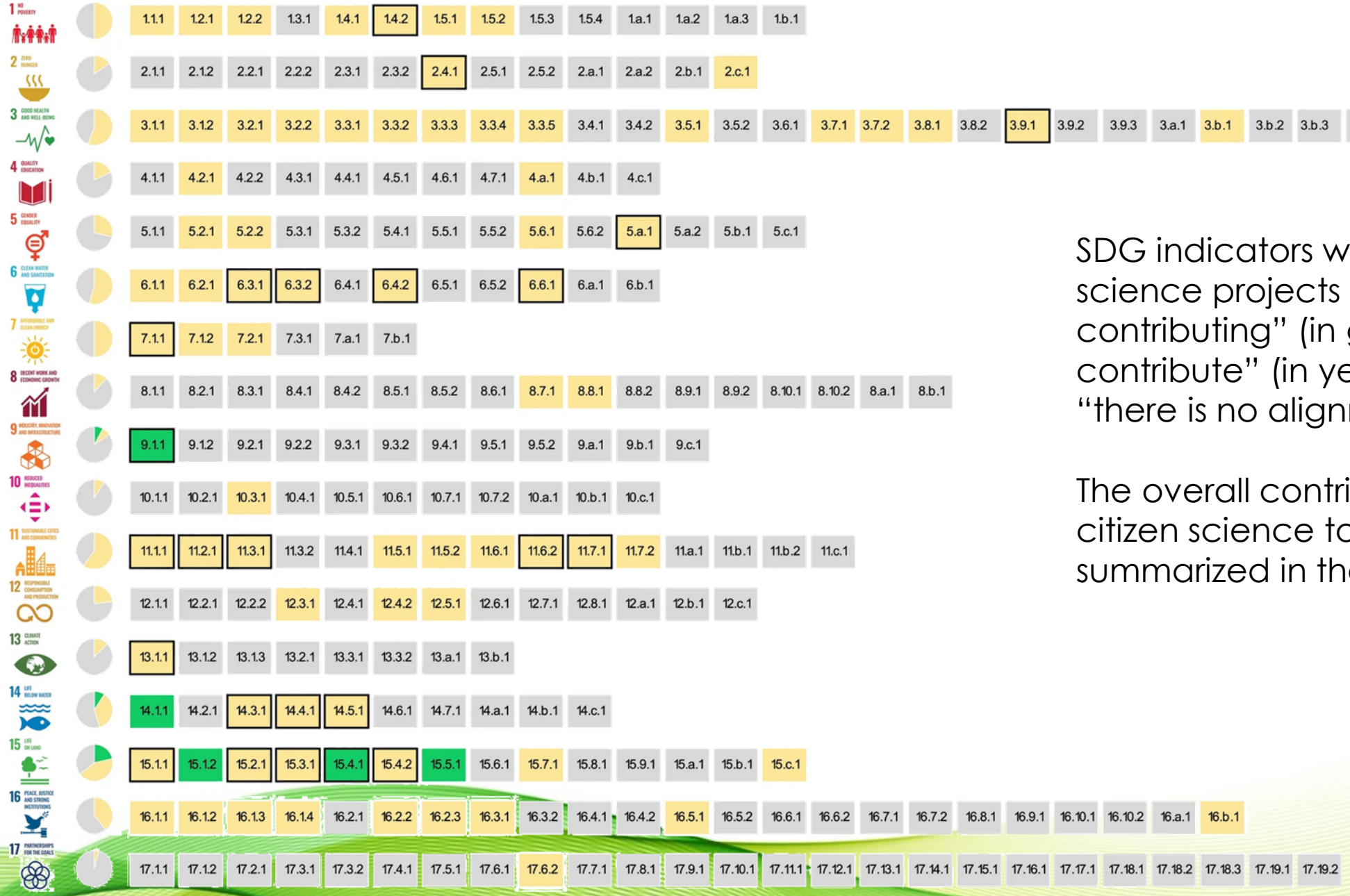

SDG indicators where citizen science projects "are already contributing" (in green), "could contribute" (in yellow) or where "there is no alignment" (in gray).

The overall contributions of citizen science to each SDG are summarized in the pie charts.

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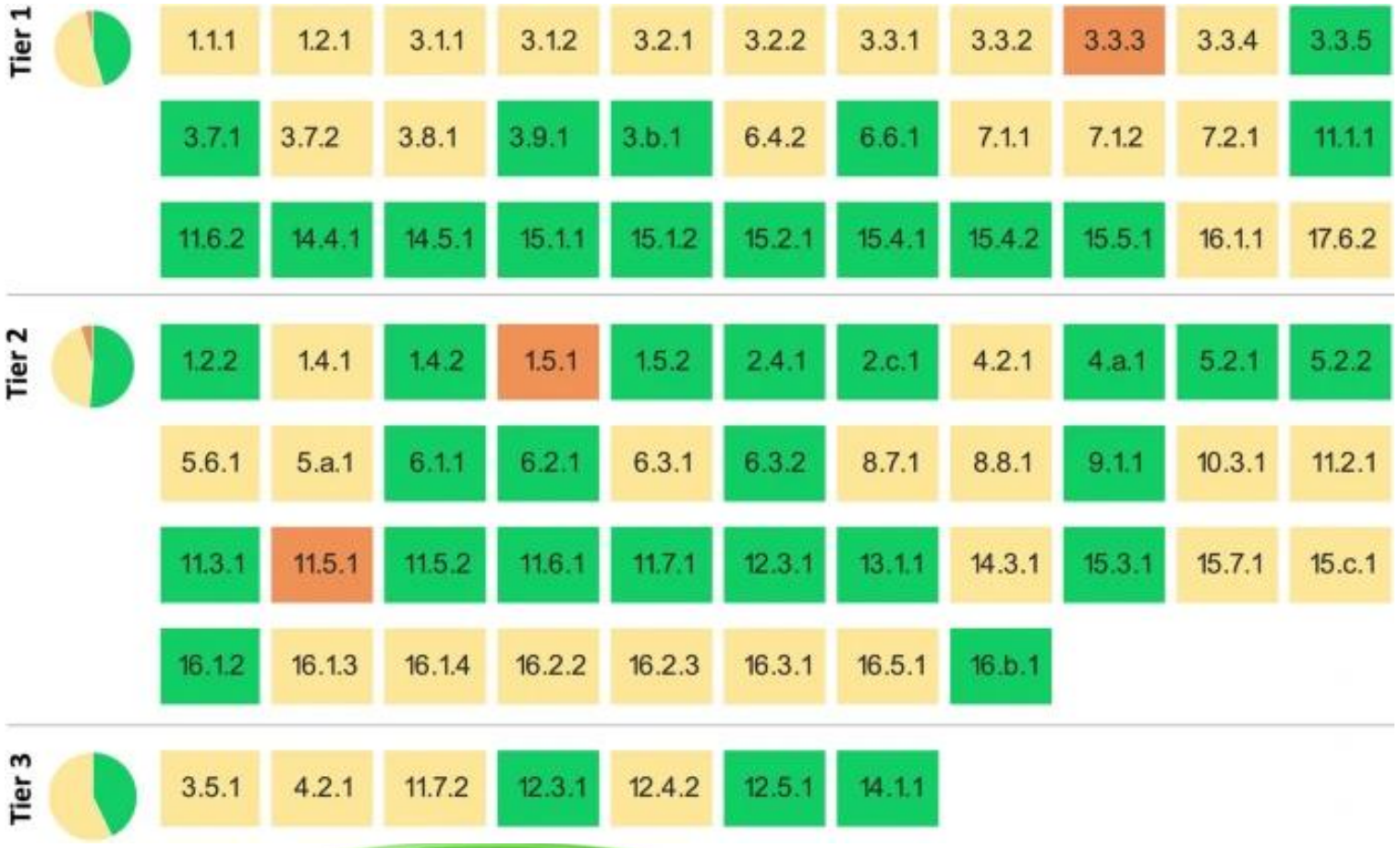

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Green: direct contributions;
Yellow: additional contributions;
Orange: indicators with both

The values inside each box are the numbers of the SDG markers.

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Thank you for your attention!

Questions ?

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