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STATUS OF BUTTERFLIES IN THE WORLD

2022 REPORT
OF THE GLOBAL
BUTTERFLY CENSUS,
"*CITIZEN SCIENCE*" PROJECT
BY FRIEND OF THE EARTH

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WHAT ARE BUTTERFLIES?

There are an estimated 10 million species of insects on the planet, but only about a million of them are known, including approximately 178,000 species of butterflies and moths. According to the most recent study updated to 2020 by the IUCN, butterflies include around 18,000 species and moths around 160,000! [1]

Butterflies, like moths, are insects that belong to the varied order of *Lepidoptera*. They are a group that evolved as such 50 million years ago, but their ancestors date back to the Cretaceous period, 150 million years ago, with the appearance of flowering plants. [2]

In that evolutionary period, these flying insects established a relationship of reciprocal dependence (symbiosis) with certain species of plants that continues to this day: the plants offer sugary nectar as food, while butterflies and moths help in fertilizing plants of the same species by transporting pollen from one flower to another.

Since this process is called pollination, this is the reason why they, together with bees, are included among the most important pollinating insects. It is no coincidence that 90% of wild plants and 75% of agricultural crops also benefit from and depend on these insects, whose pollination service is worth 153 billion dollars per year. [3]

Scientific literature gives a rather clear description of butterflies and moths: the former are grouped in the suborder *Rhopalocera*, i.e. diurnal, colorful, with clavate antennae and resting wings folded together and close to each other.

Moths, on the contrary, are classified as *Heterocera*: this means that they are generally nocturnal and they can either have bright or camouflaging colors. In fact, red, yellow, orange, or contrasts such as black/white or red/blue are defined as aposematic colors because they warn possible predators, such as birds or reptiles, of their toxicity. They also have feathered or filiform antennae, and their wings are arranged as a canopy, that is, with the forewings covering the hindwings. [4]

1. IUCN Butterfly Specialist Group: www.iucn.org/commissions/ssc-groups/invertebrates/butterfly-and-moth

2. Lista Rossa delle farfalle italiane: http://www.iucn.it/pdf/Comitato_IUCN_Lista_Rossa_delle_farfalle_italiane_2016.pdf

3. ISPRA ambiente: www.isprambiente.gov.it/files2021/pubblicazioni/rapporti/rapporto-ispra-350_21.pdf

4. Animali volanti: www.animalivolanti.it/insetti/farfalle-e-falene/

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Saturnia pyri, Italy by Laura Zanella

Some of them, especially the large, stocky-bodied saturniids, can be active mostly during the day and live about two weeks, just like the largest European moth, the *Saturnia pyri*, which has a maximum wingspan of 17cm! [5] Others, such as the *Zygaenidae* family, are an exception to these characteristics as they are completely diurnal, small in size and may sport brighter or aposematic colors to deter predators.

Butterflies, like moths, however, are not all the same! The species are defined as such because each one is different from the other, and for this reason they are divided into families and subfamilies according to particular physical and genetic features. An example we can give is that of Italian diurnal butterflies, which are divided into six main families:

- ***Nymphalidae*** (generally medium or large with colorful or brown rounded wings).
- ***Papilionidae*** (with a few exceptions, they are recognizable by their yellow-black color and swallow-like terminal tails).
- ***Pieridae*** (completely white butterflies with black polka dots or yellowish-green colorations).
- ***Lycaenidae*** (no larger than 3.5 cm, generally light blue if male and brownish if female, with several black polka dots and orange eyespots).
- ***Hesperiidae*** (small, brownish, oblong-winged, with large head and eyes).
- and with only one member in the ***Riodinidae*** family (the *Hamearis lucina* with white checkered patterns, but in tropical areas other species have metallic patterns!) [6]

Butterflies and moths, as many already know, undergo a metamorphosis that includes the stages of egg, larva, chrysalis, and adult. [7] The first stage involves the oviposition by the female, in periods of vegetation abundance such as spring, on the leaves of the nurse plant (like the *Aristolochia* plant for the Italian Festoon butterfly).

The second stage sees the hatching of the egg and the growth of the larva through many changes of skin, called molts, as during this time it feeds continuously.

In winter, or when temperatures get colder, they go into diapause, a sort of hibernation during which the larva grows and transforms inside a cocoon. However, caterpillars, before creating one, go in search of good hiding places: butterfly larvae generally prefer the lower page of leaves or solid twigs, while moth larvae go underground (like the elephant Howk-moth) or create small tunnels in specific trunks (like the leopard moths in olive trees).

At that point the third stage begins, and they can start secreting silky threads to form the cocoon or chrysalis, which, depending on the species, has different colors and shapes: some chrysalises, such as that of the nymphalid *Dynastor darius*, have the appearance of a snake, so as not to be eaten by birds! [8] Others, like that of the *Mechanitis polymnia*, are golden, with the same purpose of keeping predators away. [9]

5. Georgofili INFO:
www.georgofili.info/contenuti/la-quintessenza-della-pi-grande-falena-europea/2560

6. Guida alle farfalle d'Europa e del Nord Africa:
www.ibs.it/guida-delle-farfalle-d-europa-libro-tom-tolman-richard-lewington/e/9788866940029?utm_source=tradetracker&utm_medium=affiliazione&utm_campaign=384768

7. Vita in campagna:
www.vitaincampagna.it/giardino/bruco-farfalla-un-sorprendente-ciclo-della-vita/

8. Rivista Natura:
www.rivistanatura.com/la-farfalla-e-il-serpente/

9. Il blog di Jacopo Ranieri:
www.jacoporanieri.com/blog/?p=28548

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LET'S TALK NUMBERS!

Is there a country with the most butterfly species? Well, yes! More than 70% of the existing animal and plant species reside in mainly tropical countries with a high level of biodiversity. [10] Colombia, with 3,642 species of butterflies and 2,085 subspecies, is home to 20% of the total number of butterflies on the planet. [11]

Italy, on the other hand, counts 289 species of butterflies, of which 288 are indigenous and one is native to South Africa. Eighteen of these species are threatened with extinction, equal to 6.3% of the species evaluated and published by experts in the 2016 IUCN Red List.
Most Italian *Rhopalocera* populations, however, are stable, although the decline of once-common species such as white pierids and lycaenids has been ongoing since the 2000s. [12]

THREATS

These same threats equally affect other species worldwide, with the addition of deforestation, the indiscriminate use of pesticides and herbicides, the introduction of alien species, the sale of exotic species on the black market and illegal trafficking. [13]

These threats cause imbalance in a habitat, so that even certain nurse plants, which some species of butterflies feed on at the larva stage, have a high risk of disappearing. A clear example is that of *Zerynthia polyxena* (located in northern Italy, including the Liguria region) and its sister species *Zerynthia cassandra* (central and southern Italy).

This is an exceptional papilionid which has disappeared in some parts of Italy and is present in other areas in concentrated populations, whose caterpillar depends exclusively on the plant of the genus *Aristolochia*, whose habitat is exposed to constant land reclamation. [14]

10. Foreste Per Sempre:
www.forestepersempre.org/web/foreste/biodiversita.htm

11. Natural History Museum:
www.nhm.ac.uk/discover/news/2021/june/colombia-has-the-most-butterflies-in-the-world.html

12. Lista Rossa delle farfalle italiane:
www.iucn.it/pdf/Comitato_IUCN_Lista_Rossa_delle_farfalle_italiane_2016.pdf

13. LIPU Molise:
www.lipumolise.altervista.org/index_file/Farfalle_come_indicatori_ambientali.htm

14. Aree umide della Toscana settentrionale:
www.zoneumidetoscane.it/it/polissena

Zerynthia cassandra, Italy da Clarissa Puccioni

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Danaus plexippus, USA by Kathy Pope

They are very sensitive to changes in temperature on a global scale, so that species that live in mild habitats but experience an increase in temperature are forced to move further north or higher in altitude to seek the same thermal conditions.

Two striking examples reported by experts are the displacement of 49 species of moths and 18 species of butterflies that were usually found on the slopes of the Himalayas, which are suffering the melting of their perennial snow. [15] The same applies to the arrival, even by species from southern countries, in countries closer to the Arctic pole due to the increase in average annual temperature, as the South African lycaenid *Cacyreus marshalli* has managed to do.[16]

These important shifts and sudden changes in temperature put butterflies under biological stress as they are ectothermic insects, and therefore their reproductive cycle and normal vital functions are strongly influenced by temperature.

However, butterflies are also greatly affected by soil changes, which is why they are considered excellent environmental bio-indicators: 17 European butterflies and 8 moths depend on good agricultural soil management and prefer grassy mowing habitats or fields where traditional or organic farming methods have been used. [17]

The intensive use of herbicides and pesticides is a major concern, especially for migratory butterflies that are unable to complete their journey. The American monarch *Danaus plexippus* has decreased by 90% compared to the years 2018 and 2019 as, against 30 thousand specimens, only 2000 were counted in flight in 2020! [18]

The distribution of the herbicide glyphosate on agricultural crops has killed much of the *Asclepias* which, along with *Euphorbia*, are the plants from which the monarchs derive all their nourishment. The monarch, since it undertakes a long migration from Mexico to Canada and only one complete metamorphosis (egg, larva, chrysalis, adult) has difficulty in reaching its destination.

During the journey, in fact, the adult lays eggs as it progresses towards Canada, but the larvae that emerge need to feed on the *Asclepias* or milkweed. If, however, this plant is missing (killed by glyphosate), the larvae die of hunger, which prevents reproduction and therefore a complete new metamorphosis that would allow the migration to progress. [19]

The latter are also extremely affected by deforestation efforts to make room for an increasing number of intensively farmed fields and ranches. Not only the monarch, but all the species that depend on rainforest ecosystems both in South America (such as the *Morpho helenor peleides*, better known as blue morpho), and in Indonesia are at risk of disappearing permanently. Droughts and fires caused by intensive logging or slash-and-burn deplete the soil of nutrients and eliminate plants on

15. MetaMorfeo: www.metamorfeo.com/cambiamenti-climatici-farfalle-conquistano-himalaya/

16. MUSE: www2.muse.it/pubblicazioni/18/86/21%20Balletto.pdf

17. Corte dei Conti Europea: www.eca.europa.eu/Lists/ECADocuments/SR20_13/SR_Biodiversity_on_farmland_IT.pdf

18. Nature Serve Explorer: https://explorer.natureserve.org/Taxon/ELEMENT_GLOBAL.2.860028/Danaus_plexippus_pop_1

19. University of Melbourne: https://www.frontiersin.org/articles/10.3389/fevo.2020.00162/full

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Morpho helenor, Colombia by Gladys Daiana

Tyta luctuosa, Italy by Carlo Poggio

which, in many cases, butterflies and moths depend even at the adult stage to feed themselves (symbiosis): an example is the sphinx moth *Xanthopan morganii* with its long proboscis, found in Madagascar by Darwin during his famous trip, which feeds exclusively on the nectar of the orchid *Angraecum sesquipedale*. In recent years, deforestation in the Red Island has caused the disappearance of between 80% and 90% of the vegetation [20], and for this reason, many orchids of the genus *Angraecum* are listed in vulnerable or critical status by the IUCN. The subsequent disappearance of Darwin's moth should therefore come as no surprise. [21]

The threat list does not stop here - on the contrary, one of them has attracted a lot of attention in the last years: the introduction of allochthonous species of plants and animals, that is species present in a habitat different from their own, which compete with the autochthonous species, or native of the area.

In Japan, precisely on Ogasawara Island, have evolved the so-called "Ogasawara blue butterflies" - small lycaenids with deep blue wings - which seem to be possibly extinct because of the presence of lizards and other predators not native to the country. Despite efforts to create a breeding and reintroduction project, Japanese lycaenids are failing to survive and as of 2018, researchers have not spotted any of them in the wild. [22]

The 53% of the world's butterflies and moths have reached appallingly low numbers so far [23], and this will weigh on the preservation of ecological balance in various ecosystems worldwide, including wetlands and mangroves, which are among the most sensitive and threatened on the planet. However, this also has an impact on agriculture, as many butterflies, especially lycaenids, are responsible for pollinating grasses; while just as many nocturnal moths, such as *Tyta luctuosa*, pollinate many more grassland plants, such as white clover, in the dark.

Nature has an immense regenerative capacity that, however, has its own times. Times that we have not been able to respect, and so we now must fight against a clock that keeps ticking faster and faster: that of extinction.

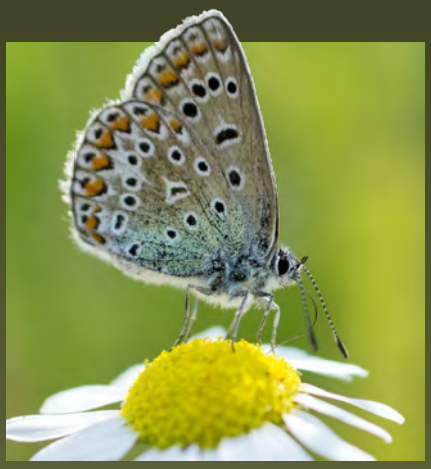
20. Lemur Conservation Network: www.lemurconservationnetwork.org/how-much-of-madagascars-forest-have-we-lost/

21. Lista Rossa IUCN: www.iucnredlist.org/search?taxonomies=110563&searchType=species

22. The Japan Times: https://www-japantimes-co-jp.translate.goog/news/2020/08/28/national/blue-japanese-butterfly-extinct/?_x_tr_sl=en&_x_tr_tl=it&_x_tr_hl=it&_x_tr_pto=nui,sc

23. IAS Study Center: https://vajiramias.com/current-affairs/insect-population-decline/5c7228b01d5def712e4e05dd/

THE SOLUTIONS



Genetic mapping, transects and Citizen Science projects are some of the most effective conservation efforts to safeguard these magnificent and essential insects, but they are not enough if we neglect to take care of the ecosystems and habitats in which they live. A great number of animals and plants depend on each other and are closely linked to the habitats in which they live.

This balance has lasted for millions of years, and the slightest change can prove catastrophic. Therefore, collaboration between governments, experts and agencies is essential to identify the issue and find the solution. In England, from 2002 to 2006, the MACMAN project managed to save the lycaenid *Maculinea arion*, almost disappeared because of the high grass that prevented it from becoming larvae thanks to the care of ants. [24]

In California, a biologist managed to mass reproduce, in collaboration with the California Academy of Sciences, the papilionid *Battus philenor*, which was disappearing in parallel with its nurse plant. [25] Fortunately, we are keeping pace in the protection of lepidopterans in Europe as well with the Butterfly Conservation Europe, which monitors populations through scientifically certified methods such as transects and bio-blitzes. [26]

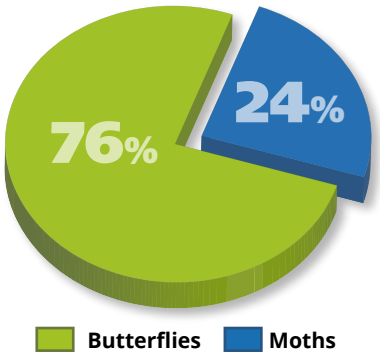
24. MacMan Project:
www.ufz.de/macman/

25. Alta Online:
www.altaonline.com/dispatches/a3777/butterfly-boom/

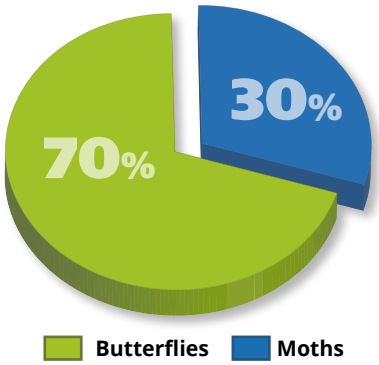
26. BCE:
www.vlinderstichting.nl/butterfly-conservation-europe/?fbclid=IwAR1tsrKvC1UxZAJpMoJeNo6nZrfbzTyTzYMu2FXpo4e2qIE3P6ytgqU1YpI

OUR PROJECTT

Percentage of butterflies and moths from Italy



Percentage of butterflies and moths from around the world

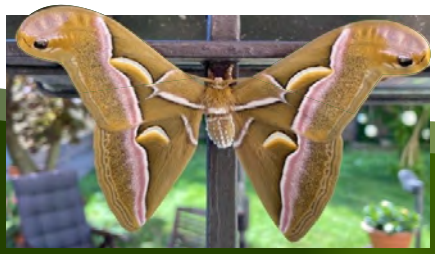


27. Associazione Polyxena FB: www.facebook.com/apspolyxena

28. National Wildlife Federation: www.nwf.org/Educational-Resources/Wildlife-Guide/Threats-to-Wildlife/Invasive-Species

Our World Sustainability Organization is also committed to protecting critical butterfly habitats through the Friend of the Earth certification, whose serious standards are aligned with current agricultural policies, ensuring compatibility between habitats of endangered species and agriculture. The first collaboration, started with the Polyxena Association, allowed WSO to give a concrete help in the conservation of diurnal butterflies with the construction of a butterfly house in Monopoli, Puglia. Thanks to this action, all citizens can admire and support research on rare species in our country such as *Zerynthia polyxena*, *Melanargia arge* and *Hipparchia sbordonii*, included in the IUCN Red List. [27] Recently, WSO's Friend of the Earth also launched the Global Butterfly Census Program in January 2021, to promote their conservation through citizen engagement. Photos sent to WhatsApp number +39 351 2522520 are identified and, along with scientific names, displayed on the website's interactive map. Cataloguing and entering the data into Excel files will help update statistics on their status and implement conservation measures.
So far, more than 1,230 photos have been submitted and validated, with about 475 different species of butterflies and moths from 27 countries!

The results from a first general and simple statistical study revealed that the countries with the greatest homogeneity among butterfly and moth families are Italy, Colombia, Brazil, and France, but the countries with the greatest diversity so far are Italy and Colombia.
Unfortunately, there have been reports of species of butterflies and moths that have been accidentally or voluntarily introduced in countries where they have never developed before, posing a threat to agriculture, of which they can be invasive pests, as well as to local biodiversity, with which they compete for food and territory. [28]
An example is that of the saturnid species *Samia cynthia*, endemic to Southeast Asia and found in northern Italy, which infests urban gardens and roadsides with ailanthus trees, or the Australian saturnid *Opodiphthera eucalypti*, introduced in Europe with its host plant eucalyptus, also non-European. *Pieris brassicae*, which is a Palearctic species (Europe and Asia), was also photographed in Chile, a country that it monopolized in the early 90s with catastrophic consequences for the local crops, of which its larva is a parasite. *Cydalima perspectalis*, an Asian moth introduced from Russia to Europe photographed in Italy, was also highly invasive against shrubs such as boxwood. *Paysandisia archon* is also a moth of Asian origin, accidentally introduced to Europe by ship through the palm trade, plant on which its larvae feed. Curiously, the *Aemene sp*. moth, endemic to East Asia, was found in Colombia, where we assume it was introduced unwittingly.



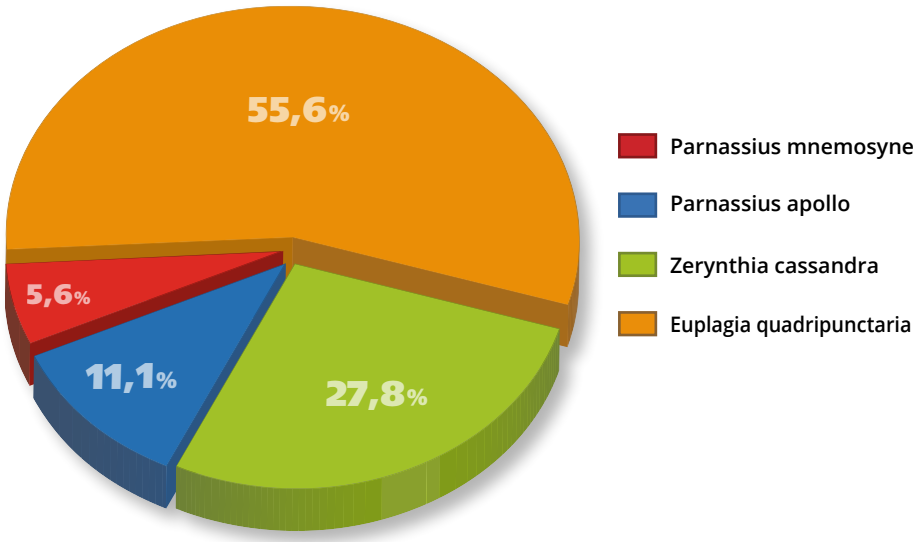
Samia cynthia, Italy by Paola

Pieris brassicae, Chile by Cristian Andres Contreras

Troides helena, Malaysia by Olga Kysliuk

Troides brookiana, Malaysia by Olga Kysliuk

In addition, 13 species of butterflies and 5 species of moths are recognized as being in serious decline by the scientific community, among which a total of 4 species are included in the Council Directive 92/43/EEC!
Among these, the *Zerynthia cassandra* mentioned above, but also the *Euplagia quadripunctaria* moth, whose metamorphosis depends on humid habitats such as holm oaks forests or woods rich in Mediterranean biodiversity defined as "noble" and of community importance. We have also received photos of *Parnassius mnemosyne*, a species of papilionid endangered by grazing and forestry activities that put its grass habitat in crisis. Finally, the beautiful *Parnassius apollo* which, with its large black polka dots and red ocelli, is threatened both by collectors and climate change, which have considerably reduced its numbers on European mountain ranges. [29]



Finally, the papilionids *Troides helena* and *Troides brookiana* were reported to us from Malaysia, heavily trafficked across the border at the request of collectors. Both species are included in Appendix II of CITES, which prohibits their trade, and are therefore strictly protected in the countries where they are present.

The project is young but full of potential, and for this reason we will continue on the road of awareness, which is an important tool to reach the most remote corners of the souls and of the world and to give wonderful shape to projects like ours. In fact, as the Brazilian poet Màrio Quintana wrote: "*Don't waste your time chasing butterflies. Mend your garden, and the butterflies will come*."

29. ISPRA: www.mite.gov.it/sites/default/files/archivio/allegati/rete_natura_2000/Manuale_specie_animali_2016_prima_parte.pdf

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