

## WUYISHAN NATIONAL PARK: A THREATENED BIODIVERSITY HOTSPOT BY GLOBAL WARMING

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### 1. Abstract

Wuyishan National Park is one of the first five national parks in China's mainland. It is the only National Park in China recognized as both a World Biosphere Reserve and a World Cultural and Natural Heritage Site by the United Nations Educational, Scientific, and Cultural Organization. The unique geographical environment contributes to the best-preserved primary forest ecosystem in the subtropics. The Wuyi Mountains within the Park are justifiably valued in southeastern China for studies of plants, birds, insects, amphibians, and reptiles. Since 2010, 18 new species (never before discovered) have been discovered and 5 new record species to China have been found in the Park. However, biodiversity in the Wuyi Mountains is not only being affected, but possibly threatened by climate change. Climate warming is not only changing ecosystem hydrothermal dynamics but is also affecting the growth, distribution, and reproduction of organisms, altering ecosystem species composition and biodiversity. Therefore, it is of great theoretical and practical significance to monitor and study the long-term biodiversity changes in Wuyishan National Park to aid in biodiversity conservation and protect the ecosystems under future climate change.

### 2. Keywords

Wuyishan National Park; Biodiversity; Mountains; Climate change; Warming; Conservation

Wuyishan National Park (27°31'20" ~ 27°55'49" N, 117°24'13" ~ 117°59'19" E, Figure 1) is one of the first five national parks in China's mainland. Located in southeastern China, in northwest Fujian and extending northwards into Jiangxi, it was established by the State Council of the People's Republic on September 30, 2021 (Central People's Government of the P.R.C. 2021). It is

the only National Park in China recognized as both a World Biosphere Reserve and a World Cultural and Natural Heritage Site by the United Nations Educational, Scientific, and Cultural Organization (UNESCO 1999). Wuyishan National Park spans an area of 1280 km<sup>2</sup>, with an average elevation of 1200 m ranging between 300 and 2158 m above sea level. The elevational gradient and unique geographical environment contribute to the best-preserved primary forest ecosystem in the subtropics and a gene bank of rare and endemic plants (He et al. 2018).



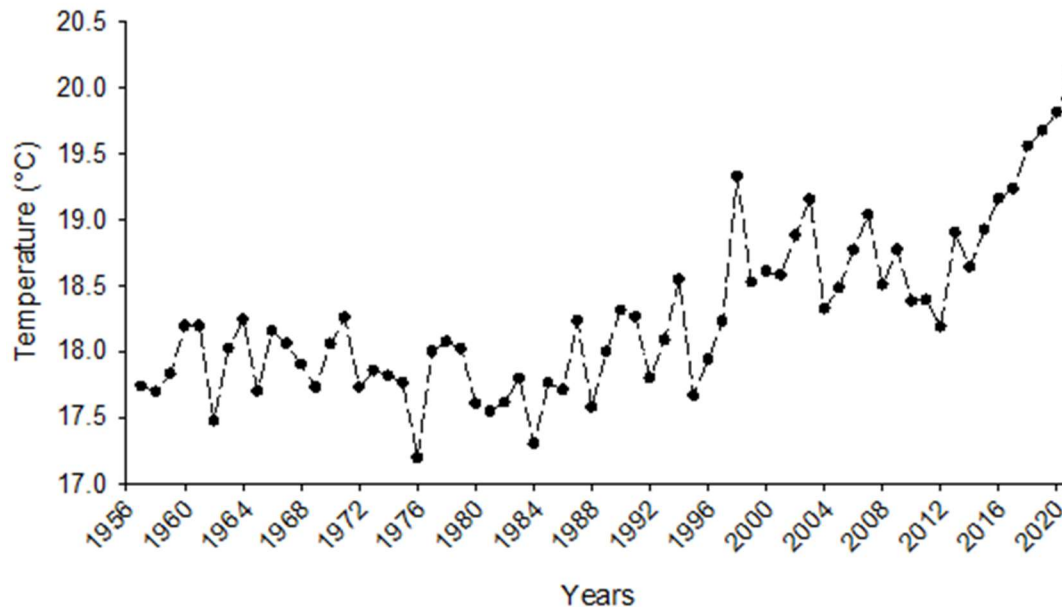
**Figure 1:** A vista of Wuyishan National Park showing local flora and elevational range.

Wuyishan National Park is known as a biodiversity hotspot of global significance. Field surveys conducted over decades have recorded 2799 species (including subspecies and varieties) of higher plants in 269 families, 239 species (191 genera) of algae in 73 families, 503 species (83 genera) of fungi in 38 families and 558 species (332 genera) of wild vertebrates in 5 classes, 35 orders, 125 families. There are 6849 species of insects in 599 families and 31 orders, 139 species of higher aquatic plants in 51 genera and 42 families, 67 species of zooplankton, and 104 species of fish in 56 genera and 22 families (Wuyishan National Park 2017). The Wuyi Mountains within the Park are justifiably valued in southeastern China for studies of plants, birds, insects, amphibians, and reptiles. Since 2010, 18 new species (never before discovered) have been discovered in Wuyishan National Park, including *Odorrana huanggangensis* (Chen et al. 2010), *Thymaris ruficollaris*, *Thymaris sulcatus* (Sheng & Sun 2011), *Eudonia abrupta* (Li 2012), *Gamasholaspis aliventroanalis*, *Lattinela robustocalcaris* (Ma & Lin 2011), *Gastrodia fujianensis* (Liang et al. 2019), *Sinoennea pupoidea* (Zhou et al. 2011), *Parasteatoda wangi* (Jin & Zhang 2013), *Rhizomyia leptodicrata*, *Rhizomyia meniscata* (Jiao & Bu 2013), *Megophrys ombrophila* (Messenger et al. 2019), *Pseudostellaria wuyishanensis* (Luo et al. 2021), *Impatiens wuyiensis* (Wang et al. 2020), *Neottia wuyishanensis* (Chen et al. 2021), *Rana wuyiensis* (Wu et al. 2021), *Typhrasa polycystis* (Wang et al. 2021), *Drupeus guadunensis* (Hájek 2021). In addition, 5 new record species to China have been found in the Park, including *Vellonifer doncasteri* (Fang et al.

2010), *Rubus parvifolius* (An et al. 2019), *Hypsibius pedrottii Bertolani* (Fan & Sun 2014), *Palaina pusilla*, *Carychium noduliferum* (Zhou et al. 2011).

The Wuyi Mountains, located in subtropical areas, are especially suitable for many specialist species, due to the elevation gradient as well as the rugged terrain that facilitates the survival of endemic species (Myres 1990; Menendez-Guerrero et al. 2020). In addition, biodiversity in Wuyishan National Park has been well protected from local human effects. However, local weather records show that global human effects may be more important with a large increase in annual temperature since 1957 (Figure 2). For example, warming at the Park has increased homogenization of vegetation activity (~35 %) along the elevation gradient during 1998-2018, leading to altered vegetation structure and land cover that constitute bird habitats (Li et al. 2021; Bellard et al. 2012). Birds are sensitive to environmental changes and the bird community structure has changed in an uneven manner sequentially at Wuyishan (Xu et al. 2021). Climate warming is changing ecosystem hydrothermal dynamics as well as affecting the growth, distribution, and reproduction of organisms, altering ecosystem species composition and biodiversity (Maina et al. 2022; Riddell et al. 2021; Li et al. 2021).

Biodiversity in the Wuyi Mountains is not only being affected, but possibly threatened by climate change (Xu et al. 2021). Among the numerous wild animals with historical distribution records in Wuyishan National Park, some species have not been recorded in the wild for many years (Xu 2022). More attentions should be paid not only to the discovery of new species but undoubtedly also to the loss of known species. Biodiversity loss will inevitably affect ecosystem structure, stability, function and resilience by pushing many species toward extinction (Chase et al. 2020). Different from previous assumptions (Riddell et al. 2021; Burrows et al. 2011; Loarie et al. 2009; Warren et al. 2018; Trisos et al. 2020), the vulnerability of all taxa at a site exposure to climate change may be not equal (Riddell et al. 2021). Estimates from climate projections are unlikely to accurately reflect the local conditions without accounting for the effects of microhabitat buffering on climate change. Therefore, it is of great theoretical and practical significance to monitor and study the long-term biodiversity changes in Wuyishan National Park to aide in biodiversity conservation and protect the ecosystems under future climate change.



**Figure 2:** Mean annual temperature from 1957 to 2021. Data obtained from <https://rp5.ru/>.

### Declarations

**Conflict of interests:** The authors declare no conflict of interests.

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### Availability of data and materials

Mean annual temperature data are available at <https://rp5.ru/>.

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