

EVERYTHING YOU NEED TO KNOW



LAMPENFLORA

DEFINITION, DEVELOPMENT
& PREVENTION

DEFINITION

WHAT IS LAMPENFLORA?

“Lampenflora” designates the totality of all autotrophic plants (some bacteria as well as algae, mosses and ferns) occurring in proximity to permanently installed light sources in caves and mining galleries. The term “Lampenflora” was coined by Klaus Dobrant (University of Tübingen, 1963) who wrote the first scientific work on this topic. Already in 1922, the Austrians Kyrle and Morton described the phenomenon of plant growth in show caves. Being heterotrophic organisms and living on nutrients such as wood, leaves, food etc., fungi are not classified as lampenflora. The flora occurring near the entrance of a cave is generated through sunlight and has nothing to do with lampenflora.

WHAT CAUSES LAMPENFLORA?

Autotrophy (auto = self, troph = nutrition) is the capability of organisms to produce their compounds (and organic reserves) exclusively from inorganic substances, generally using heat or light as a source of energy. In show caves this energy is generated by artificial light, which allows lampenflora to grow. But also the CO₂ content of the cave air as well as minerals in the cave soil or nitrogen in the cavern water (e.g. by fertilizers used on fields and meadows above the cave) may lead to a corresponding increase, especially for green and blue algae.



REQUIREMENT FOR LAMPENFLORA

Sufficient light and moisture as well as germs, seeds or spores are a precondition for the formation and development of lampenflora. They are transferred by water, air, animals and primarily by visitors to the cave. Initially, blue-green algae and diatoms grow with blue-black, green or brown coatings. Here, primarily cyanobacteria (Aley 2004) play a decisive role. In the advanced stages, mosses and ferns develop, similar to those found near the entrance area.





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PHOTOSYNTHESIS

AS SOURCE OF LAMPENFLORA



Flowering plants, ferns, mosses and algae essentially need light to grow. During photosynthesis they absorb light energy, transform carbon dioxide from the air and minerals from the soil into organic compounds such as sugar/glucose and starch. Thus, organic compounds store light energy and always contain carbon dioxide. Green plants can only survive inside a cave for as long as they have sufficient light. They encroach into the cave to a depth that correlates with their specific minimum light requirements. However, spores are also carried far into the show cave by visitors walking along the footpaths.

RECOMMENDATIONS

Lampenflora and thus visible algae, cyanobacteria (blue-green algae), mosses and ferns are always caused by artificial lighting in show caves.

Already studies from the 1980s pursued two objectives on the level of light management of a show cave:

- Reduction of light intensity and illumination duration
- Removal of lampenflora by mechanic or chemical means

The removal of lampenflora by chemical means implies certain consequences for the cave biotope and is not recommended due to unknown effects. In practice, however, chemical means are still often used, especially in show caves with high visitor numbers, long opening hours and corresponding long illumination times.



RÉSUMÉ



To a small extent, there will always be lampenflora, especially algae, in show caves because they grow under artificial light in an otherwise absolutely dark environment. It is to be hoped, however, that the points mentioned above will be taken into account in future management plans, particularly with regard to illuminance and lighting duration. The authors' long-term experience shows that thus not only the expansion of lampenflora can be decisively reduced, but also the lifetime of the illumination system can be increased.

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MEASURES

FOR AVOIDING LAMPENFLORA

- Reduction of light intensity (e.g. by means of continuously adjustable LED illumination)
- Reduction of total illumination duration. Light should only be switched on where visitors may be
- Sensitive areas should not be illuminated at all, or only locally (local switching)
- Differentiation between cave light (to increase attractiveness) and path lighting (safety lighting) in order to avoid excessive lighting in show caves
- Dividing the caves into illumination zones corresponding to the guided tours
- Central control unit for light control and monitoring
- Distance between lighting fixture and lighting object should be large enough (2m)
- Selection of appropriate optics with LEDs
- Expert light design to avoid lampenflora
- Means for collecting and draining cleaning water
- Regarding grate construction: dirt particle collection and subsequent contamination through visitors can be prevented by installing protective covers (tarpaulins) beneath the pathways and regularly cleaning them
- Training of cave guides regarding the illumination system to make sure that available switch options are actually used
- Environmentally friendly removal of lampenflora (a biospeleological expert advice should be obtained beforehand)



Further information can be found here:
cavelighting.de



Cave Lighting CL GmbH & Co. KG
Hohe Strasse 700 Geb. 7
35745 Herborn
Germany