

LICHENS AS SENTINELS OF AIR QUALITY IN URBAN AREAS

A CITIZEN SCIENCE PROJECT

promoted by the IABEP

International Association for Biomonitoring of Environmental Pollution

OPERATIVE PROTOCOL

1. Site Selection

1.1 Select a representative number of sampling sites throughout the city, possibly based on a randomized or systematic design.

Note: the availability of trees limits the choice of sites to be sampled (see §2); Google maps or Google street view may be useful tools for planning site selection;

1.2 Sampling sites have roughly a circular shape, with a radius of about 50 m;

1.3 The center of two adjoining sampling sites must be at least 200 m apart (i.e. the outer boundaries must be at least 100 m apart;

2. Tree selection

2.1 Sites must have a minimum of 3 trees suitable for lichen sampling (see §2.2 and §2.3)

2.2 The trees to be sampled must be chosen in such a way as to ensure that the survey is carried out under comparable ecological conditions. The trees must thus comply with the following features:

- isolated position (trees within bushes must not be included, as in these environments the lower amount of light can limit lichen presence)
- straight trunk, with inclination $<10^\circ$ and without large branches or forks in the part to be sampled (1-2 m from ground, see 2.1), where water stagnation or areas of preferential stemflow may influence lichen presence;
- trunk circumference at breast height >60 cm;
- absence of obvious disturbances (e.g. painting, wounds, diseases, fungicide treatments, etc.).

2.3 Since bark features (especially pH) may greatly influence the lichen vegetation, only trees belonging to the genera *Tilia* and *Quercus* (linden/lime tree and oak) should be sampled; poplar (*Populus* spp.) and elm (*Ulmus* spp.) may be included if necessary. Unsuitable trees: horse chestnut (*Aesculus hippocastanum*), plane tree (*Platanus orientalis*), since their bark is flaking off, black locust (*Robinia pseudacacia*) since its bark is eutrophic and has a very high water-holding capacity. All conifers must be excluded as well, since their bark has a very low pH.

3. Lichen sampling

3.1 For each of the at least 3 trees selected in each sampling site, the lichens all around the trunk from 1 to 2 m from ground must be observed, and the relative rank noted as follows:

0 – absence of lichens (“lichen desert”)

1 – presence of crustose lichens

2 – presence of narrow-lobed foliose lichens, with orange or grey color (e.g. *Physcia adscendens*, *Hyperphyscia adglutinata*, *Phaeophyscia orbicularis*, *Physconia grisea*, *Xanthoria parietina*)

3 – presence of large-lobed foliose lichens (e.g. *Parmelia sulcata*, *P. tiliacea*, *F. caperata*, *Parmotrema perlatum*, "melanoparmelia", *P. acetabulum*, *Physconia distorta*)

4 – presence of fruticose lichens (e.g. *Evernia prunastri*, *Pseudevernia furfuracea*, *Usnea* sp.)

Under mixed situations, note multiple values or a range (e.g., 1-3).

3.2 For ranks 1-4, also indicate the degree of trunk cover (abundance) for each category, according to the scale:

1 = <5%

2 = 5-25%

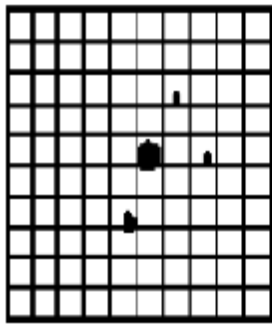
3 = 25-50%

4 = 50-75%

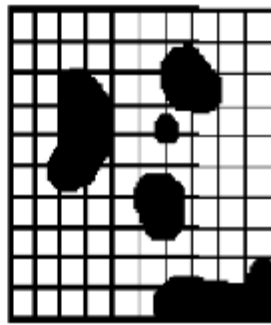
5 = >75%

Note: see the pictogram below for a quick visual comparison of % cover

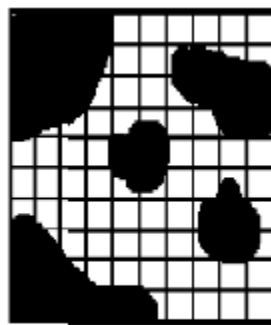
3.3 Additional data: record the coordinates (e.g. from Google maps) of the center of the sampling site and of the individual trees; take photos of the sampled trees; shortly describe the site (e.g. avenue with heavy traffic, urban park, residential area, etc.)



1



2



3



4



5