Changes of the light condition in a forest with Cobra SMARTsense

Biology | Ecology & environment | Ecosystems

Difficulty level	Group size	Preparation time	Execution time
easy	2	10 minutes	30 minutes

This content can also be found online at:

http://localhost:1337/c/5f4451675eef7d00031fcae6

PHYWE

Teacher information

Application

PHYWE

Experiment set-up

In a deciduous forest, hardly any other plants grow except trees of approximately the same height, unless they are young plants of the same tree species. This experiment shows how the light intensity in a mixed oak-beech forest changes during the foliage in spring and what consequences this has for the vegetation.

PHYWE

Robert-Bosch-Breite 10
37079 Göttingen

Tel.: 0551 604 - 0
Fax: 0551 604 - 107

info@phywe.de
www.phywe.de

Other teacher information (1/6)

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Prior knowledge

The students should already know photosynthesis and the principle of plant respiration. It is also helpful if they know that there is a continuous competition for light in the forest.

Scientific principle

The pupils measure the light intensity in the forest at different times.

Other teacher information (2/6)

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Learning objective

The students should realize that with increasing vegetation a competition for light begins. In the course of the vegetation period, less and less light reaches the forest floor, the plants there disappear and only higher growing plants receive enough light to be able to carry out photosynthesis.

Tasks

The students measure the light intensity in a deciduous forest and at the same time in the open air. From these values they calculate the quotient. They repeat this measurement several times during the vegetation period and interpret the results.

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37079 Göttingen

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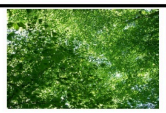
Other teacher information (3/6)

Result (1/2)

The results in the table show that with increasing foliage the brightness decreases dramatically. Even without foliage before budding, only 70% of sunlight reaches the ground. After 4 weeks, when the canopy is closed, it is even only 10%. This low residual light intensity does not allow plant growth in the ground area.

Datum	20.4.	27.4.	4.5.	11.5.
				
Messung	6800 lx	8000 lx	2550 lx	1100 lx
Kontrolle	9700 lx	19300 lx	16500 lx	10500 lx
Quotient	70%	41%	15%	10%

Other teacher information (4/6)

Result (2/2)

The experiment can be used well to address the principle of stratification (tree layer, shrub layer, herb layer, moss layer, root layer). In an oak-beech mixed forest there is no pronounced stratification, but the tree layer dominates. Light is only transmitted in spring, so that no shrub layer and not even a herb layer can develop. In the herb layer, the only species accompanying the oak-beech mixed forest is the wood anemone (Anemone nemorosa), a spring geophyte that grows in the forest as a broad carpet of flowers due to a lack of competition. After the canopy has closed, there is hardly any light available in the layers below, which is why no other plant species can settle permanently. Only in places where the foliage cover in the canopy is no longer intact due to wind breakage or tree felling, and where translucent areas have been created, can a shrub and perennial herb layer temporarily form as long as the canopy has not been closed again by regrowing beech and oak trees.

PHYWE
Robert-Bosch-Breite 10
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Other teacher information (5/6)

Further information (1/2)

The experiment only provides useful values if the student thinks about the experiment methodology. The following factors that influence the measurement should be considered:

- Location of the measuring instrument: always in the same place.
- Taking into account the time of measurement: introduction of a control measurement so that the result of the measurement is independent of the time of day; the control measurement is carried out outside the forest, as close as possible to the measurement.
- Fluctuation of solar radiation within a measurement, e.g. when clouds pass through or wind blows: Formation of an average value from as many individual measurements as possible, also for control measurements. For reasons of convenience and in the interest of accurate results, the measurement can be recorded on the SD memory card over a longer period of time and evaluated using the average value function of the measure software.

Other teacher information (6/6)

Further information (2/2)

Due to the arrangement of the brightness sensor in the Weather sensor unit, lateral scattered light is avoided, but only light that penetrates through the tree layer is measured.

With the same measuring arrangement the following further tests are possible:

- Comparison of the light conditions depending on the forest species.
- Comparison of the foliage time of different tree species (measurement also possible with solitary trees).

Wood anemone carpet on 20.4.

Wood anemone carpet on 11.5.

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Safety instructions

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- The general instructions for safe experimentation in science teaching apply to this experiment.

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Student Information

PHYWE

Robert-Bosch-Breite 10
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Motivation

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Experiment set-up

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Tasks

Why are there so few different plants in a deciduous forest?

The series of measurements is carried out in spring, during budding. One measurement per week is sufficient. The time of day of the measurement is not relevant, since in addition to the measurement in the forest, a control measurement is carried out in the open air and the quotient is formed from this.

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Equipment

Position	Material	Item No.	Quantity
1	Cobra SMARTsense - Light, 1 ... 128 kLx (Bluetooth + USB)	12906-01	1
2	measureAPP - the free measurement software for all devices and operating systems	14581-61	1

PHYWE
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Set-up

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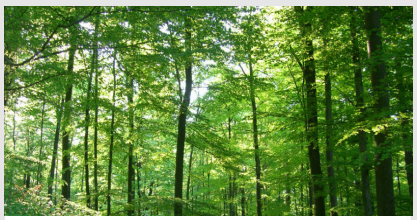
- Switch on the Cobra SMARTsense 'Light' by pressing the power button.
- Make sure that Bluetooth is activated.
- Open the PHYWE measure App and select the sensor "Light".
- Select brightness (E) as the measured value.

Start of measurements



End of measurements

Procedure

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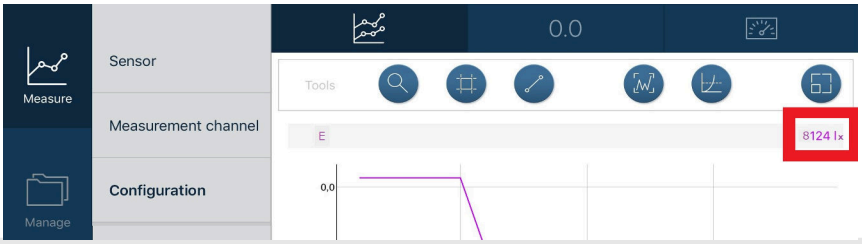
- The measuring combination is placed on a flat surface so that the opening of the brightness sensor points upwards. It is important that during further measurements the measuring device is always in the same position, at the same angle upwards.
- Read the measured value (figure below) and record it.
- Perform and record the control measurement in the open air.
- In case of strong fluctuations, calculate the average value from several individual values.



PHYWE
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Report

Task 1

Drag the words to the right place.

At the _____ of the vegetation period we see mainly herbaceous plants at ground level. Due to the _____ foliage on the trees, they get enough light to do photosynthesis. In the course of the vegetation period, the number of plants at _____ decreases, since less and less light reaches the ground due to the _____ of the trees.

beginning
debrisation
ground level
lack of

Check

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Task 2

In the (deciduous) forest there is a continuous competition for various resources. Light is one of them. In the course of the growing season, only those plants that can approach the light at a higher level receive enough light.

○ True ○ False

Check

In the (deciduous) forest there is no continuous competition for various resources (light, nutrients, etc.). Every plant gets enough to survive in all places.

○ True ○ False

Check

Slide	Score / Total
Slide 17: Growing season	0/4
Slide 18: Multiple tasks	0/2

Total amount 0 / 6

Solutions Repeat

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