

Seeing the wood for the trees - making the most of tree planting schemes

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In recent years, many schools have been involved in tree planting schemes. Usually, the primary aim of these initiatives is to provide a more attractive school site, both to people and wildlife. With careful planning, it is also possible to use such an area to assist in the teaching of National Curriculum Scientific Investigations, and to provide long-term data for statistical analysis by older students.

When trees are planted, the surrounding vegetation competes for water and nutrients, and in order for young trees to establish properly, some form of weed control needs to be applied for at least three years [1]. We have used our tree planting site to compare the growth of the trees under different weed control regimes, and the growth of nursery-raised plants of different sizes.

THE TREE PLANTING SCHEME AT THE MEDINA VALLEY CENTRE

In November 1990, a small copse of about 600 trees and shrubs was planted on land adjacent to the Medina Valley Centre recreational field. The central part is mainly oak and ash, with a shrub belt of nine different native woodland and hedgerow species around the edge. An experimental plot within the copse was laid out as shown in Figure 1, and weed control methods are indicated. Twelve trees were planted in each of the designated areas.

MEASUREMENTS

Height and diameter measurements

Each February, the maximum height and diameter of trunk at base are measured for each tree in the experimental plot. The data are fed into a computer spreadsheet which calculates the total growth of each tree, and the yearly growth increment. Means for each plot are also calculated.

Foliage measurements

(a) Size of leaves

For both oak and ash leaves, the area was determined by weighing photocopies of the leaf (knowing the density of the paper in g m^{-2}). The

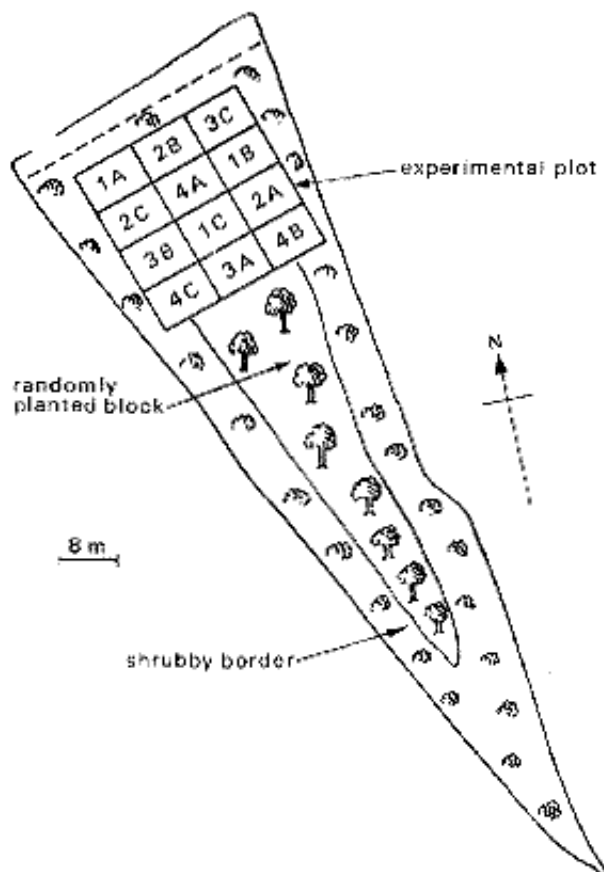


Figure 1 Tree planting scheme

dry mass of leaf was found and correlated well with the area obtained by the weighing exercise. Both of these methods are time-consuming, and a more rapid method was sought. Maximum width and length of oak leaves, and individual leaflet length of ash leaves were measured. Using linear regression analysis, mean leaflet length for ash and the product of maximum width x maximum length for oak gave strong positive correlations with area as determined by the weighing technique. Measurement of leaf dimensions has the added advantage that it is a non-destructive sampling technique.

(b) Nutrient analysis

A foliar analysis for various minerals has been carried out by the Forestry Commission's Alice Holt Research station. As expected, preliminary results suggest that nitrogen levels are higher in those plots where some form of weed control has been applied.

Microclimatic and meteorological data

Growth of the trees will be influenced by the micro-climate both within the plot and individual shelters, and there is scope for measurement using a data-logging system, such as LogIT.

Experimental plot

Trees

- 1 Oak transplants
- 2 Ash transplants
- 3 Oak whips
- 4 Ash whips

Management

- A mulch mats
- B herbicide
- C no treatment

Randomly planted block

- Oak
- Ash
- Shrubs (as in border)

Shrubby border

- Field Maple
- Hazel
- Wild Cherry
- Aspen
- Wild Privet
- Guelder Rose
- Blackthorn
- Alder Buckthorn
- Dog Rose

Transplants have been container-grown and develop side branches as they have been 'potted on' several times before being planted out. They are protected by 1.2 m high brown-tinted tree shelters. In retrospect, a 0.6 m shelter may have been sufficient both to exclude rabbits and encourage shoot growth.

Whips have a single shoot when planted, and are protected from grazing damage by the use of a plastic rabbit spiral. When acquired, they are taller than transplants.

Mulch mats are made of black heavy duty plastic (500 gauge) and cover an area 1 m² around the base of the tree. They are secured by burying the edges in a slit trench, and covering the mat with bark chippings.

Herbicide ('Roundup' in a 1 m diameter spot) is applied in the spring by a licensed contractor.

Temperatures inside and outside the tree shelters, over a period of 24 hours, can lead to a consideration of the effects of the shelters, and comparisons of different types of shelter (see Figure 2).

A Stevenson screen and rain gauge, situated at the Centre, provide daily temperature and rainfall measurements.

Soil and vegetation studies

So that edaphic variables were eliminated for the investigation, mechanical and pH analyses of the soil in each plot were carried out. A technique to measure soil moisture level around the base of the trees, and especially underneath the mulch mats, is being developed.

Prior to planting, a botanical survey of existing vegetation was undertaken, using a point frame quadrat to estimate percentage cover of herbaceous plants. This will be repeated at intervals throughout the investigation, to assess changes.

USE OF THE DATA

We are planning to gather data over five growing seasons, and expect at the end of this time to

have gathered sufficient data to contribute to local knowledge on tree planting. The copse, when it is mature, will be a valuable wildlife habitat. However, there is already considerable educational value in the site, for a variety of age groups.

TEACHING NATIONAL CURRICULUM SCIENCE INVESTIGATION (SCI) THROUGH TREE PLOTS

Setting up tree plots provides the opportunity for investigations to take place at various levels. The initial planting scheme can be designed to meet the requirements of the school; in a junior or middle school, where pupils are operating at Key Stage 2 and/or 3, trees planted in a school garden are a possible focus for a related series of activities [2]. Pupils can generate their own hypotheses relating to tree growth, and the level of complexity can vary considerably, depending on their age, ability and previous experience.

Examples of hypotheses which pupils might generate are given below, related to different National Curriculum levels.

- Level 3 'Oak whips grow better if there are no weeds round them.'
- Level 5 'Oak whips grow taller when they have more water, so mulch mats are a better way of weed control than herbicide, because the mats reduce the amount of water lost from around the tree roots.'
- Level 7+ 'Oak transplants grown in tree shelters will grow better than oak whips because of the more favourable micro-climate. Differences in temperature are likely to be larger than differences in light intensity, and it would be expected that temperature would be the limiting factor rather than light.'

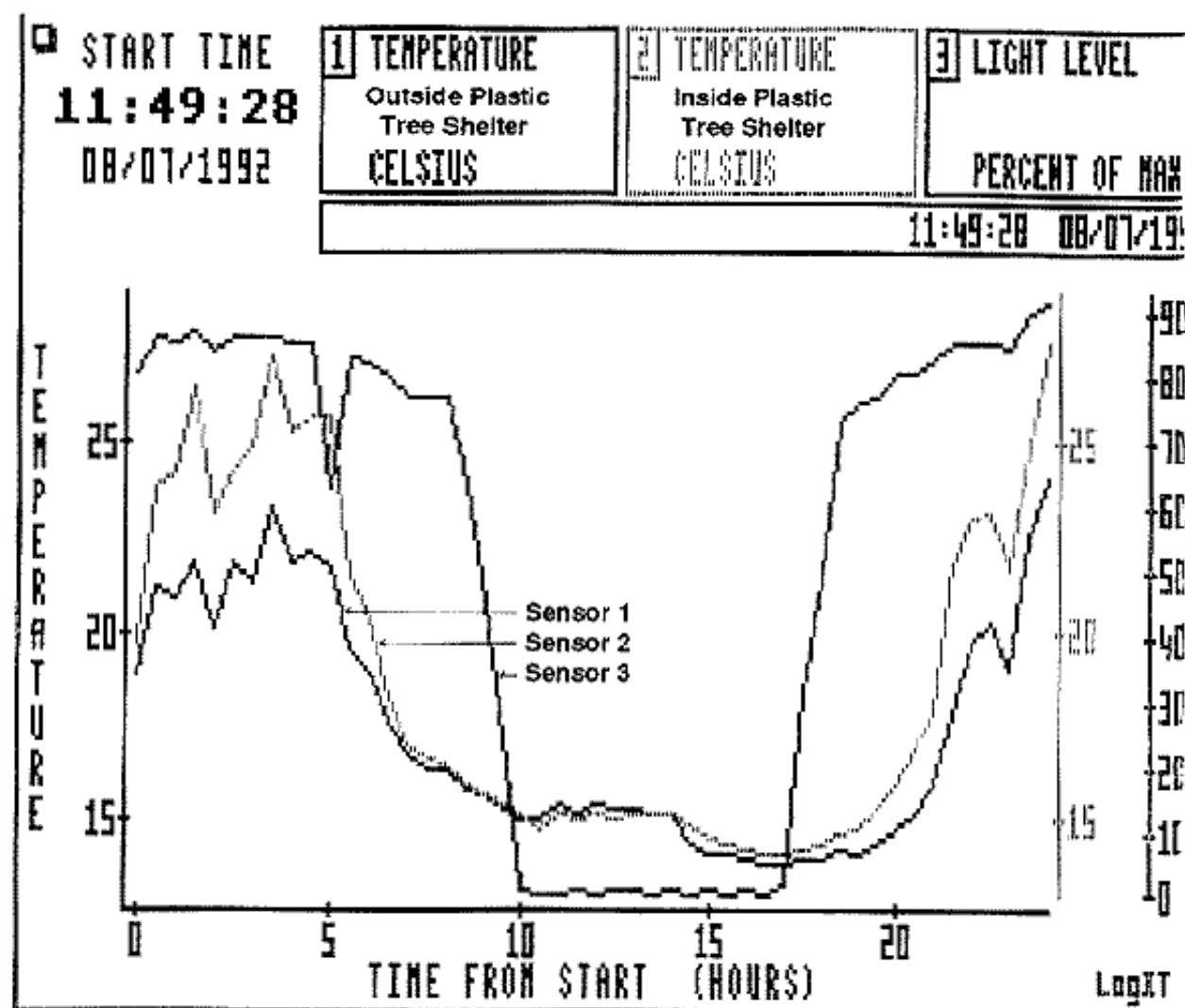


Figure 2 Example of microclimatic data obtained using data-logger (LogIT).

The project described here is quite closely directed, so it may be used as a vehicle for teaching investigative skills and processes, rather than for assessment. The questions of 'fair test', 'control' and 'variable' can be explored by considering both the ways in which the plots have been set up, and the parameters which can be measured. An important factor in pupils' progression through the levels of the National Curriculum is the opportunity to match their work against the stated targets. This exercise allows them to devise an investigation and then review their hypothesis and procedures in an attempt to reach a higher level. A possible framework for teaching the investigation is given below. At the lower levels, the exercise is relatively 'closed' in terms of devising an investigation. At the higher levels, there is potential for a more 'open' line of enquiry [3].

STARTING POINTS FOR AN INVESTIGATION

What affects the growth of trees?

Discussion in small groups, followed by collation of ideas from whole class, eg, tree species, genetic constitution, soil, climate, weather, other plants, space available per tree, size of tree, animal grazing.

How are trees grown in forestry?

Information input; experimental design of tree plots.

Seed of known origin, raised to transplant or whip, planted out suitably spaced, protected by some sort of shelter or guard, surrounding weeds removed by some means.

What data is available?

Information input

Height measurements for each year, made in February

Weather data for each year

Designing investigations

Questions to stimulate planning, and generation of hypotheses.

National Curriculum levels 1-3

- 1 What helps trees to grow well?
- 2 What is the difference between the way the trees in plot 3A and 3C have been grown?
- 3 What is the difference between the way the trees in plot 3B and 3C have been grown?
- 4 What is the difference between the way the trees in plot 3A and 3B have been grown?
- 5 Why are the trees spaced the same distance apart?
- 6 How can you decide which trees are growing best?

National Curriculum levels 4-6

- 1 How do the mulch mats stop weeds growing?
- 2 How do the mulch mats affect the amount of water in the soil round the trees?
- 3 How much effect do you think the weather has?
- 4 Height is one way to compare how the trees grow; what other ways can you think of?

National Curriculum levels 7-10

What data would you need to answer the questions below and how could they be obtained?

- 1 How fast do the trees grow?
- 2 Do the whips grow at the same rate as the transplants?
- 3 How else could you measure growth, other than by height?
- 4 Does the weather in the growing season have a noticeable effect?
- 5 Do the different types of shelter affect the micro-climate round the trees?
- 6 What do you think are the most significant factors in tree growth which you could investigate using these experimental plots?

POST 16 STUDIES

We are making use of the site, and accumulated data, as part of an A-level student investigation dealing with aspects of woodland management. Measurements obtained by the students are used in conjunction with previous records, to test various hypotheses students have devised. Students can decide what to measure and can select appropriate procedures and equipment for measurement. Combined with meteorological data, growth rate can be related to weather conditions. Whips are generally easier to measure than transplants as the tree shelters on the latter may need to be moved temporarily to allow measurement to occur. The Student's 't' test may be applied to determine whether differences in growth are significant [4].

ACKNOWLEDGEMENTS

We are grateful to the Isle of Wight Countryside Management Service for practical advice and financial support; grant aid has also been received from the Shell 'Better Britain' campaign.

USEFUL CONTACTS

English Nature, Northminster House, Peterborough PE1 1UA

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British Trust for Conservation Volunteers, 36 St Mary's St, Wallingford OX10 0EL

A set of data relating to the Medina Valley Centre experimental plots can be obtained from the address below, on receipt of a stamped addressed A4 envelope.

REFERENCES

- 1 Davies, RJ, *Trees and Weeds*, Forestry Commission Handbook 2 (HMSO, London 1987).
- 2 Bailey, A, 'Claire's tree is in the way', *Questions*, 1992, 4(8), 10-12.
- 3 Ryan, L, 'A question of levels: setting the scene for AT1 assessment', *SSR*, 1992, 74(226), 125-6.
- 4 Chambers, N and P Parker, *The OUI Project Guide Fieldwork and Statistics for Ecological Projects* (2nd edn) (Field Studies Council, 1989).

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