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# Bioscience Teaching and Learning Case Study

## An Interactive Timeline of Plant Evolution

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**Institution:** University of Cambridge

**Activity:** We have developed an online, interactive timeline tool to help students studying the topics of Plant Evolution. It allows users to visualise the circumstances and factors contributing to the current diversity of plant life.

### Student Group:

The Timeline Tool is used at Cambridge with First Year Natural Sciences students, and also with Third Year students who have chosen to specialise in Plant Sciences. Although it was constructed with the needs of Plant Scientists in mind, aspects of the tool could be useful throughout undergraduate teaching; for example, in Earth Sciences or Zoology. We have made the tool publicly available so students in any year or setting worldwide can access it for free.

### Aim:

The aim was to create an interactive time-line tool which would allow students to be able to visualise the trends in various different biotic and abiotic factors across geological time, to expose the relationships between different factors and allow students to investigate the circumstances which facilitated evolution of plant life. It was a topic which Professor Howard Griffiths, an experienced lecturer on plant evolution and teaching co-ordinator in the Department of Plant Sciences at Cambridge, identified as one which students may find difficult to comprehend as it involves understanding the interplay of many factors, set across a vast time scale. The information had previously only been available to students in a series of static, printed charts; the possibility of uniting the datasets on to a common scale and allowing information to be 'toggled' on or off was identified as being potentially very useful to students, making comprehension easier. The tool has been used 'live' by lecturers, in small group tutorials to scaffold discussions, and also by students for independent study on their own or with other students.

### Context / Background:

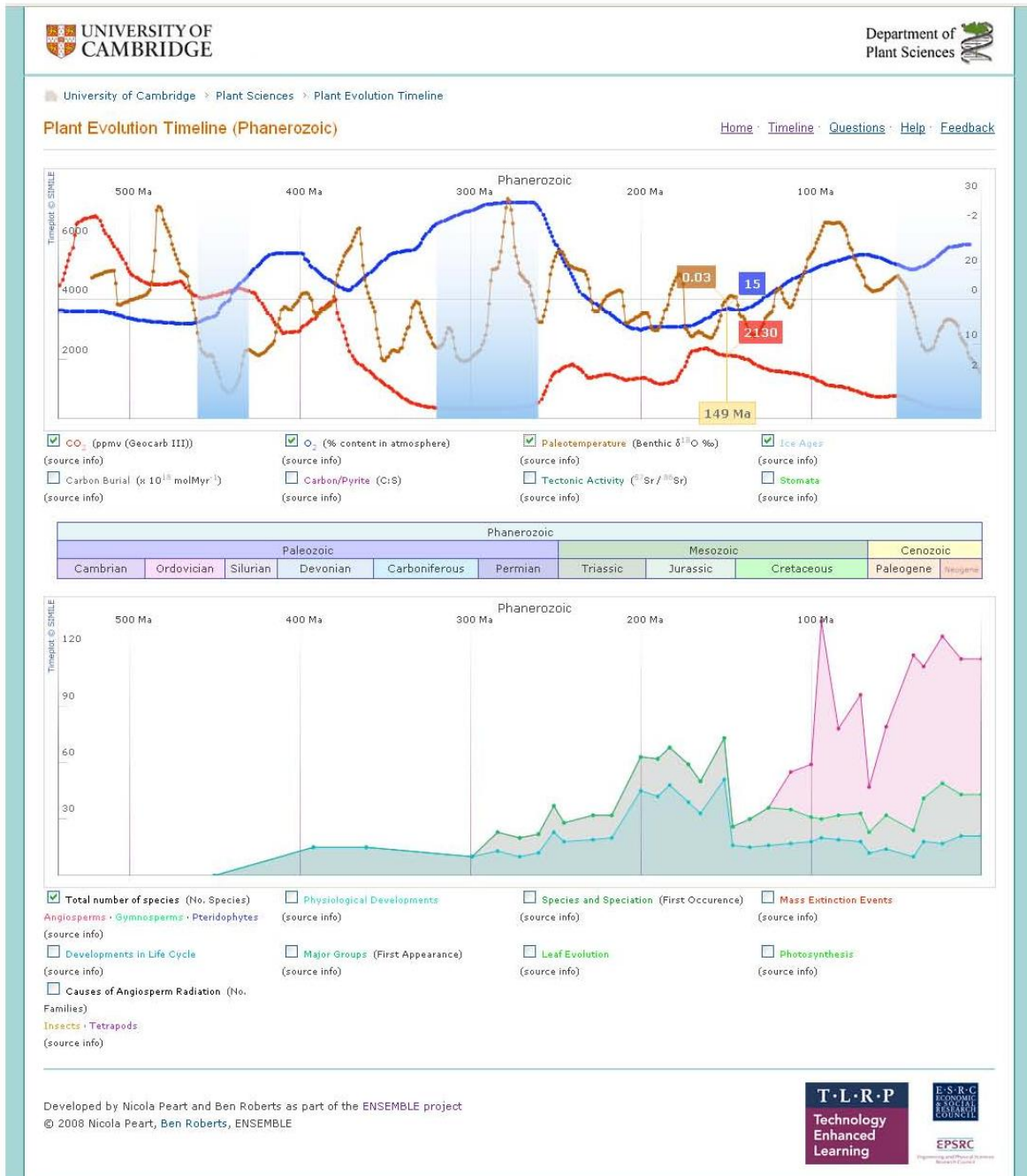
The Plant Evolution Timeline was developed during summer 2008, as part of the University's summer research studentship programme for undergraduates (the UROPs scheme). During autumn 2008, the Ensemble Project ([www.ensemble.ac.uk](http://www.ensemble.ac.uk)) was launched, investigating the potential for semantic web technologies to support undergraduate learning. As a small scale pilot, creating an interactive time-line of plant evolution appeared to be an excellent example of a topic that could benefit from use of semantic web based technologies as it involved visualisation and comprehension of a diverse collection of data sets. The Ensemble Project and Department of Plant Sciences jointly funded a UROP student (Nicola Peart) over the summer to develop this, drawing upon her expertise as a Plant Scientist, with technical support from the projects' Research Assistant (Ben Roberts). The tool was co-developed by Nicola and Ben during July - September 2008, closely liaising with expert teachers in Plant Sciences during the development process. It was published online publicly in October 2008, and has been used by undergraduate courses since then.

### Example description:

The Plant Evolution Timeline is an interactive webpage (which can be accessed publicly at [www.ensemble.ac.uk/projects/plantsci/timeline/](http://www.ensemble.ac.uk/projects/plantsci/timeline/)). It is a webpage which uses a Java API to display active

content. This generates two charts, both having time in 'millions of years ago' along the x-axis. The two charts are stacked so information shown in one corresponds with the other. The top chart displays information about abiotic factors (e.g., carbon dioxide levels, temperature, ice ages) and the bottom chart displays biotic information (for example, the first appearance of major plant groups, number of plant, insect and tetrapod species). Between the charts there is a band which translates time from 'millions of years ago' into geological time periods or era; clicking on a specific period here allows the user to 'zoom' the charts.

To help visualise the tool, please see the screenshot below, or view the timeline online at: [www.ensemble.ac.uk/projects/plantsci/timeline/](http://www.ensemble.ac.uk/projects/plantsci/timeline/)



### Screenshot 1. The Plant Evolution Timeline Tool

The data sets themselves are held as a series of files; the information is not 'hard coded' into the webpage but is separate, making re-use and easier re-development a possibility. Much of the data needed to be 'digitised' in order to create these data sets; the tool also aggregates information from online sources, such as images illustrating morphology from Wikipedia. The timeline has been published publicly online but there is also an

'internal' version for Cambridge students, which brings in additional information and links to their virtual learning environment (VLE) and direct links to related lectures.

The Plant Evolution Timeline has been applied in undergraduate teaching at Cambridge in several modes. It has been used in lectures; it has been used 'live' instead of a collection of slides containing a series of 'static' graphs. Small-group teaching is an important part of teaching at Cambridge. The tool has been used by tutors, conducting tutorials to support the lectures, to structure discussions about the topic. It has also been used on a computer in a lab to support practical classes. The 'always online' accessibility of the tool has also allowed students to use the timeline extensively during non-contact time.

### Results / Feedback:

This tool was developed and tested within Firefox, and has some problems when running in other browsers (most notably Internet Explorer). This is not a major problem, as Firefox can be easily downloaded for free from the Internet, but in the future we hope to develop a new version of the code that will allow it to be used in all internet browsers.

An evaluative questionnaire was circulated to all undergraduate Plant Sciences students at the end of summer term 2009. It had been made available to students in all years of study (it relates most explicitly to teaching in the 1st, and 3rd year at Cambridge, but 2nd year undergraduates have not been prevented from using it too); its use was most prevalent in the 3rd year (note that undergraduates in Natural Sciences study a number of different courses in their first and second years, and specialise in their third year).

The students who had used it gave very positive responses; it was considered well-designed, easy to use, and the integration of data was valuable. For example:

*"It's really useful to be able to add in just some bits and make sure you understand them as well as being able to overlay multiple layers to see the interaction. It's a really good way of starting to integrate more information. Thank you."*

Students found it particularly useful to support their learning during the term in which they were receiving lectures on the topic, and again for revision in the build up to exams at the end of the year.

Reasons some students gave for not using it included being unaware of it, or not intending to specialise in Plant Sciences.

The tool has also been considered a success by staff, reflected by its continued use in a range of teaching settings. A number of further 'tweaks' have been identified by Professor Griffiths as a result of its use in the lecture theatre, but these are mostly quite minor cosmetic issues. For example, it would be useful to be able to 'hide' the data labels for clarity. Ben Roberts has been working on refining the code to allow further flexibility to solve issues such as this, and we intend to implement a new version of the tool this summer ready for the next academic year.

In addition to its use within the University at Cambridge, we have also received unsolicited positive feedback from users across the world, in educational settings from home schooling to higher education. The tool has also been taken up by several high-quality learning object repositories, such as Merlot ([www.merlot.org](http://www.merlot.org)), Intute ([www.intute.ac.uk](http://www.intute.ac.uk)) and the Scout Report (<http://scout.wisc.edu/>).

### Further comments or information:

The Plant Evolution Timeline is publicly available online at: [www.ensemble.ac.uk/projects/plantsci/timeline/](http://www.ensemble.ac.uk/projects/plantsci/timeline/)

Please feel free to use it in your own teaching. We welcome any feedback about the tools' use outside of the original context it was designed for at Cambridge - please use the feedback form on the webpage to submit your feedback.

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