Evolution of Australian Biota
Study Day
2013

Teacher Notes
essential information and background

Illustration: Short-faced kangaroo,
Anne Musser, Australian Museum

Produced by Learning Services, Australian Museum, June 2013
6 College Street, Sydney, NSW 2010
www.australianmuseum.net.au
General notes for the Study Day

*Evolution of Australian Biota* Study Days are a joint venture of the Australian Museum, the Royal Botanic Gardens & Domain Trust and Taronga Conservation Society Australia. Educators from these organisations have collaborated to produce activities covering a large proportion of this Biology topic. Study Days are held in Sydney and at several other venues including the Australian Botanic Garden, Mount Annan and the Blue Mountains Botanic Garden, Mount Tomah. These Teacher notes are for Study Days held at the Mount Annan Botanic Garden.

Before your excursion

Booking

- You need to book your visit with the *Australian Museum’s Bookings Office* via phone on (02) 9320 6163 or fax on (02) 9320 6072.

- A *Booking Confirmation Form* is posted to you. Please check the details and advise our Bookings Office if any details need to be changed.

- Seven documents are posted to you:
  1. Teacher Notes (this document)
  2. Australian Museum session: *Learning from fossils* Student Activities
  3. Taronga Zoomobile session Student Activities
  4. Australian Botanic Garden, Mount Annan session: *Evolution and adaptation of Australian natives* Student Activities
  5. Answers for Museum session
  6. Answers for Garden session
  7. Answers for Zoomobile session

Changes to your booked number or cancellations

- Please note that if the number of students you have booked changes significantly (a decrease or increase of 5 students or more) you need to advise our Bookings Office as soon as possible.

- Significant reductions to your student number occurring within the four weeks prior to your booked Study Day will be charged according to the number shown on your Booking Confirmation form (or faxed amendment).

- Significant reductions are important to us so that other schools can be offered the opportunity to participate in this popular Study Day, and also for our staffing.

- Significant additions are also important as additional student numbers may require pre-arranged extra staffing, resources or other organisational needs.

Student supervision

- Teachers are responsible for supervising their students. Large groups that are split across different sessions must have a supervisor responsible for each group. (Our Bookings Office can advise you on whether or not your group will be split.)

- For every 10 secondary school students we provide free admission for one adult.
**Suggested pre-excursion activities**
Our research indicates that students gain maximum benefit from their excursion if they have an overview of their program for the day.

Botanic Garden educators advise that before the excursion, students should:
- become familiar with the super continent of Gondwana and the lands that were part of it 165 million years ago;
- read the information on ‘Gondwana Greening’ found at www.rbg.vic.gov.au concentrating on the information from Jurassic period to present;
- revise the structure of flowers, including male and female reproductive parts.

Taronga Zoo Educators advise that before the excursion, students should revise the following terms / concepts:
- nocturnal, diurnal, crepuscular
- behavioural, structural and physiological adaptations
- ectothermic, endothermic
- arid, temperate environments
- arboreal, terrestrial
- vertebrate animals - fish, amphibians, reptiles, birds and mammals (monotremes, marsupials and placentals)

**Photocopying**
Please photocopy the appropriate sheets for **all students** and accompanying **adults** before your visit.

**What to bring**
Teachers, please provide:
- copies of the **Student Activities** for each student (Garden, Zoo and Museum sessions).

Advise students to bring:
- clipboards, pens, pencils;
- camera;
- hats and/or wet weather gear and for outside activities;
- **lunch**, snacks, drinks.

**Further questions**
If you have any questions please phone the Australian Museum Bookings Office on **(02) 9320 6163**.
After your excursion

Suggested post-visit activities and references

Australian Museum session:
- Students complete only one allocated megafauna activity during the Museum session. Students can share their investigations with the rest of the class (via a presentation or report) back at school.
- Teachers should use the answers provided by the Museum to:
  - check that students have understood the content of their investigations;
  - act as a springboard to discuss selected concepts.
- The following Australian Museum website addresses may be useful for student research:
  - Australia's extinct animals
    www.australianmuseum.net.au/Australias-extinct-animals
  - Fossil sites of Australia
    http://www.australianmuseum.net.au/Fossil-Sites-of-Australia
  - Earth Sciences at the Museum
    http://www.australianmuseum.net.au/Earth-Science-Collections

Botanic Garden session:
- Teachers should use the answers provided by the Garden to:
  - check that students have understood the content;
  - act as a springboard to discuss selected concepts.
- The following Royal Botanic Gardens website addresses may be useful for student research:
  - Plant Net database
    http://plantnet.rbgsyd.nsw.gov.au
  - NSW Flora
  - Wollemi Pine
  - A useful reference book is The Greening of Gondwana by Mary White (Reed, French’s Forest. 1994).

Zoomobile session:
- Teachers should use the answers provided by the Zoo to:
  - check that students have understood the content;
  - act as a springboard to discuss selected concepts.
- The following Taronga Conservation Society Australia website address may be useful for student research:
  - Animal Search (animals on the Australian continent)
On the day of your excursion

Start / finish times

- Please try to arrive by **9.45 am** if you are able. This will allow time for group organisation prior to the first session which starts at 10.00 am.
- The teaching sessions at Mount Annan are scheduled to finish at 2.00 pm. Although if you have time, there may be an opportunity for the third session to run a little longer, or you may wish to further explore the Garden.

Contact numbers

- For general enquiries about the Study Day, phone the Australian Museum’s Bookings Office on **(02) 9320 6163**.

Timetable of activities

- Note that schools with small student numbers will be combined with other schools for the Study Day sessions. We aim for approximately 24 students in each session.
- Students rotate through three sessions of approximately 65 minutes duration.
- Please ensure that students are ready to begin each session on time, as there is a lot to fit into the day.

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.45 am</td>
<td>arrive at the Bowden Centre / Education Centre at the Australian Botanic Garden, Mount Annan</td>
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<tr>
<td>10.00 am</td>
<td><strong>Session 1</strong></td>
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<tr>
<td>11.05 am</td>
<td>short break (note – bring your own snacks with you)</td>
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<tr>
<td>11.20 am</td>
<td><strong>Session 2</strong></td>
</tr>
<tr>
<td>12.25 pm</td>
<td>lunch break (note – bring your lunch with you)</td>
</tr>
<tr>
<td>12.55 pm</td>
<td><strong>Session 3</strong></td>
</tr>
<tr>
<td>2.00 pm</td>
<td>Study Day sessions finish</td>
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</tbody>
</table>

Lunch

Students should bring their lunch and eat it outside near the Bowden Centre. Cover can be provided in wet weather.
Note that there is not time for students to buy their lunch at the Restaurant.

Teachers are offered free tea / instant coffee at the Education Centre.
Important information on the special entrance gate to use

- **Do not use** the main entry off Narellan Road unless you arrive late, after 10am (this Gate is **closed** before 10am). Please advise the bus driver and any students arriving independently to **ignore** the large brown road signs pointing to the Australian Botanic Garden main entry on Narellan Drive.
- Instead, **use the old entry gate via Mount Annan Drive** (see map).
  - The old entry has a security gate. Use the **intercom** located just before the gate to advise you have a special school program and ask for early entry.
  - Use the Parking area (P3) adjacent to the Bowden Centre.
  - Gather outside the Bowden Centre.
Content outline
The Study Day is divided into three sessions. The order in which students complete the three sessions is determined on the day and is related to the arrival time and readiness of the groups.

- In the **Australian Botanic Garden** session, *Evolution and adaptation of Australian natives*, students are guided to relevant parts of the Garden to examine plant species growing in the Botanic Garden find out about pollination adaptations and some evolutionary changes of Australian flora.

  The session is led by a Botanic Garden educator and the activities are student focused and hands-on.

- In the **Taronga Zoo** session, the Taronga Zoomobile visits the Garden Education Centre allowing students to interact with live animals while learning about the adaptations and evolution of native Australian animals.

  An educator leads the session and engages students in an interactive presentation and discussions.

- In the **Australian Museum** session, *Learning from Fossils*, students are introduced to the term ‘megafauna’ and the criteria that define these animals. They then work in small groups to undertake two hands-on investigations. Each group investigates **one** allocated megafauna activity (Activities 1-4) and **all** groups investigate **Platypus** evolution (Activity 5). Real fossils and cast specimens of extinct Australian megafauna and platypuses, are examined and compared with their modern relatives.

  A Museum educator introduces the session and facilitates the group work. Teachers should assist in facilitating the students' learning and keeping them on task.
Syllabus links

The Study Day is specifically designed for the Stage 6 Biology topic, 8.5 Evolution of Australian Biota.

- The outcomes addressed in the Study Day are shown in the following excerpts from the Board of Studies NSW Biology Stage 6 Syllabus (2009 updated version).

- The abbreviations (in bold) after each outcome match each of the four Study Day sessions to the outcomes they address.

Key:

RBG – indicates content in the Australian Botanic Garden, Mount Annan session.

Zoo – indicates content in the Taronga Zoo session.

AM – indicates content in the Australian Museum session.

1–5 – numbers indicate specific activities that link to the outcome.

<table>
<thead>
<tr>
<th>Students learn to:</th>
<th>Students:</th>
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</thead>
</table>
| **1. Evidence for the rearrangement of crustal plates and continental drift** indicates that Australia was once part of an ancient super continent. | • identify and describe evidence that supports the assertion that Australia was once part of a landmass called Gondwana, including:
  - matching continental margins
  - fossils in common on Gondwanan continents, including *Glossopteris* ...
<p>| RBG Zoo AM 5 |
| | • discuss current research into the evolutionary relationships between extinct species, including megafauna and extant Australian species. |
| | | AM 1 &amp; 5 |
| | • ... gather, process and analyse information from secondary sources and use available evidence to illustrate the changing ideas of scientists in the last 200 years about individual species such as the platypus as new information and technologies became available. | Zoo AM 5 |</p>
<table>
<thead>
<tr>
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<th>Students:</th>
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<tbody>
<tr>
<td>2. The changes in Australian flora and fauna over millions of years have happened through evolution.</td>
<td>• identify the relationship between variation within a species and the chances of survival of species when environmental change occurs.</td>
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<tr>
<td></td>
<td>Zoo</td>
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<tr>
<td></td>
<td>• identify and describe evidence of changing environments in Australia over millions of years.</td>
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<tr>
<td></td>
<td>RBG</td>
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<tr>
<td></td>
<td>• gather information from secondary sources to describe some Australian fossils, where these fossils were found and use available evidence to explain how they contribute to the development of understanding about the evolution of species in Australia.</td>
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<tr>
<td></td>
<td>AM 2 &amp; 5</td>
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<tr>
<td></td>
<td>• perform a first-hand investigation, gather information of named Australian fossil samples and use available evidence to identify similarities and differences between current and extinct Australian life forms.</td>
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<tr>
<td></td>
<td>AM 1, 2, 3, 4 &amp; 5</td>
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<tr>
<td>3. Continuation of species has resulted, in part, from the reproductive adaptations that have evolved in Australian plants and animals.</td>
<td>• describe some mechanisms found in Australian flora for:</td>
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<tr>
<td></td>
<td>– pollination</td>
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<td></td>
<td>– seed dispersal</td>
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<td></td>
<td>– asexual reproduction with reference to local examples</td>
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<tr>
<td></td>
<td>RBG</td>
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<tr>
<td></td>
<td>• describe some mechanisms found in Australian fauna to ensure:</td>
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<tr>
<td></td>
<td>– fertilisation</td>
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<td></td>
<td>– survival of the embryo and of the young after birth.</td>
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<td></td>
<td>Zoo</td>
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<tr>
<td>4. A study of palaeontology and past environments increases our understanding of the possible future range of plants and animals.</td>
<td>• explain the importance of the study of past environments in predicting the impact of human activity in present environments.</td>
</tr>
<tr>
<td></td>
<td>AM 5</td>
</tr>
<tr>
<td></td>
<td>• identify the ways in which palaeontology assists understanding of the factors that may determine distribution of flora and fauna in present and future environments.</td>
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<tr>
<td></td>
<td>AM 5</td>
</tr>
<tr>
<td></td>
<td>• gather, process and analyse information from secondary sources and use available evidence to propose reasons for the evolution, survival and extinction of species, with reference to specific Australian examples.</td>
</tr>
<tr>
<td></td>
<td>Zoo</td>
</tr>
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<td>AM 1 &amp; 5</td>
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