**ESS742 Senior Environmental Science: Curriculum Study Option B**

**VCE Environmental Science Unit 3: Area of Study 1**

**Outcome 1: Threats to biodiversity and Protection and restoration of biodiversity**

This teaching resource is a collection of case studies based on VCE Environmental Science Unit 3: Area of Study 1, Outcome 1 Threats to biodiversity and Protection and restoration of biodiversity. The purpose of this is to support the teacher by having access to case studies that introduce date analysis onto VCE Environmental Science. This resource addresses three case studies to cover content thoroughly and align with the VCE Environmental Science Study Design 2017-2021. They cover some of the key knowledge dot points of Threats to biodiversity and Protection and restoration of biodiversity. The intent of this collection of case studies is to pool useful resources together to provide the user with a ‘one stop shop’ for locating information relevant to AoS1, Outcome 1 Threats to biodiversity and Protection and restoration of biodiversity. These case studies are designed to align with the pedagogy of problem based learning to invoke deep critical thinking in the learner.

**Case Study 1. Koala Conservation**

This case study is designed to be an introduction into environmental case studies. Koala conservation in this case study demonstrates how populations differ in different habitats on the eastern side of Australia. Whilst this case study is well publicised and deals with the ‘cute and fuzzy’, it can be used to focus on human and/or non-human threats to biodiversity. The over-abundance of koalas in the Otways demonstrates how detrimental balance in an ecosystem is, whilst forest clearing in New South Wales and Queensland shows how rapidly a species can decline. This case study is expected to take up 2-4 hours of class time.

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| VCE Environmental Science Unit 3: Area of Study 1  Outcome 1: Threats to biodiversity and Protection and restoration of biodiversity  Case Study 1. Koala Conservation | |
| VCE Key Knowledge (VCAA 2017-2021) | Unit 3: How can biodiversity and development be sustained?   * human and non-human threats to biodiversity including creation and isolation of small populations through habitat modification and over-exploitation * strategies for maintaining and growing populations that also build species resilience to changes in the environment, including: translocation of animals and habitat regeneration, restoration or replacement |
| Student Learning Outcomes | Upon completion of this module students will:   * identify and examine human and non-human threats that can impact one genera of mammals * understand the complexities involved with translocation of animals * describe and evaluate methods for protecting environments and managing healthy populations * understand the importance of restoration of vegetation |
| Teacher Resources | **Non-human threats**  Video: This video (9:21) gives a detailed description of how Dr Desley Whisson’s team are radio collaring koalas in Cape Otway to monitor koala movement. It also explains problems associated with translocation of koalas and attempts to revive the Manna gum woodlands. <http://www.abc.net.au/catalyst/stories/3715819.htm>  News article: This article was published on The Age website on March 4, 2015 justifying the culling of koalas in the Otways in Southern Victoria. <http://www.theage.com.au/victoria/killing-of-700-otway-koalas-the-right-thing-to-do-scientists-say-20150304-13v25p.html>  News article: This article was published on the ABC news website on May 13, 2017. It outlines some strategies that are being implemented to address the overabundance of koalas in the Otways.  <http://www.abc.net.au/news/2017-05-13/program-to-rescue-starving-koalas-at-cape-otway-showing-results/8521148>  Website: This website gives a brief overview of koala habitat rescue and ecological burns. <https://conservationecologycentre.org/discover/otway-stewardship/>  Website: This website addresses the need to conserve manna gum woodlands to keep our koalas fed and healthy. <https://conservationecologycentre.org/2012/11/20/conserving-manna-gum-woodlands/>    **Human threats**  Four Corners episode: Koala Crunch Time (44:49) A detailed report of how urbanisation has impacted on koala habitat in New South Wales and Queensland. At 6:25, translocation of koalas is addressed. At 25:25 Lone Pine Koala Sanctuary. A report on koala hunting in 1927 for the koala fur is addressed. At 31:35 the over-abundance of koalas in Victoria and decreasing gene pool is discussed.  <http://www.abc.net.au/4corners/koala-crunch-time/4217700>  The following three website links are from WWF highlighting the increased tree clearing that’s occurring in Queensland and how its impacting koalas:   * Website: <http://www.wwf.org.au/news/news/2017/new-dramatic-escalation-in-tree-clearing-in-queensland-shows-why-stronger-laws-must-be-passed#gs.F30TqSY> * Website: <http://www.wwf.org.au/news/blogs/in-photos-koalas-with-nowhere-to-go#gs.loFsuUA> * Website: <http://www.wwf.org.au/news/blogs/in-photos-mother-nature#gs.zHvmGWg> |
| Activities | Discussion points: These statements are highlight points taken from a scientific journal article that could be used as a basis for a research project, scientific poster or just to promote scientific thinking using problem based learning.   * Koalas are experiencing major declines in the north, while southern populations are relatively stable or increasing. * New threats are looming, such as climate change and mining, whereas the long-standing threats remain undiminished. * Conservation and management policies must consider all threats and their interactions, and not just focus on one or two. * Much more needs to be done to recover northern koala populations and sustainably manage southern populations.   Laboratory Investigation/Demonstration: Germination of Acacia Seeds. Large gumnuts can also be used in this experiment with good results. It shows how fire/heat opens seedpods and stimulates germination very much like a bushfire would for the manna gum woodlands. <http://www.guidelinesonlearning.com/userfiles/Native%20seed%20germination%20Prac%202010(1).pdf>  Scientific thinking exercise: Map of Eastern Australia showing the distribution of koalas. Students could work together in small groups to explain what is happening in each region of Australia and give reasons for their explanations. <https://ars-els-cdn-com.ezproxy-b.deakin.edu.au/content/image/1-s2.0-S0006320715301130-gr1.jpg> |

**Case Study 2. Volcanic Grasses**

This case study is a more ‘localised’ case study concentrating on the Natural Temperate Grasslands of the Victorian Volcanic Plain. This bioregion is situated from the North-western suburbs of Melbourne through to Portland in South-western Victoria. There is less than five percent of this ecological community left due to agriculture and livestock grazing. These volcanic grasses are home to many vulnerable, endangered and critically endangered plant and animal species. This case study is expected to take up 2-4 hours of class time.

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| VCE Environmental Science Unit 3: Area of Study 1  Outcome 1: Threats to biodiversity and Protection and restoration of biodiversity  Case Study 2. Volcanic Grasses | |
| VCE Key Knowledge (VCAA 2017-2021) | Unit 3: How can biodiversity and development be sustained?   * human and non-human threats to biodiversity including creation and isolation of small populations through habitat modification and over-exploitation * strategies for maintaining and growing populations that also build species resilience to changes in the environment, including: protected areas, retaining remnant vegetation and habitat regeneration, restoration or replacement * the application of relevant regulatory frameworks including the Environment Protection and Biodiversity Conservation Act 1999 (Australia) |
| Student Learning Outcomes | Upon completion of this module students will:   * identify and examine human and non-human threats that can impact ecological communities * understand that there are treaties, agreements and regulatory frameworks in place to help protect ecological communities and threatened species * describe methods that can be used by farmers for protecting ecological communities * understand the importance of restoration of vegetation * collect secondary data and assess the threat to biodiversity in determining conservation status of specific flora and fauna within an area |
| Teacher Resources | eBooklet: Natural Temperate Grassland of the Victorian Volcanic Plain: EPBC Act policy statement 3.8. A 16-page document issued by the Australian Government <http://websites.sportstg.com/get_file.cgi?id=683727>  Website: This is a summary of the Victorian Volcanic Plain that is recognised as a biodiversity hotspot. <http://www.environment.gov.au/biodiversity/conservation/hotspots/national-biodiversity-hotspots#hotspot5>  Article: Published on the DELWP website on September 15, 2017 about a critically endangered species from the Victorian Volcanic Plain being 100km from its habitat.  <https://www.wildlife.vic.gov.au/media-releases/plains-wanderer-wanders-far-from-home>  Video: Grasslands of the Victorian Volcanic Plains (5:17) demonstrating the diversity of the grasslands. <https://www.youtube.com/watch?v=ISH4tp_fm0I>    Fact Sheet: This fact sheet is designed to assist farmers in identifying if they have grasslands on the property and offer support to protect the remaining grasslands. <http://www.environment.gov.au/system/files/resources/747f2d3b-aed1-49a0-a64e-6a59f7811d7d/files/grasslands-victoria-fact-sheet.pdf> Video: Victorian Volcanic Plains Biodiversity Grants (2:22) An example of how a farmer has been government assisted to protect grasslands on his property. <https://www.youtube.com/watch?v=Kzmar87Zqlc>  Fact Sheet: Golden Sun Moth, a critically endangered species that lives in Natural Temperate Grasslands. <http://www.dse.vic.gov.au/__data/assets/pdf_file/0014/103406/Golden_Sun_Moth_Fact_Sheet.pdf>  eBooklet: Significant impact guidelines for the critically endangered spiny rice‑flower (Pimelea spinescens subsp. spinescens). This eBooklet gives information on the spiny rice-flower including habitat assessment and translocation details. <http://www.environment.gov.au/system/files/resources/431ef46a-27ac-43d8-9311-d63764d63e43/files/spiny-rice-flower.pdf> |
| Activities | eBooklet: Natural Temperate Grassland of the Victorian Volcanic Plain: EPBC Act policy statement 3.8. Pages 8-10 has a list of significant species from the Volcanic grasses. This list could be used as a basis for a research project, scientific poster or informative pamphlet on an ‘ugly’ endangered species demonstrating that not all endangered species are ‘cute and fuzzy’. <http://websites.sportstg.com/get_file.cgi?id=683727>  Field Trip: Werribee Zoo offer Dynamic Ecosystems using grasslands from Victorian Volcanic Plain. Students use quadrats to collect data for analysis. This field trip also has student and teacher notes. <https://www.zoo.org.au/education/school-programs/werribee/dynamic-ecosystems> |

**Case Study 3. Lord Howe Stick Insects**

This case study is on the Lord Howe Stick Insect which has been widely publicised by the Melbourne Zoo where they have been bred successfully in captivity. These insects are critically endangered and were on the brink of extinction in 2001. This case study is expected to take 2-4 hours of class time.

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| VCE Environmental Science Unit 3: Area of Study 1  Outcome 1: Threats to biodiversity and Protection and restoration of biodiversity  Case Study 3. Lord Howe Stick Insects | |
| VCE Key Knowledge (VCAA 2017-2021) | Unit 3: How can biodiversity and development be sustained?   * predictions of species population survival using probabilities including likelihood of extinction * non-human threats to biodiversity including creation and isolation of small populations through habitat modification * assessment of threat in defining conservation categories including extinct in the wild * strategies for maintaining and growing populations that also build species resilience to changes in the environment, including: captive breeding and reintroduction programs |
| Student Learning Outcomes | Upon completion of this module students will:   * identify non-human threats that can cause environmental impact * describe and evaluate methods for protecting environments and managing healthy populations * define the different conservation categories giving examples of each * understand the importance of captive breeding in the restoration and reintroduction of a near extinct species |
| Teacher Resources | Blog post: A concise historical overview of the Lord Howe Stick Insect. <http://www.australiangeographic.com.au/blogs/creatura-blog/2014/06/lord-howe-island-stick-insect-phasmid/>  Website: A description of Melbourne Zoos captive breeding program to assist re-introduction of the Lord Howe Stick Insect with nice photographs. <https://www.zoo.org.au/melbourne/animals/lord-howe-island-stick-insect>  eBooklet: The Lord Howe Island Biodiversity Management Plan is quite cumbersome to read but on page 22-24 the predation of the Ship rat as an accidentally introduced species is implicated in the extinction of the Lord Howe Stick Insect from the Lord Howe mainland.  <http://www.environment.gov.au/system/files/resources/e30dcdd3-e6d5-43e2-bc33-7fdb6dd9061e/files/lord-howe-island.pdf>  Video: A ‘world first’ interesting video (6:02) on the hatching of a Lord Howe Stick Insect. <https://www.youtube.com/watch?v=noDDiOpWOdY>  Article: This article (page 244-252) explains the breeding program for Lord Howe Stick Insects at Melbourne Zoo. <http://www.izn.org.uk/Archive/401/401.pdf>  Blog Post: This blog post is about the pros and cons of captive breeding. It has been included to entice some critical thinking and set up for debate on whether conservationists should be preserving near extinct species or ‘letting’ nature take its course. <https://wp.natsci.colostate.edu/findingporpoise/captive-breeding-programs-the-pros-and-cons-to-building-an-arc/>  Article: An interesting article relating to cloning of a presumed extinct frog considering the blog post above to create further discussion of preserving extinct or near extinct species.  <http://www.australiangeographic.com.au/news/2013/03/cloning-brings-extinct-frog-back-from-dead> |
| Activities | Debate: Have students research pros and cons of captive breeding programs to create critical thinking surrounding the topic of preserving and reintroducing near extinct species. The website below gives a lesson outline, related resources and related questions.  <https://www.nationalgeographic.org/activity/captive-breeding-species-survival/> |