Institution: University of Portsmouth		
Unit of Assessment: UoA4 - Psychology, Psychiatry and Neuroscience		
Title of case study: The discovery and protection of a new orangutan species, the Tapanuli orangutan, and sustaining and protecting existing orangutan species		
Period when the underpinning research was undertaken: 2009 to 2017		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	**Role(s) (e.g. job title):**	**Period(s) employed by submitting HEI:**
Marina Davila Ross	Reader in Comparative Psychology	17/05/07 - date
Period when the claimed impact occurred: From 2017 to 31 December 2020		
Is this case study continued from a case study submitted in 2014? N		

1. Summary of the impact

Dr Marina Davila Ross' research on orangutan long calls has contributed to the first discovery of a new living ape species in nearly a century, the Tapanuli orangutan. With fewer than 800 individuals, it is the most endangered great ape species in the world. As a result, the Tapanuli orangutan has been classified as Critically Endangered (to become Extinct), instigating global protection legislation and conservation action plans to preserve the species. She has also co-developed methods to assess the survival potential of rehabilitant orangutans with conservation and government organisations in Malaysia. These methods have improved release programmes, reduced the risk of unsuccessful releases and contributed to the survival of the species.

2. Underpinning research

This Impact Case Study is the result of a body of research undertaken between 2009 and 2017 by **Davila Ross**, University of Portsmouth, in collaboration with a range of academic institutions and a conservation organisation in Zambia (Chimfunshi Wildlife Orphanage). This research has provided an innovative approach to developing evolutionary relationships, or 'phylogenetic trees', among orangutan species, using acoustic analysis of orangutan long call data. It has also demonstrated the presence of individual variations in fitness-related behaviours in great apes that have relevance to conservation strategies.

Using acoustic analysis of orangutan long calls to determine phylogenetic trees

Orangutan loud calls (usually termed long calls) are emitted by adult males; they are relatively stereotyped, species-specific and have been proposed to function as a spacing device among males and to attract females. **Davila Ross** has pioneered the idea that, if great apes rely on long-distance calls to communicate to other members of the species, then the acoustic analysis of such long calls may be used to map phylogenetic trees. **Davila Ross** first demonstrated that acoustic analysis could be used to establish distinctions between orangutan populations whilst at the University of Hannover under the supervision of Dr Geissmann (American Journal of Primatology, 69(3), 305-324). Following her move to Portsmouth, she further developed her acoustic analysis methodology to confirm that it was a reliable method that, in the same way that geneticists use genetic data, enabled the identification of phylogenetic trees. Specifically, she compared orangutan long calls across populations to challenge the long-held assumption of a strict dichotomy between Sumatran and Bornean orangutan species (**R1**) and she created phylogenetic trees based on acoustic analysis across great ape species (**R2**, **R3**).

The contribution of phylogenetic acoustic analysis of long call data to the discovery of a new orangutan species (*Pongo tapanuliensis*)

Prior to 2017, it was believed that there were just two orangutan species, Bornean and Sumatran orangutans. However, an expedition in 1997 (Meijaard, 1997) reported the presence of a small population of orangutans in North Sumatra that seemed phylogenetically different. A further expedition in 2016 estimated that there were only approximately 800 individuals left in this population (Wich et al, 2016). The process to determine whether this was a new species of orangutan required complex genetic, behavioural, ecological and morphological analyses. Hence, an international team of researchers, including **Davila Ross**, joined forces to carry out a large interdisciplinary study to conduct an exhaustive phylogenetic analysis of the genetic, behavioural, and morphological data each team held on existing orangutan populations. For this study, **Davila Ross** contributed her recordings of orangutan long calls and developed a more sophisticated

acoustic coding scheme by systematically selecting the strongest acoustic indicators of species variation (**R4**).

Combined analysis of these data confirmed **Davila Ross**' acoustic analysis methods as reliable, non-invasive indicators of species classification, as they mirrored and complemented the conclusions from genetic and morphological data. Most importantly, these analyses revealed the clear distinction of this orangutan population from the two, already-known, orangutan species, Bornean and Sumatran orangutans, and its classification as a new species, *Pongo tapanuliensis* or the Tapanuli orangutan.

Individual variation in fitness-related behaviours in great apes

Davila Ross' research has also confirmed that there are individual and colony variations in fitness-related behaviours in great apes. Fitness-related behaviours are those associated with activities that improve the chances of species survival, such as feeding, foraging and nest-building. In collaboration with the Chimfunshi Wildlife Orphanage (Zambia), **Davila Ross** found colony-level (**R5**) and individual-level (**R6**) differences in fitness-related foraging behaviours across colonies of semi-wild chimpanzees. Crucially, and based on her long-standing collaborations with animal conservation centres in Malaysia and Indonesia, **Davila Ross** recognised the potential for this enhanced understanding of individual fitness-related behaviours to be incorporated into strategies for the rehabilitation and reintroduction of ex-captive or displaced animals back into their habitats

These findings had important implications for the conservation of great apes and, specifically, on strategies for the rehabilitation and reintroduction of ex-captive or displaced animals back into their habitats.

3. References to the research

3.1. Research outputs

R1. **Davila Ross, M**., & Geissmann, T. (2009). Circadian long call distribution in wild orangutans. *Revue de Primatologie*, (1). https://doi.org/10.4000/primatologie.219

R2. **Davila Ross, M. D.**, Owren, M. J., & Zimmermann, E. (2009). Reconstructing the evolution of laughter in great apes and humans. *Current Biology*, *19*(13), 1106-1111. https://doi.org/10.1016/j.cub.2009.05.028

R3. **Davila Ross, M. D.**, Owren, M. J., & Zimmermann, E. (2010). The evolution of laughter in great apes and humans. *Communicative & Integrative Biology*, *3*(2), 191-194. https://doi.org/10.4161/cib.3.2.10944

R4. Nater, A., Mattle-Greminger, M. P., Nurcahyo, A., Nowak, M. G., de Manuel, M., Desai, T., Groves, C., Pybus, M., Sonay, T. B., Roos, C., Lameira, A. R., Wich, S. A., Askew, J., **Davila Ross, M.**, Fredriksson, G., de Valles, G., Casals, F., Prado-Martinez, J., Goossens, B., ... Krützen, M. (2017). Morphometric, behavioral, and genomic evidence for a new orangutan species. *Current Biology, 27*(22), 3487-3498. https://doi.org/10.1016/j.cub.2017.09.047.

R5. Rawlings, B., **Davila Ross, M.**, & Boysen, S. T. (2014). Semi-wild chimpanzees open hard-shelled fruits differently across communities. *Animal cognition*, *17*(4), 891-899. https://doi.org/10.1007/s10071-013-0722-z

R6. Forrester, G. S., Rawlings, B., & **Davila Ross, M.** (2016). An analysis of bimanual actions in natural feeding of semi-wild chimpanzees. American Journal of Physical Anthropology, 159(1), 85-92. https://doi.org/10.1002/ajpa.22845

3.2. Evidence of the quality of research

These outputs are a representative selection of a substantial body of research in this area. They are original research studies employing data occurring in natural settings. All are published in respected peer-reviewed academic journals. Combined, they have been cited 212 times according to Scopus (range 5-109) and 517 times according to Google Scholar (range 4-239). R2 was returned to REF 2014; R4 is returned to REF2021 (Output ID: 11695802, Davila Ross).

4. Details of the impact

Orangutans are a flagship species endemic to the tropical rainforests on the islands of Borneo and Sumatra, Indonesia and the only great apes of Asia. They play a vital role in maintaining the health of the forest ecosystem, which hosts other important large species, including tigers, Asian elephants and Sumatran rhinos. Unfortunately, due to illegal wildlife trade and rapid deforestation, their numbers have fallen significantly. **Research by Davila Ross has made a significant contribution to the conservation of the only remaining orangutan populations in the world.** Specifically, her research has contributed to the identification of a new species of orangutan that is now protected under international law and conservation actions plans. Additionally, Davila Ross has co-developed methods to enhance successful rates of rehabilitation programmes for ex-captive and displaced orangutans.

Protection of a new orangutan species, the Tapanuli orangutans

The confirmation of *Pongo tapanuliensis* as a new species of orangutan (**R4**) was the first discovery of a new living great ape species in nearly a century. It is considered to be one of the most significant scientific findings in the past 5 years and was a runner up in Science Magazine's Breakthrough of the Year in 2017 (**S1**). Crucially, this discovery was made in time to prevent the Tapanuli orangutans from becoming extinct. In December 2017, upon receipt of the research report (**R4**) and in view of the estimate that only 800 individual animals remained, the International Union for Conservation of Nature included the Tapanuli orangutan in the Red List of Threatened Species as 'Critically Endangered' (**S2**). At that time, the IUCN predicted a population decline of up to 83% within three generations and inevitable global extinction of the Tapanuli orangutan if no conservation actions were taken (**S2**).

As a result of IUCN Red List inclusion, a portfolio of conservation actions have been put in place to help ensure continuity of the species and its habitat. These include:

- **International legislation regulating trade**: The Tapanuli orangutan is included within *Pongo abelii* in Appendix 1 of the Convention on International Trade in Endangered Species (CITES). CITES is an international agreement between governments that seeks to prevent unsustainable exploitation of wild fauna or flora from international trade. In general, all international commercial trade in species listed in CITES Appendix 1 is banned. There are currently 183 Parties signed up to the Convention including the European Union (EU), Russian Federation, United States of America, China and Indonesia. Additionally, all countries within the EU are bound by further trading prohibitions and restrictions under European Commission Regulation (EU) 2019/2117 that directly references species in CITES Appendix 1.
- **International advocacy to prevent destruction of Tapanuli habitat**: In 2018, North Sumatra Hydro Energy (NSHE) submitted plans to develop a hydroelectric power plant in the only known habitat of the *Pongo tapanuliensis* - a small area of only 1,500km^2 within the Batang Toru Ecosystem, North Sumatra. This area is divided into three distinct forest habitats. Protection of these areas, as well as the maintenance and extension of corridors between them, is vital to the survival of the species. The submitted plans for the power plant would have isolated one of the areas, limited the options for reconnecting the other two and would have impacted upon nearly 10% of the total population of *P. tapanuliensis*. Research commissioned by the Indonesian Government resulted in the inclusion of wildlife management measures into the proposals, including building of orangutan bridges, planting of fruit trees in key locations, monitoring and evaluation of the Tapanuli orangutans and regular anti-poaching patrols (**S3**). Nevertheless, the proposal was met with widespread international objection including publications in prestigious global media and academic outlets (**S4**) and an international Change.org petition (**S5**) calling for the Bank of China, a major investor in the project, to withdraw funding. This petition had been signed by over 1,300,000 people by 31 December 2020. In October 2019, the IUCN SSC Primate Specialist Group on Great Apes made an international appeal for a moratorium on any hydroelectric power development in the Tapanuli orangutan range (**S6**). In April 2020, the IUCN published the Batang Toru Hydropower Project Fact Check that '*identifies specific assertions made by NSHE and assesses them against the best scientific knowledge available*' (**S7**). In March 2019, the Bank of China 'noted the concerns expressed by some environmental organisations' and announced it would re-evaluate its support for the project. Most recently (July 2020), a decision has been taken to delay the project

for three years, allowing further time for studies to assess the impacts of the project on the Tapanuli orangutan.

- **Conservation action plans:** In 2017, the Sumatran Orangutan Conservation Programme (SOCP) - a collaboration between the Indonesian Nature Conservation Authority and the international conservation organisation PanEco - launched a monitoring programme to protect the Tapanuli organutans. There are now five dedicated full-time members of staff employed at the Batang Toru Monitoring Station (**S8**). Also, in April 2019, the IUCN called for the adoption of a conservation management plan, for the designation of a further 8,000ha of the Bantang Toru Ecosystem as "Conservation Forest" to protect and extend the connecting corridors, and for a moratorium on any projects that might impact the habitat or viability of the Tapanuli orangutan (**S9**).

Improvements in orangutan rehabilitation and release programmes in Malaysia

Sustaining orangutan populations also relies on successful rehabilitation-release programmes. These programmes offer ex-captive or displaced orangutans an opportunity to return to the wild. However, the overall mortality rate for released orangutans can be high (Russon et al., 2009), particularly as rehabilitant animals may have very different sets of skills due to early experiences in life. In 2011, following a number of unsuccessful orangutan rehabilitations, [text removed for publication] sought Davila Ross' expertise on individual fitness-related behaviours in great apes to improve release survival rates. Since 2014, Davila Ross visited [text removed for publication] on six occasions, using these opportunities for research collaboration, training and meetings with staff and wildlife authorities.

As a result, Davila Ross and [text removed for publication] co-developed methods to measure individual characteristics of orangutans. In 2017, these were incorporated into decisions taken by [text removed for publication] to select five release candidates. Between August 2017 and May 2019, Davila Ross trained eight [text removed for publication] staff to systematically record individual survival skills and behaviours to assess individuals' release potential and to identify areas where improvement in survival skills is needed. In 2018, and based on research led by Davila Ross, [text removed for publication] implemented a new programme of transitional release. The programme places rehabilitant individuals in a pre-release site, where they can learn from their conspecifics prior to full release into the [text removed for publication] Wildlife Reserve. Released orangutans are then followed for a further year. Between April and September 2019, Davila Ross trained four [text removed for publication] staff in coding of orangutan behaviours and seven orangutans were released into the transitional site in May 2019. This system means that it is possible to determine, within a short time period and in a pre-release setting, if the orangutans are ready for full release. According to the Wildlife Officer, [text removed for publication] '*the new, softer release approach that considers the individual orangutan skill development helps to increase survival rates. Research undertaken with Dr Davila Ross has enabled us to introduce new policies and strategies that continue to improve release methods, reducing the risk of unsuccessful releases and ultimately reducing the likelihood of death for this critically endangered species'* (**S10**).

5. Sources to corroborate the impact

S1. *Science Magazine* shortlisting of the discovery of *Pongo tapanuliensis* as a runner up for Scientific Breakthrough of the Year, 2017
https://vis.sciencemag.org/breakthrough2017/finalists/#orangutan

S2. IUCN Assessment report confirming that publication R2 supported a new classification of orangutans into three extant species, and justification for the classification of *Pongo tapanuliensis* as Critically Endangered. Copy downloaded 3 December 2020 from https://www.iucnredlist.org/species/120588639/120588662.

S3. Final Research Report - Impact of Batang Toru Hydropower Construction on Primary Forest, Orangutan Population and Habitat, Drought and Flood, Greenhouse Gases Emission and Socio-Economic Surroundings. The Center of Study, Advocacy and Nature Conservation (Pusaka Kalam) / PT North Sumatera Hydro Energy (2018): http://docplayer.net/130436049-Final-research-report.html

S4. Compilation of articles and publications from around the world (Sept 2018 - July 2020) describing the controversy surrounding the Batang Toru Dam project and petitioning for further research, exploration of alternatives and/or a moratorium on the project to protect the Tapanuli orang-utans.

S5. Link to Change.org petition to the Bank of China to withdraw funding for development of a power plant in the Bantag Toru River. https://www.change.org/p/bank-of-china-save-batang-toru-and-the-rarest-ape-in-the-world-2?recruited_by_id=81f861f0-53d0-11e5-8809-63fd6429c2e8

S6. IUCN SSC Primate Specialist Group call for a moratorium on hydroelectric power development in the Tapanuli orangutan's range: http://www.primate-sg.org/sga-moratorium/

S7. IUCN Batang Toru Hydropower Project: Factcheck and References on Key Issues. IUCN Publication, April 2020.

S8. Sumatran Orangutan Conservation Programme monitoring of Tapanuli orangutans: https://www.sumatranorangutan.org/our-work/monitoring-and-research/

S9. IUCN article calling for designation of land for the establishment of connection corridors and a moratorium on projects endangering the Tapanuli habitat https://www.iucn.org/news/secretariat/201904/iucn-calls-a-moratorium-projects-impacting-critically-endangered-tapanuli-orangutan

S10. Corroborating statement from [text removed for publication], Wildlife Officer [text removed for publication] confirming the introduction of new policies and strategies for the protection of orangutans and improved methods to release orangutans back into the wild, 8 August 2019.