



Centre for  
Biodiversity  
Analysis



Australian  
National  
University



# Centre for Biodiversity Analysis 2017-18 Annual Report

October 2018

Established in 2012, the CBA is a joint initiative of ANU and CSIRO founded on world-class biodiversity science spanning evolutionary biology, genomics, bioinformatics, spatial modelling, population and ecosystem ecology, and paleoecology; and key infrastructure such as the National Biological Collections and advanced genomic and computer laboratories, including the Ecogenomics and Bioinformatics Lab (EBL).

With contributions from ANU (RSB, CMBE and DVCR) and CSIRO (National Research Collections) the Centre for Biodiversity Analysis was renewed for a further three years from July 2017, and the capacity and reach of the CBA was further developed at the beginning of 2018 with the University of Canberra (Institute of Applied Ecology) joining the Centre as a full partner.

With a core focus of incorporating genomics, bioinformatics and spatial modelling into understanding the evolution of Australia's biodiversity and its protection, the CBA has built an interactive research community across ~70 ANU, CSIRO and UC labs in its first six years (2012-18). The Centre has used its modest resources to develop collaborations via visiting scientists, seminars and the delivery of 18 ECR-focused training workshops, five annual conferences, and seed funding of 48 Ignition grants, with over 110 researchers and students involved in an Ignition project to date.

In the current year the CBA continued to build on its activities of the last five years whilst looking for opportunities to broaden the Centre's focus to include wider applications of evolutionary biology and ways to align our science with strong impact to community and government and important strategic areas in our partners (CSIRO's Environomics FSP, ANU's Strategic Plan, etc.).

The CBA launched a new funding opportunity, Synthesis Groups, that aims to provide support for small group meetings and interim analyses that aim to generate high impact syntheses and reviews of existing data or concepts; collaborative grant proposals; and/or policy and management outcomes via knowledge transfer amongst biodiversity scientists and policy makers and managers. Our community responded strongly to this new opportunity and we funded 5 Synthesis Groups this year (~\$15-25K per group).

The CBA was made one of the Research School of Biology's National Institutes Grant goals (securing the RSB/CMBE \$100K pa contribution to CBA). This initiated stronger engagement and collaboration with ANU's Fenner School of Environment and Society (FSES) in the biodiversity management / conservation space.

CBA Director Craig Moritz led an (ultimately unsuccessful) ARC Centre of Excellence bid 'Evolutionary Science for Managing Change' with participants from ANU, UMel, UQ, USyd, Maq, CSIRO, WA DBCA.

During the current year the CBA also targeted recruitment of joint ANU-CSIRO Honours and PhD students, with the aim, along with continuing activities, of further strengthening interactions across our three partner institutions. The CBA promoted the CSIRO Postgraduate Scholarship Program and assisted with finding ANU co-supervisors and funded four student projects as part of our Ignition Grant scheme.

Our long-term goal of taking evolutionary biology from the lab into the policy landscape continued to advance with the appointment of the UC-based 0.5FTE Knowledge Broker currently underway. The CBA Knowledge Broker will play a key role facilitating a two-way exchange of information between knowledge producers (biodiversity scientists at ANU, UC and CSIRO) and those who use this knowledge (environmental policy makers and managers).

## Summary of the activities coordinated, facilitated and funded by the Centre for Biodiversity Analysis (Year 6, 2017-18).

Interactions and collaborations in **bold**. Detailed information on each activity is available on the CBA webpage via links.

Date	Activity	Type	Notes
Oct 2017	<a href="#">Citizen science and biodiversity in the age of artificial intelligence</a>	Roundtable workshop	Airfares, venue, catering. CBA contribution to <b>QuestaGame</b> workshop at the Australian Museum in Sydney. CBA funding: \$5000.
Nov 2017	<a href="#">CBA Mk 2 launch</a>	Social function	End of year lunch and welcome to the <b>University of Canberra</b> , who becomes a full partner of the Centre from 2018 onwards. CBA funding: \$1500 (catering).
Nov 2017	<a href="#">Reference- and alignment-free estimation of genetic distance using k-mers</a>	TEA Talk	Kevin Murray, ECR, Research School of Biology, <b>ANU</b>
Dec 2017	<a href="#">Anchored Phylogenomics</a>	Visiting Scientist seminar & workshop	Contribution to sabbatical visit - Alan and Emily Lemmon, <b>Florida State University</b> . CBA funding: \$5000 (accommodation).
Dec 2017	First round of new <a href="#">Synthesis Group</a> funding announced.	Funding program	3 applications received
Dec 2017	McElroy, K., et al. 2018. Mitogenomic and nuclear diversity in the Mulga Parrot of the Australian arid zone: cryptic subspecies and tests for selection, <i>Emu - Austral Ornithology</i> , 118:1, 22-35, DOI: <a href="https://doi.org/10.1080/01584197.2017.1411765">10.1080/01584197.2017.1411765</a> .	Publication	CBA-funded Ignition Project: <a href="#">Bill adaptation in parrots: finding loci involved in surface area increases by integrating morphometrics with Next Gen Sequencing</a>
Jan 2018	Catullo, Renae & Morgan, MJ & Piggott, Maxine & Alford, Ross. 2018. <i>Batrachochytrium dendrobatidis</i> surveys from the savannah regions of Northern and Central Queensland, Australia. <i>Herpetological Review</i> . 49. 41-44.	Publication	Ignition Project: Investigating the effects of diversity, distribution and chytrid load on <i>Uperoleia</i> frog skin microbial communities
Feb 2018	<a href="#">Synthesis Groups</a> approved by Liaison Committee:		3 proposals funded (CBA funding: \$60,397)
1	How to use genomic data for relatedness and quantitative genetic estimation in non-model species	Synthesis Group	Workshop/meetings, travel. Timothée Bonnet, Megan Head, Loeske Kruuk (RSB, <b>ANU</b> ), Bernd Gruber, Elise Furlan, Arthur Georges (IAE, <b>UC</b> ), Clare Holleley, David Bush (NRCA, <b>CSIRO</b> ), Ben Hayes ( <b>UQ</b> ). CBA funding: \$15,920
2	Using expert elicitation to identify impacts of climate change on Australia's alpine animals	Synthesis Group	Workshop/meetings, travel, data analyst salary. Rachel Slatyer, Adrienne Nicotra, Sonya Geange (RSB, <b>ANU</b> ), Francisco Encinas-Viso, Bryan Lessard, Juanita Rodriguez (NRCA, <b>CSIRO</b> ), Kate Umbers (WSU), Ary Hoffmann ( <b>UMelb</b> ), Erik Wapstra, Geoff While ( <b>UTAS</b> ), Ken Green (NPWS). CBA funding: \$19,700
3	Crossing Lines: a new synthesis on Asian, Melanesian and Australian biotic exchange	Synthesis Group	Workshop/meetings, travel, conference expenses, data analyst salary. Craig Moritz, Mike Crisp (RSB, <b>ANU</b> ), Janelle Stevenson

Date	Activity	Type	Notes
			(Culture, History & Language, <b>ANU</b> ), Sarah Matthews, Leo Joseph (NRCA, <b>CSIRO</b> ) Arthur Georges (IAE, <b>UC</b> ), Darren Crayn ( <b>JCU/CSIRO</b> ), Paul Oliver ( <b>QM</b> ), Elizabeth Joyce ( <b>JCU/CSIRO</b> ), Nick Matzke (U. <b>Auckland</b> ), Alicia Toon ( <b>UQ</b> ), Mike Lee ( <b>SAM</b> ) Kale Sniderman ( <b>UMelb</b> ), Kevin Rowe ( <b>NMV</b> ). CBA funding: \$24,777
Feb 2018	<a href="#">Conversation articles relevant to CBA research interests and activities</a>		(Initial list compiled by Emily Rodrigo, CBA Intern)
Mar 2018	Draft Revision of Australia's Biodiversity Conservation Strategy	Policy knowledge exchange	<a href="#">Round table discussion</a> about the <b>Dept. Environment &amp; Energy's</b> Draft Revision of Australia's Biodiversity Conservation Strategy with CBA scientists and Dept. representatives from the Biodiversity Policy/Biodiversity Conservation Division.
Mar 2018	<a href="#">Submission</a> to the Draft Revision of Australia's Biodiversity Conservation Strategy	Policy knowledge exchange	Submitted by <b>The Australian Academy of Science</b> , led by CBA Director Craig Moritz. Also ABC Radio Canberra's Breakfast Program <a href="#">interview</a> with CM about the draft Strategy.
Mar 2018	Round 8 of <a href="#">Ignition Grant</a> funding announced.	Funding program – CBA grants	7 applications received.
Mar 2018	<a href="#">Knowledge Broker</a> - part time position at UC	Policy knowledge exchange	Position description written and sent to UC HR to be advertised (hiring freeze at UC has delayed advertising)
Apr 2018	Liaison Committee (LC) Meeting	Meeting	Welcome to University of Canberra. UC representatives: Janine Deakin and Dianne Gleeson.
Apr 2018	<a href="#">Ignition Grants</a> approved by Liaison Committee:		5 proposals funded (CBA funding: \$45,000)
1	Wealth from weeds: Isolation of fungal disease resistance genes from invasive weeds for integration into crop plants	Ignition Grant	Lab consumables/ sequencing. Gavin Hunter (Health and Biosecurity, <b>CSIRO</b> ), Sambasivam Periyannan (PS, RSB, <b>ANU</b> ). CBA funding: \$10,000
2	Elucidating the diversity and population structure of the invasive coastal weed <i>Euphorbia paralias</i> (Sea spurge) in Australia	Ignition Grant	Fieldwork, sequencing. Gavin Hunter, Ben Gooden (Health and Biosecurity, <b>CSIRO</b> ), Celeste Linde (RSB, <b>ANU</b> ). CBA funding: \$10,000
3	Evolution of chemical defences in Tasmanian dalodesmid millipedes (Diplopoda: Dalodesmidae)	Ignition Grant (student co-supervision)	Sequencing; David Rowell (RSB, <b>ANU</b> ), Juanita Rodriguez (ANIC, <b>CSIRO</b> ). CBA funding: \$5,000
4	Telomere length as a biomarker for stress in an Australian pest moth	Ignition Grant (student co-supervision)	<u>Honours project</u> : Lab consumables/sequencing; \$5K stipend. Kerensa McElroy ( <b>CSIRO</b> ), Angela McGaughan (RSB, <b>ANU</b> ). CBA funding: \$10,000
5	Beating the heat? Population genomics of climate change in Australian birds	Ignition Grant (student co-supervision)	<u>Honours project</u> : travel/accom support; \$5K stipend. Hons student Elroy Au, Alexander Mikheyev, Janet Gardener (RSB, <b>ANU</b> ), Leo Joseph (NRCA, <b>CSIRO</b> ). CBA funding: \$10,000
Apr 2018	<a href="#">Theo Murphy ECMR Initiative</a> proposal	Grant application	Proposal: Evolutionary biology for the future. \$10K awarded from <b>Australian Academy of Science</b> for activity to produce an Evolutionary

Date	Activity	Type	Notes
			Science whitepaper (2019-20). Co-contributions: ANU: CBA \$5K, RSB \$2.5K, E&E \$2.5 & <b>UAdelaide</b> \$10K.
Apr 2018	<a href="#">Environomics FSP</a> Postdoc	ECR support	CBA contribution to <b>CSIRO Environomics FSP</b> postdoc salary contribution (\$50Kpa); operating contribution (\$2.5Kpa); relocation costs (\$2K). CBA funding: \$159.5K
Apr 2018	<a href="#">University bioQuest</a>	Outreach	Sponsorship and promotion of <b>QuestaGame's</b> citizen science University bioQuest. CBA funding: \$1,000
Apr 2018	Supple M, et al. 2018. Landscape genomic prediction for restoration of a <i>Eucalyptus</i> foundation species under climate change. eLife2018;7:e31835 DOI: <a href="#">10.7554/eLife.31835</a>	Publication	CBA funded Ignition Project: <a href="#">How local is local? Landscape genomics in Yellow box</a>
May 2018	<a href="#">TreeScaper: Visualizing and Extracting Phylogenetic Signal from Sets of Trees</a>	Training workshop	Jeremy Brown, <b>Louisiana State University</b> sabbatical visit hosted by Craig Moritz. 19 workshop participants: 14 ANU, 3 CSIRO, 2 UC.
May 2018	<a href="#">Phylogenetic Tales from the Genome: Sagas, Myths, and Mystery</a>	TEA Talk	Jeremy Brown, <b>Louisiana State University</b>
June 2018	CSIRO <a href="#">Environomics FSP</a> -CBA post-doctoral fellow appointment	Joint CSIRO-ANU postdoc	Renee Catullo commenced (supervisors: Craig Moritz, RSB, <b>ANU</b> and Sarah Mathews, ANH, <b>CSIRO</b> ).
June 2018	The Earth BioGenome Project and Chromosomes in the light of evolution	Visiting scientist seminar	Airfares and accommodation for Harris Lewin, <b>UC Davis</b> . CBA sponsorship of 2018 <b>Genetic Society of Australasia conference</b> (proposed by Janine Deakin, UC). CBA funding: \$2000
July 2018	CBA Mk 2 formally established		Variation to the CBA contact (Umbrella Agreement) to include the <b>University of Canberra</b> fully executed.
July 2018	CBA – <a href="#">NIG</a> Goal	External funding	The CBA was made one of the Research School of Biology's <b>National Institutes Grant</b> goals: <i>Achieving impact in biodiversity management through collaborative evolutionary biology: The Centre for Biodiversity Analysis</i> . Funding: \$100K pa (RSB/CMBE contribution to CBA). Requires strong CBA engagement and collaboration with <b>Fenner School of Environment and Society</b> (FSES) in the biodiversity management / conservation space.
July 2018	<a href="#">ARC Centre of Excellence</a> bid submitted	Grant application	<b>ARC CoE</b> in Evolutionary Science for Managing Change (for funding commencing 2020). Bid led by CBA Director Craig Moritz; participants from <b>ANU, UMel, UQ, USyd, Maq, CSIRO, WA DBCA</b> . Unsuccessful.
July 2018	Moon, K., et al. 2018. Penguin ectoparasite panmixia suggests frequent extensive host movement within a colony. <i>The Auk</i> 135:657-668. doi: <a href="#">10.1642/AUK-17-226.1</a>	Publication	CBA-funded Ignition Project: <a href="#">Penguin ectoparasites of the Southern Hemisphere</a>
Sept 2018	Round 2 <a href="#">Synthesis Group</a> and Round 9 of <a href="#">Ignition Grant</a> funding announced.	CBA grants	2 Synthesis Group and 11 Ignition Grant proposals received.

Date	Activity	Type	Notes
Sept 2018	Liaison Committee Meeting	Meeting	
Sept 2018	Senate Inquiry into the Faunal Extinction Crisis	Policy knowledge exchange	CBA Director Craig Moritz answered questions at the Senate Inquiry into the Faunal Extinction Crisis
Oct 2018	<a href="#">Synthesis groups</a> approved by Liaison Committee:		2 proposals funded (CBA funding: \$45,000)
1	Improving species conservation: Pathway to the wild	Synthesis Group	Co-funded with <b>Fenner School of Environment and Society</b> . Adrian Manning ( <b>Fenner</b> ), Craig Moritz (RSB), Jennifer Pierson ( <b>Tidbinbilla, ACT Gov</b> ), Andrew Young ( <b>CSIRO</b> ). CBA funding: \$15,000
2	Reconciling comparative and meta-analytic practices in an era of big data	Synthesis Group	Workshop at Kioloa, flights for international speakers. Daniel Noble, Megan Head, Mike Jennions (RSB, <b>ANU</b> ), Ross Thompson (IAE, <b>UC</b> ). CBA funding: \$23,665
Oct 2018	<a href="#">Ignition grants</a> approved by Liaison Committee:		7 proposals funded (CBA funding: \$67,570)
1	eDNA: The next frontier of pest and biological control detection in agriculture	Ignition Grant	Fieldwork, sequencing, RA salary. Valerie Caron (Health and Biosecurity, <b>CSIRO</b> ), Dianne Gleeson, Cat Campbell (IAE, <b>UC</b> ). CBA funding: \$10,000
2	Evo-devo in non-model beetles by studying herbivorous ladybirds (Coccinellidae)	Ignition Grant	Fieldwork, consumables, sequencing. Hermes Escalona, Adam Slipinski (ANIC, <b>CSIRO</b> ), Maja Adamska (RSB, <b>ANU</b> ), Yoshinori Tomoyasu ( <b>Miami U</b> ). CBA funding: \$9,500
3	Evolution of Müllerian mimicry in Australian velvet ants (Hymenoptera: Mutillidae)	Ignition Grant	<b>Atlas of Living Australia</b> co-funded Ignition Grant. DNA extraction, library prep, sequencing. Juanita Rodriguez, Thekla Pleines (ANIC, <b>CSIRO</b> ), Renee Catullo (RSB, <b>ANU</b> ), Claudia Schipp ( <b>U Queensland</b> ), Kevin Williams ( <b>CDFA, USA</b> ), Joseph Wilson ( <b>USU-Tooele</b> ). CBA funding: \$10,000; ALA \$5,000.
4	Laser scanning ecosystem structure to map habitat quality and measure landscape change	Ignition Grant	Fieldwork, technical salary. Kara Youngentob, (RSB, ANU), Adrian Manning (Fenner, <b>ANU</b> ), Tommaso Jucker ( <b>CSIRO, WA</b> ). CBA funding: \$9,850
5	Developing hyRAD-X capabilities in the CBA for population genomics and identification of cryptic species: a high-throughput tissue to SNP pipeline, tested in <i>Monotoca</i> (Ericaceae)	Ignition Grant	DNA extraction, library prep, sequencing, HyRAD-X development, RNA extraction, Bioinformatics salary. Todd McLay, Sarah Mathews, Dave Albrecht (ANH, <b>CSIRO</b> ), Luisa Teasdale (ANIC, <b>CSIRO</b> ), Kevin Murray, Niccy Aitken, Ashley Jones (RSB, <b>ANU</b> ). CBA funding: \$10,000
6	New approaches to understanding trophic ecology in marine ecosystems for industry application	Ignition Grant	DNA extraction, PCR primers, Metabarcoding library prep and sequencing. Allen Rodrigo, Louis Ranjard (RSB, <b>ANU</b> ), Dianne Gleeson, Elise Furlan (IAE, <b>UC</b> ), Simon Nicol ( <b>Dept Agriculture &amp; Water Resources</b> ). CBA funding: \$8,220
7	Genetic rescue of the Southern Brush-tailed Rock Wallaby: Is there genomic evidence it is reducing inbreeding?	Ignition Grant (student co-supervision)	DNA extraction, library prep, DArT sequencing, bioinformatics. Jennifer Pierson (ANU, <b>UC, ACT Gov</b> ), Janine Deakin (IAE, <b>UC</b> ), Richard Hill ( <b>VIC Dept Land, Water &amp; Parks</b> )

Date	Activity	Type	Notes
Oct 2018	Bioplatforms Australia <a href="#">Oz Mammal Genome (OMG) Initiative</a>	Research collaboration	Contribution to <b>Bioplatforms Australia</b> OMG Coordinator Anna McDonald's salary (contract extension). CBA funding: \$10,000

## CBA Projects in progress (funded in previous 12 months)

Project	Update
<p>Tackling the unknown – a next-generation phylogenetics approach to explore the immense diversity of Australian thynnine wasps (Tiphidae: Thynninae) (July 2016)</p> <p>Thomas Semple (ANU PhD student); Rod Peakall (RSB, ANU), Andreas Zwick (CSIRO NRCA)</p>	<p>We acquired 96 samples of thynnine wasp and outgroup species from both recent collections and pinned material from the Australian National Insect Collection, with roughly 80% coverage across all genera in the subfamily. DNA extraction was completed successfully and delivered to the Australian Genome Research Facility for library preparation, target enrichment and high-throughput sequencing of Ultra-Conserved Elements. This process was delayed considerably at the sequencing facility, but has since been completed successfully with consistent yield across almost all samples. Bioinformatics and phylogenetic analysis has been planned out and is due to commence before the end of the year (Oct 2017).</p>
<p>Genomic diversity in Australian palms (July 2016)</p> <p>Sarah Mathews (CSIRO NRCA); Bee Gunn (RSB)</p>	<p>At the commencement of the CBA ignition grant in August 2016, Bee collected 32 samples of silica-dried leaf material of Australian palms from the living collections of the Royal Botanic Garden NSW Sydney. Genomic DNA was isolated from 38 taxa including three palms from herbarium vouchers from the Gauba Herbarium at ANU.</p> <p>Probe design for exon capture of nuclear markers was carried out in collaboration with Felipe De Mello Martins at ANU. We downloaded the whole genome sequence of the Phoenix dactylifera (date palm) from Genbank and transcriptome sequences from the 1 Kp project for mapping onto the annotated genome sequence. We found that the date palm genome sequence was only partially annotated which made mapping of the transcriptomes for exons boundaries information for bait design a challenge because splice sites could not be determined accurately.</p> <p>During December 2016, Bee took up a postdoctoral position at the Royal Botanic Gardens Victoria in Melbourne. Whilst she has been focusing on the phylogenomics of the Australian Asparagales, she has continued to investigate new protocols applicable for the palm project through her current job.</p> <p>In July 2017, Bee attended the XIX International Botanical Congress in Shenzhen, China and was inspired by many cutting-edge NGS methods presented by colleagues at the meeting. The Hyb-seq (Weitmier et al. 2014) method is an innovative NGS protocol, which combines genome skimming and target enrichment of baits for over 300 nuclear exon and flanking regions. The Palm Phylogeny Working Group (EUNOPS) has an exon bait kit suitable for target enrichment across all palms and we propose to apply this bait kit and protocol for pulling down the nuclear exons for Australian palms for this CBA ignition grant project. This will provide a robust phylogeny for subtribe Ptychospermatinae based on chloroplast and nuclear genomes. Furthermore, our high throughput sequence data may be combined with sequences of palms worldwide generated by the Palm Phylogeny Working Group. This will be a significant contribution for a comprehensive generic level phylogeny of all palms and enlighten the evolutionary history of the Australian palm lineages and their diversification in the global context.</p>

Project	Update
	<p>We plan to isolate palm species from the living collections at the Royal Botanic Gardens Melbourne by March 2018 and carry out the library preparation using the Hyb-seq high throughput sequencing protocol and sequencing on the Illumina HighSeq platform by September. Bioinformatics pipeline post sequencing and analyses November/December. (Oct 2017).</p>
<p>Biogeography of sex reversal and the effects of climate change on reptile sex determination (July 2016)</p> <p>Clare Holleley (CSIRO NRCA), Kerensa McElroy (CSIRO NRCA), Dan Rosauer, Craig Moritz (RSB, ANU), Arthur Georges (IAE, U Canberra)</p>	<p>This study has successfully tripled the spatial and temporal sampling of bearded dragons and tested for occurrences of sex reversal. We now have genotyped a total of 398 specimens spanning a 37-year period (1980 – 2017); whereas our last published report included just 131 individuals spanning a 9-year period (2003 – 2011) [Holleley et al., 2015]. Sex reversal occurrences are geographically clustered and temporally stable, with the highest-incidence occurring on the border of NSW and QLD. This suggests that it is possible for mixed-model systems of sex determination (GSD + thermal override) to exist stably in the short term, with low rates of sex reversal. It also suggests that loss of the heterogametic sex chromosome could be buffered by immigration from surrounding populations.</p> <p>To understand how the occurrence of sex reversal relates to real-world climate data, we developed models to probabilistically estimate egg incubation date and nest location based on adult capture data. We used this framework to query publicly available climate datasets and estimate the likely egg incubation temperatures in the field. Despite having an increased empirical dataset, we did not detect a significant correlation between predicted nest environment (mean maximum temperature and mean diurnal temperature range) and sex reversal. This suggests that occurrence of sex reversal in the wild might be more closely associated with variability in the physiological threshold for sex reversal (temperature sensitivity) rather than an absolute temperature experienced during development. However, the statistical power of this model could be improved with new information on the age structure of wild populations, life-span in the wild and territory size of female individuals.</p> <p>DNA extractions from formalin preserved specimens have proved to be challenging and thus we have not yet been able to include these samples in the analyses mentioned above. However, efforts continue and we are optimistic that we will have successful workflow for formalin preserved specimens in 2018, adding another potential 933 specimens from museum collections nationally (Oct 2017)</p>
<p>Characterizing the evolutionary and ecological diversity of invertebrates in the Monsoonal vine thickets of the Kimberley (July 2016)</p> <p>Russell Dinnage (RSB, ANU); Marcel Cardillo (RSB, ANU), Gavin Huttley (RSB, ANU), Owain Edwards (CSIRO Land &amp; Water)</p>	<p>Report not provided (delays in contract signing has delayed this project).</p>
<p>The Untold Story of Underground Communities: Fungi and Soil Seed-banks in Mountain Ash forests (July 2017)</p> <p>Elle Bowd (ANU PhD student, Fenner); David Lindenmayer, Sam</p>	<p>Report not provided</p>

Project	Update
Banks, Fenner (Fenner, ANU), Andrew Bissett (NRCA, CSIRO), Tom May (Royal Botanical Gardens, VIC)	
Biodiversity change: A risk factor for human health? (July 2017)  Aparna Lal (ANU); Karel Mokany, (CSIRO)	Analyses are underway for our Ignition Grant.
Phylogeny of the longhorn beetle genus <i>Rhytiphora</i> (Coleoptera: Cerambycidae) (July 2017)  Lauren Ashman (ANU PhD student), David Rowell (RSB, ANU), Adam Slipinski, Andreas Zwick (ANIC, CSIRO)	Sequencing has been completed and will now be analysed. Findings will be written as a chapter of LA's PhD thesis.
Uncovering the Hare Microbiome (July 2017)  Robyn Hall (H&B, CSIRO), Benjamin Schwessinger, John Rathjen, Louis Ranjardi (RSB, ANU)	An ANU Masters Student has been recruited to work on this project. Somasundhari Shanmuganandam will be co-supervised by Robyn Hall (CSIRO) and Benjamin Schwessinger (ANU). Her ANU and CSIRO student agreements have been fully executed.
Understanding biological invasions: assessing the biosecurity threat of the pink bollworm to Northern Australia (July 2017)  Angela McGaughran, Rob Lanfear (RSB), Tom Walsh, (CSIRO)	We have spent our grant money on miniON and DaRT sequencing and the remaining funds (\$1,500) will go towards publication costs when we're at that stage.
Landscape genomics of a dryland river keystone species (July 2017)  Jake Gillen (Fenner, ANU); David Bush (NRCA, CSIRO)	Report not provided