



The Remote Sensing Research Centre

2016 Annual Report



Remote Sensing Research Centre: **Output and Outcomes for 2016-2017**

SCIENCE IMPACT



346
SCIENTIFIC
PUBLICATIONS



6,458
CITATIONS



6 PhD
GRADUATES
(54 SINCE 2000)



> 20
CONFERENCE
PAPERS

SUPPORTING GOVERNMENT



15 RESEARCH &
ACADEMIC STAFF



COLLABORATIVE
PARTNERS ACROSS
3 STATES



CONSISTENT
SATELLITE IMAGE PRODUCTS
FOR LEGISLATED MAPPING &
MONITORING



35 YEARS
OF LANDSAT SATELLITE
IMAGERY & SENTINEL 2

APPLIED RESEARCH



NATIONAL
HORTICULTURE MAPPING
& MONITORING



1,000 KM
OF REEFS SURVEYED & MAPPED



**CONFERENCE &
STANDARDS**
FIRST IN AUSTRALIA



FIELD TO IMAGE
NEW TOOLS

NATIONAL COORDINATION



330
MEMBERS



8 NATIONAL
COMMUNITY MEETINGS



5
ONLINE TECHNICAL
WORKSHOPS &
WEBINARS



10 YEAR PLAN
AUSTRALIAN EARTH OBSERVATION
COMMUNITY PLAN - 2026



GLOBAL
FORMAL LINKS TO
GLOBAL EO ACTIVITIES

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1. The Remote Sensing Research Centre

The Remote Sensing Research Centre (RSRC) functions as a leading national and international research and training centre for biophysical remote sensing for understanding and solving environmental monitoring and management problems.

The significant investment and critical mass we have in advanced field data collection equipment and techniques, all forms of image data processing, unique long term large scale image data sets, and methods for linking these, enables our activities to develop significant advances in knowledge and applications of EOS in Australia and globally for mapping and monitoring:

- vegetation height and canopy structure from tree to continental scales;
- environmental properties from site (m^2) to continental (10^6 m^2) scales and separating human induced changes from natural variability;
- the composition and energy dynamics of urban environments; and
- the composition, structure and productivity of terrestrial and marine systems (seagrass and coral reefs).

In addition we provide the basis for Australia to develop a coordinated national capacity for Earth Observation, through our roles in initiating, developing, leading and running:

- Australia's Terrestrial Ecosystem Research Network (www.tern.org.au)
- Australia's first long term plan for ecosystem science and the resultant establishment of Australia's Ecosystem Science Council (www.ecosystemscienceplan.org.au)
- The Australian Earth Observation Community Coordination Group (www.aeoccg.org.au) and resultant Australian Earth Observation Community Plan – 2026 (www.aeoccg.org.au/aeocp-the-plan)

1.1. Message from RSRC Director Professor Stuart Phinn

2016 was a very productive year for our centre on all levels of teaching, applied research and national to international coordination. On the teaching front our cohort of doctoral students grew, increasing our fun and highly engaging international group to 14 students, with students from each continent, but still very few Australians. Everyone continues to contribute by helping each other with proposals, presentations, fieldwork, coding/processing and making sure their work has an impact. We had six students successfully defend their thesis and graduate out into positions across Australia and internationally. This group and our alumni continue to drive and support what the centre does and our productivity and success is mainly as a result of this network and hard work.

On an applied research side major progress was made in our reef mapping pilot projects, led by Dr Chris Roelfsema, and now covering two major sections of the Great Barrier Reef through the support of the Great Barrier Reef Foundation. We also played a lead role in enabling NASA to successfully start its CORAL project across the Great Barrier Reef.

On the terrestrial side, the Joint Remote Sensing Research Program moved to the first operational use of the Sentinel 2a image archive as part of the workflow in several state governments and is now moving towards a fully linked Landsat-Sentinel archive for all of Australia. At a more detailed level, JRSRP combined with our Horticulture Innovation Australia project, led by Assoc. Professor Andrew Robson, from JRSRP's new partner at University of New England, to develop and deliver new national land use mapping practices focussed on horticultural industry requirements for mangoes, macadamia and avocado. Dr Kasper Johannsen has lead our push into the drone/UAS space in building our drone and sensor fleet and all associated calibration/validation requirements. We also successfully ran Australia's first ever "environmental drone applications conference <http://conf2016.uas4rs.org.au/> "and have carried that through to 2017.

In terms of national coordination, the AEOCCG completed another national first by developing and delivering Australia's first ever whole of community – industry-government-research, 10 year plan for Earth Observation www.aeoccg.org.au/aeocp-the-plan which is now being implemented and enabling Australia to present a united front nationally and internationally to building its Earth Observation Program.

Special thanks to Dr Chris Roelfsema for co-directing and keeping us all linked, Jo Edkins for making everything happen smoothly and keep running across so many areas, and the beyond amazing finance, HR, technical and administrative staff of the School of Earth and Environmental Sciences.

1.2. RSRC Senior Researchers

Dr Chris Roelfsema

Research interests: Monitoring ecosystem health of coral reefs and seagrass habitats, integrating field and remote sensing image datasets, calibrating and validating of remotely sensed imagery in coastal environments, and the developing cost-effective benthic habitat mapping approaches. He has developed unique field methods for the calibration and validation of high/low spatial resolution, multi-/hyper-spectral airborne and satellite imagery in combination with object based image analysis approaches. These methods have been adopted as standard practice in a number of resource management agencies and research institutes around the world.

Current projects: Developing an approach and mapping geomorphic zonation and benthic composition for the full extent of the Great Barrier Reef, currently these maps do not exist to that level of detail and extent and will support monitoring, modelling and management.

<https://www.rsrc.org.au/gbrcommon>

Dr Peter Scarth

Research interests: Broad remote sensing skills across terrestrial and aquatic environments. Working to democratise spatial data access and use. Happiest when producing and delivering automated, operational and validated national and global scale products that can be used by scientists, policy and the public.

Dr Kasper Johansen

Research Interests: A focus on designing approaches for automatic mapping and monitoring of features in natural, agricultural, mining, and urban environments. Several of Kasper's projects have used UAV data (e.g. mine site rehabilitation; oil palm mapping; lychee, banana, avocado, mango and macadamia mapping).

Developing specialised techniques for GEOBIA and innovative approaches for integrating field survey data of biophysical variables with high spatial resolution image data. Several of Dr Johansen's developed methods have been adapted by industry (e.g. Trimble Navigation Limited), NGO's (Sugar Research Australia), and government agencies and councils (e.g. Victoria Department of Sustainability and Environment and Brisbane City Council).

Current Projects: Automatic geographic object-based image analysis (GEOBIA) and vegetation structure mapping of mango, avocado and macadamia plantations; monitoring of mine site rehabilitation sites for assessing the safety, stability and sustainability using multi-spectral UAV image data; and mapping of sugarcane grub damage. Also involved in TERN's AusCover facility, mainly focussing on field and airborne image data collection and processing.

2. Objectives, Goals and Primary Activities

The Remote Sensing Research Centre's four guiding objectives are:

- **Centre Research, Coordination and Training**
To maintain and develop the RSRC and UQ as a leading international research, research training, and research to operational activities centre for use of remote sensing in earth observation and monitoring.
- **Core Projects**
To develop and maintain our centre's internationally unique critical mass of highly trained staff, specialized equipment, software and databases necessary to undertake and deliver research projects (knowledge, methods, software) that enable mapping, monitoring and modelling of our ecosystems from local to global scales.
- **Earth Observation Coordination**
To act as the national focus that provides the resources and personnel necessary to maintain and develop Australia's national Earth Observation coordination capacity across all levels of government, private industry, non-government groups and education.
- **Long Term Sustainability**
To provide the operational, staffing and training environment necessary to develop and maintain the highest level research and research training capacity for remote sensing at UQ while providing industry, government and academia with the next generation of ecosystem scientists and managers who are highly skilled in the practical application of remote sensing.

Our ongoing goals are to:

1. Further establish our centre as the highest-quality and impact remote sensing teaching and research centre in Australia, and one of the top five globally.
2. Continue to build on our basic operating principles, obtaining and leveraging more competitive grant, government, NGO and industry funding and sustaining key activities, such as the Joint Remote Sensing Research Program, to allow retention of our high quality postdoctoral appointments and research fellows.
3. Develop an effective ecosystem science focus, in support of activities in the physical geography program where the monitoring and modelling of ecosystem processes requires some form of remotely sensed data.
4. Continue to provide professional and academic support to sustain and develop key national coordination activities, such as the Australian Earth Observation Coordination Group and the Long Term Plan for Ecosystem Science.
5. Develop a start-up private industry group based on RSRC/JRSRP principles for non-university and government work – break the mould and set new boundaries!

We aim to increase our research profile, build a collaborative research base into industry and government, continue to attract high quality postdoctoral appointments and doctoral students internationally and drive more students to undergraduate remote sensing and postgraduate coursework.

2.1. Primary Activities for 2016-2020

Table 1: Proposed RSRC objectives, timelines and milestones 2016 – 2020, status as of 20 June 2017.

Strategic Activity [Objective]	Timeline [Times]	Milestones [Outputs]	Status
Centre research coordination and training. <i>To maintain and develop the RSRC and UQ as a leading international research, research training, and research to operational activities centre for use of remote sensing in earth observation and monitoring.</i>	1. Ongoing activities [weekly]		
	• Group research discussion and review meetings	Group research discussion and review meetings [Record of meeting materials on RSRC wiki, conference talks ready for conference]	Ongoing
	• Monthly instructional activities on all aspects of remote sensing, science and ecosystem science and management	Monthly instructional activities on all aspects of remote sensing, science and ecosystem science and management [Record of meeting materials on RSRC wiki, Entire group is brought to the same level to support one another]	Ongoing
	• Participation in introductory and advanced remote sensing class instructions by RHD and research staff.	Participation in introductory and advanced remote sensing class instructions by RHD and research staff. [RHD staff participation in course and teaching experience]	Ongoing
	2. Internship program establishment and operation. [September 2015 – March 2016 program start]	Internship program establishment and operation. [Program guidelines and operational program]	Ongoing
	3. Mentoring program revision and operation to fit in with School. [March – May 2015 –program start]	Mentoring program revision and operation to fit in with School. [Mentoring guidelines and active process in RSRC]	Ongoing
	4. Professional development program linked to EO in industry, government and research institutions. [September 2015 – March 2016 program start]	Professional development program linked to EO in industry, government and research institutions. [EO RHD students placed in relevant EO organisations with knowledge of main skills]	Ongoing

Strategic Activity [Objective]	Timeline [Times]	Milestones [Outputs]	Status
Core projects <i>To develop and maintain the centre's internationally unique critical mass of highly trained staff, specialized equipment, software and databases necessary to undertake and deliver research projects (knowledge, methods, software) that enable mapping, monitoring and modelling of our ecosystems from local to global scales.</i>	1. Essential staff funding – agreements and proposals to fund essential research and support staff. [June - September 2015]	Essential staff funding – agreements and proposals to fund essential research and support staff. [Support staff in place in an effective work environment and position]	Complete
	2. Infrastructure funding and operational – agreements and proposals to update and maintain all field instrumentation (spectrometers, laser scanners, etc). [June – November 2015]	Infrastructure funding and operational – agreements and proposals to update and maintain all field instrumentation (spectrometers, laser scanners, etc). [Infrastructure in an operational and accessible state, along with documentation, trained personnel and use – data management guidelines]	Complete
	3. Joint Remote Sensing Research Program – maintain and develop operational plan and budget, annual meeting/report, deliver research goals. [monthly, meeting and report by August 2015]	Joint Remote Sensing Research Program – maintain and develop operational plan and budget, annual meeting/report, deliver research goals. [Active program, papers and operational techniques addressing JRSRP research plan items]	In Progress
	4. Short-term research projects (0.5 – 1 year) Proposals, project work, data. Software, publications and communication-use products. By existing staff and RHD (incl. Hons) students where applicable. [ongoing]	Short-term research projects (0.5 – 1 year) Proposals, project work, data. Software, publications and communication-use products. By existing staff and RHD (incl. Hons) students where applicable. [Proposals, project work, data. Software, publications and communication-use products.]	In Progress

Strategic Activity [Objective]	Timeline [Times]	Milestones [Outputs]	Status
	5. Long-term research projects (3-5 years) Proposals, project work, data. Software, publications and communication-use products. By existing staff, new staff and RHD (incl. Hons) students where applicable. Includes all competitive, state and national programs, as well as international programs through foreign space agencies and international projects. [ongoing]	Long-term research projects (3-5 years) Proposals, project work, data. Software, publications and communication-use products. By existing staff, new staff and RHD (incl. Hons) students where applicable. Includes all competitive, state and national programs, as well as international programs through foreign space agencies and international projects. [Proposals, project work, data. Software, publications and communication-use products.]	In Progress
	6. Trial projects: (a) Industry – joint venture program; (b) Open data and software Development of proposals and projects with appropriate IP and open-access for specific clients. [(a) – January-June 2016] [(b) July-December 2016]	Trial projects: (a) Industry – joint venture program; (b) Open data and software Development of proposals and projects with appropriate IP and open-access for specific clients. [Project proposals]	In Progress
Earth Observation Coordination <i>To act as the national focus that provides the resources and personnel necessary to maintain and develop Australia's national Earth Observation coordination capacity across all levels of government, private industry, non-government groups and education.</i>	1. Maintain and develop funding to enable continued coordination and operation of all AEOCCG activities through JRSRP at UQ. [revise by January 2016, 2017]	Maintain and develop funding to enable continued coordination and operation of all AEOCCG activities through JRSRP at UQ. [Support staff, operational website, activities for whole of community communication and coordination]	Complete
	2. Maintain involvement in AGEOSWG as essential link of government to the Australian EO community. [ongoing]	Maintain involvement in AGEOSWG as essential link of government to the Australian EO community. [Input from AEOCCG included in AGEOSWG activities]	In Progress
	3. Establish and maintain involvement in CEOS as essential link of government to the Australian EO community. [July 2015 – December 2016]	Establish and maintain involvement in CEOS as essential link of government to the Australian EO community. [Input from AEOCCG included in CEOS activities]	In Progress

Strategic Activity [Objective]	Timeline [Times]	Milestones [Outputs]	Status
Long term sustainability <i>To provide the operational, staffing and training environment necessary to develop and maintain the highest level research and research training capacity for remote sensing at UQ while providing industry, government and academia with the next generation of ecosystem scientists and managers who are highly skilled in the practical application of remote sensing.</i>	1. Develop and maintain core set of research priorities within the centre that relate to its established long term knowledge, data, skills and personnel bases. [April – July 2015, annual revisit]	Develop and maintain core set of research priorities within the centre that relate to its established long term knowledge, data, skills and personnel bases. [Developed program on RSRC and implemented priorities for Wiki and website]	Complete
	2. Develop and maintain a set of regular centre activities that enables term provision of highly skilled and experienced EO scientists and a commitment to an open EO community that shares and builds their knowledge base. [April – July 2015, annual revisit]	Develop and maintain a set of regular centre activities that enables term provision of highly skilled and experienced EO scientists and a commitment to an open EO community that shares and builds their knowledge base.	Complete

3 Research Activities

The RSRC uses remotely sensed data (ground, boat/submarine, airborne and satellite), field data and various processing algorithms and programming codes, to measure, map and monitor biophysical properties in terrestrial, atmospheric and aquatic environments. The information we produce is developed in association with scientists and managers to better understand and manage the earth's environments and resources.

Our research provides private and public sector organisations with the techniques to turn satellite and airborne images and field survey data into meaningful maps or information for one or many points in time. These results can then be used to better understand where, how and why environments are changing, and to separate natural changes from those produced by humans.

There are several formally established and funded groups that operate within the RSRC. These are complemented by several areas of activities where there is a critical mass of research of researchers.

3.1. Main Research Areas

Within the centre our staff and students are engaged in three main areas of research, each of which involves close collaboration with scientific institutions, government agencies and private industry across Australia and globally. The three areas are:

- **Biophysical Remote Sensing**
Understanding how remotely sensing can be used to measure, map and monitor biological, physical and chemical properties of the earth's environments.
- **Image Acquisition, Processing, Analysis and Visualisation**
Techniques for collecting and transforming data collected from satellite, aircraft, drones, and in-situ sensors to measure, map and monitor biophysical information.
- **Communication, Sharing and Application**
Techniques for effective use of biophysical information derived from remotely sensed data across science, industry and government.

Our research activities take two main forms, (1) centre research coordination and training, and (2) four main core project areas:

- Terrestrial mapping and monitoring
- Coastal (including coral reefs) mapping and monitoring
- Object based image analysis
- Drones and High Spatial Resolution Data Collection, Processing Mapping and Monitoring

3.2. Project Summary

Core Area	Title - Timeline	Funding Source
Terrestrial	Joint Remote Sensing Research Program - Mapping and Monitoring for Australian State and Territory Governments, 2005 -2020	Queensland, New South Wales and Victorian state governments
	Multi-scale Crop Monitoring, 2015-2018	HIA Pty Ltd – Commonwealth Dept. of Agriculture, Rural Research and Development for Profit Program
	Advanced Vegetation Mapping, 2016-2019	ARC Linkage with UNSW
	Mapping and managing degraded lands	ARC Discovery – Dr Eve McDonald-Madden
	Linking long term environmental survey and satellite image data	Google Earth Engine Discovery
	Global mud mapping - mapping global inter-tidal areas	Google Earth Engine Discovery
Coastal	Great Barrier Reef Common 'Live' Habitat Mapping, 2016-2017: 200 reefs Cairns management region	Great Barrier Reef Foundation
	Coral Reef Habitat Mapping and Monitoring, 2001-	Various
	Reprocessing 15 years of photo quadrates using next generation systems of coral reef monitoring 2017-	Caitlin Seaview project
	Seagrass Habitat Mapping and Monitoring, 2000-	Healthy Water Ways, Coastal Carbon Cluster CSIRO, DISITI.
	Capacity Building and Citizen Science, 2011-	Local agencies
	GBR Common 'live' habitat map - Pilot Study Capricorn Bunker Group, 2015-2017	Great Barrier Reef Foundation
	Remote Sensing Toolkit 2006, 2010, 2015, 2017 (Bahasa Indonesia), 2009-2010, 2013-2015.	UQ, Worldbank Coral Reef Targeted Research, SEES T& L Funding, Australia Indonesia Institute Funding.
	Seagrass thermal dynamics and Remote Sensing GBR, 2015-2017.	Great Barrier Reef Foundation
	Flinders Reef Ecological Assessment (FREA) Citizen Science Based Project, 2015-2017.	QPWS, University Underwaterclub, Crowdsourcing.
	Coral Reef Airborne Laboratory (CORAL), 2015-2017.	NASA
	Detailed Water surface temperature variability over Coral Reefs, 2016.	JCU Grant
	Placing Moreton Bay's reefs on the map, 2015.	Landcare
	Assessing the effect of Sea Level Rise on Mangroves, Seagrass and Coral in Solomon Islands, 2011-	UQ, AUSAID
	Mapping for coral reef conservation: Comparing the value of participatory and remote sensing approaches, 2011-2016.	UQ, The Shedd Aquarium, the Danajon Bank communities, Fulbright Scholarship, a UBC

Core Area	Title - Timeline	Funding Source
		Graduate Fellowship, Man in Motion Fellowship. Planet Action, the Point Defiance Zoo and Aquarium, BRITE, and the BBC Wildlife Fund. Project Seahorse is supported by Guylian Chocolates.
	Development of Underwater Spectrometer protocols, methods and equipment, 2014-	Infrastructure grant and strategic money
	ACEAS Working group: Australian seagrass habitats: condition and threats, 2012-2013	ACEAS
	Seagrass in Moreton Bay Over Time (live map), ongoing	Various
	Biophysical Properties of Coral Reef Habitats in Space and Time for Heron Reef, 2000-	ARC Linkage, CSIRO flag ship, WB Target Coral Reef Research, Digital Globe
	Coral Reef Habitats Dynamics of the Capricorn Bunker Group, 2000-	ARC Linkage, Digital Globe, UW funding
	Seagrass Dynamics Eastern Banks 2004-Current, 2000-	ARC, Coastal CRC, EHMP, QPWS, Digital Globe, UQ_UWA, CSIRO
	Coastal and Estuarine Classification Frame Work, 2013-	EHP
Object Based Image Analysis	To be commenced in 2017	
Drone and High Spatial Resolution	To be commenced in 2017	

3.3. List of Projects

Current Grants and Contracts

Year	Title of Current Grant, Contract or Project	Granting Agency	\$ Amount (if any)	Chief Investigators & Staff Member in order	Percent and Nature of your Contribution
2017-2018	Reprocessing 15 years of photo quadrates using next generation systems of coral reef monitoring	Caitlin Seaview project	\$40,000	Dr. Manuel Gonzales Dr. Julie Vercolonnie Dr. Chris Roelfsema	
2016-2017	Delivering a reef resilience plan for the Cairns management area through an integrated spatial decision support environment	Great Barrier Reef Foundation	\$237,600	Dr Chris Roelfsema Dr. Eva Kovacs Dr. Juan Ortiz Dr. Kasper Johansen Professor Stuart Phinn Professor Peter Mumby	50% design, planning, management, analysis and write up
2015-2018	Measuring rehabilitation response to fire: Implications for long term resilience and mine closure	Wesfarmers Curragh Pty Ltd	\$120,054	Dr Peter Erskine Professor Stuart Phinn Mr Phillip McKenna	
2015-2018	Multi-scale monitoring tools for managing Australian Tree Crops: Industry meets innovation	Horticulture Innovation Australia Limited	\$1,187,415	Professor Stuart Phinn	
2015-2018	Advancing vegetation classification and mapping to meet conservation needs (ARC Linkage project administered by UNSW)	University of New South Wales	\$111,140	Professor Stuart Phinn	
2015-2016	Great Barrier Reef common 'live' habitat maps: Capricorn pilot	Great Barrier Reef Foundation	\$115,342	Dr Chris Roelfsema Dr Eva Kovacs Professor Stuart Phinn Professor Peter Mumby	
2015	Duplicate record of 2014002418 Phinn	Commonwealth Scientific and Industrial Research Organisation	\$0	Professor Stuart Phinn Dr Peter Scarth	
2015-2017	Mud, glorious mud! Mapping the world's intertidal ecosystems	Google Inc	\$121,402	Associate Professor Richard Fuller Professor Stuart Phinn	

Year	Title of Current Grant, Contract or Project	Granting Agency	\$ Amount (if any)	Chief Investigators & Staff Member in order	Percent and Nature of your Contribution
2014	Development of new capabilities in Earth System monitoring	University of Queensland	\$139,210	Professor Hamish McGowan Professor Stuart Phinn Associate Professor Patrick Moss Dr Talitha Santini Dr Chris Roelfsema Dr Joshua Larsen Dr Kasper Johansen Professor Jamie Shulmeister Professor Sue Golding	
2014-2017	AusCover Facility - Brisbane Node (TERN III to V)	Commonwealth Scientific and Industrial Research Organisation	\$794,750	Professor Stuart Phinn Dr Peter Scarth	
2013-2016	Climate Change Adaptation for Natural Resource Management in East Coast Australia	Commonwealth Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education	\$1,032,913	Professor Catherine Lovelock Professor Hugh Possingham Professor Stuart Phinn Associate Professor Jonathan Rhodes	
2013-2014	Woody Vegetation Change Detection	World Wildlife Fund, Inc	\$33,000	Professor Stuart Phinn	
2013-2016	Seagrass connectivity, community composition and growth: attributes of a resilient Great Barrier Reef (led by JCU)	James Cook University	\$56,650	Professor Stuart Phinn Dr Chris Roelfsema Dr Eva Kovacs	20% design, analysis write up
2013-2017	Understanding Australia's Changing Ecosystems: Linking Long Term Satellite Image and Field Survey Archives	Google Inc	\$42,586	Professor Stuart Phinn	
2012-2016	Marine and Coastal Carbon Biogeochemistry Flagship Cluster (CSIRO Wealth from Oceans Flagship Theme)	University of Technology Sydney	\$418,000	Professor Catherine Lovelock Professor Stuart Phinn	

Year	Title of Current Grant, Contract or Project	Granting Agency	\$ Amount (if any)	Chief Investigators & Staff Member in order	Percent and Nature of your Contribution
2016- 2018	Global Coral Reef Mapping	NASA	\$200,000	Dr. Eric Hochberg and others	5% field support and field design

Completed Grants and Contracts

Year	Title of Completed Grant or Contract	Granting Agency	\$ Amount (if any)	Chief Investigators & Staff Member in order	Percent and Nature of your Contribution
2015-2016	Great Barrier Reef common 'live' habitat maps: Capricorn pilot	Great Barrier Reef Foundation	\$115,342	Dr Chris Roelfsema Dr Eva Kovacs Prof Stuart Phinn Prof Peter Mumby	40% design, planning, management, analysis and write up
2015-2016	Marine plant habitat survey and monitoring program	Griffith University	\$15,000	Dr Chris Roelfsema	50% design, planning, management, analysis and write up
2015-2016	Capacity building in coastal food resource monitoring	Australia Indonesia Institute	\$12,000	Dr.Chris Roelfsema Dr. Muhammad Kamal Prof. Stuart Phinn	70% design, planning, management, delivery and write up
2015	Seagrass monitoring workshop	Department of Perth Water	\$7,000	Dr.Chris Roelfsema	90% design, planning, management, delivery and write up
2016-2017	Development of commercial approach for and results comparison of SPOT-6/7 and WorldView-2/3 image data for mapping of sugarcane grub damage and risk using object-based image analysis.	Sugar Research Australia	\$60,000	Kasper Johansen	100% - Responsible for project
2015	Impervious surface mapping of the Brisbane Local Government Area using WorldView-2 Imagery, LiDAR data and object-based image analysis.	Brisbane City Council	\$21,000	Kasper Johansen and Sabrina Wu	50% responsible for project

Submitted Grants and Projects

Grant applications or projects submitted where the outcome is pending.

Submitted Grants and Projects	Granting Agency	\$ Amount	Chief Investigators & Staff Member in order	Percent and Nature of your Contribution
Remote sensing with Unmanned Aircraft Systems (UAS) for ecosystem science	ARC	\$810,000	A. Lucier (UTas) S.Phinn K.Johansen N.Coops	CI 20%
Capacity building for monitoring coastal environments to sustain coastal food resources for Indonesia		\$0	Dr Chris Roelfsema Prof Stuart Phinn	
Sensor calibration facility for high-accuracy spectroscopy and ultra-high resolution remote sensing	ARC	\$162,000	Lucieer A; Lucieer V; Malenovsky Z; Gonzalez L; Roberts J; Rudiger C; Robinson S; Phinn S; McGrath A,	CI 10%
Emerald: Empowering Australian Research with Virtual Supercomputing	ARC	\$2,000,000	Abramson D, Phinn S, Bernhardt D, Visscher P, Stow J, Tomlinson R, Zhou Y, Connolly S, Field M, Cummins S, Griffiths L, Dale J, Butler H, Verma B	CI 5 %
High resolution remote sensing of vegetation biodiversity	ARC	\$490,000	Lucieer, A. and Phinn, S.	CI 20%
Harnessing citizen phone and drone users to monitor ecosystems	Government	\$493,200	Dean Miller John Romney Norm Duke Chris Roelfsema	10% application design and writing
Will coral reefs continue to protect coasts in changing climate?	The Australia & Pacific Science Foundation	\$40,000	Danniel Harris Hannah Power Adroew Pmernoy Chris Roelfsema Stacy Jupiter	10% application design and writing

Submitted Grants and Projects	Granting Agency	\$ Amount	Chief Investigators & Staff Member in order	Percent and Nature of your Contribution
Developing institutional capacity for regional monitoring of coastal climate change impacts through remote sensing	Australian Government	\$45,000	Sarah Hamylton Prof Stuart Phinn, Prof Ove Hoegh-Guldberg Dr Chris Roelfsema Prof Jamaluddin Jompa Dr Nurjannah Nurdin Dr Nani Hendiarti Dr John Hedley	10% application design and writing

4 Joint Remote Sensing Research Program

The Joint Remote Sensing Research Program (JRSRP) www.jrsrp.org.au is a collaborative program that combines research, research training expertise and infrastructure from the RSRC with remote sensing groups supporting the Queensland, New South Wales and Victorian governments. The JRSRP Collaborative Partners are:

- The Remote Sensing Research Centre, University of Queensland
- Queensland Department of Science, Information Technology and Innovation
- New South Wales Office of Environment and Heritage
- Victoria Department of Environment Land Water and Planning
- The University of New South Wales
- The University of New England

Tasmanian and Northern Territory governments are also engaged in ongoing projects with JRSRP to build their own satellite environmental measurement and monitoring capabilities.

The JRSRP's aim is to increase Australia's capacity to conduct research using remote sensing and convert it to operational procedures for use in environmental monitoring and management policies at local, state and national scales.

These programs also provide critical information to the space agencies in the U.S., Europe and Japan, who operate satellite imaging systems, and to the global science community who use the algorithms developed in the program. The program's activities are of critical importance to the state governments of Queensland, New South Wales, Victoria, Tasmania and the Northern Territory who use the program's research results to understand and inform policy decisions' and legislated monitoring activities.

A major accomplishment for the program has been to acquire and process over 35 years of Landsat satellite imagery collected every month over Australia for consistent environmental monitoring. This extensive archive has significantly improved capabilities into the study of changes and trends in land cover over time.

Most recently the JRSRP has lead a coalition of state governments to interact with Geoscience Australia and the Department of Industry and Science to develop a national position on Australia's EO needs. This has enabled whole of country approaches to the national space agencies of Europe, US, China and Japan, to secure access to their EO data.

4.1. JRSRP Research Activities

The JRSRP researchers meet annually to identify and prioritise the key research needs for its collaborative partners. These are summarised in a research plan around themes such as capabilities, research and develop and projects, processing systems and product distribution and communication. The current research plan is summarised in the table below:

2.1. JRSRP Research Plan

		Priority	Timeline	Status
1. Capabilities				
1.1. Training	Data support and training <ul style="list-style-type: none"> Webinars Seminars Training notebooks 	P2-P3		
1.2. Education	Provide support, mentoring and promotion of JRSRP activities	P2		
	Maintain tasks suitable for undergraduate Student projects	P2 or P3		
	Undertake supervision of PhD and MPhil students – P2 or P3	P2 or P3		
1.3. Staff capability assessment for future requirements				
2. Research and Development Projects <i>Specific short term projects that either contribute applications to the processing system, new products, new knowledge in the program and or scientific publications</i>				
2.1. Woody Vegetation Change and Extent	Rapid Landsat woody change (existing 4b) – completed and operational for QLD			
	Rapid Sentinel woody change	P2		
	Landsat and Sentinel woody change model update	P1		
	Identification of Landsat woody regrowth	P1		
	Identification of Sentinel woody regrowth	P1		
	Identification of SPOT 5 woody regrowth (existing 4e) - (low priority for QLD)	P2 or P3		
	Woody vegetation extent improvements (existing 4f) – P1	P1		
	Woody vegetation trend (Landsat) – P2	P2		
2.2. Non-woody Change and Classification	Refinement of modified grassland mapping SCDI and development of change monitoring	P2 or P3		
	Spatial (patchiness) metrics for ground cover – P1	P1		
2.3. Biophysical Product Development	FPC – update to surface reflectance *	P1		
	Fractional cover – update/calibrate using latest site data *			
	• Landsat Model *	P1		
	• Sentinel 2 Model *	P1		

		Priority	Timeline	Status
	<ul style="list-style-type: none"> • VIIRS/Sentinel-3 models (existing 23a) * 	P3		
	<ul style="list-style-type: none"> • Validate fractional ground cover (cover under trees) 	P1		
	Leaf equivalent moisture index	3?		
2.4. Aerial Image Processing Method Development	Scanned air photo automatic rectification methods	2		
	ADS imagery radiometric correction (existing 11)			
	UAS method development *	3		
2.5. Fire Mapping	Develop operational fire scar mapping system for QLD (Landsat and Sentinel) (existing 8)	1		
	Develop operational fire scar mapping system for NSW			
2.6. Land Use Mapping	HIA project – land use mapping of tree crops (existing 41) – (deliverable for QLD)	1		
	Object based image analysis methods for land use mapping / horticulture? (existing 12)			
	Crop monitoring:			
	<ul style="list-style-type: none"> • Active crop mapping Landsat/Sentinel 	2		
	<ul style="list-style-type: none"> • Crop type mapping Landsat/Sentinel 	2		
2.7. Vegetation Structure and Biomass	Biomass field data system *[TD3]			
	Biomass library * - P2 or P3 (completed for woody biomass?)			
	Above ground Woody Vegetation Biomass *			
	<ul style="list-style-type: none"> • K&C III project * - completed? 	2 or 3		
	<ul style="list-style-type: none"> • Vegetation height updates * 	3		
	Pasture biomass (TSDM) (Landsat/Sentinel(s)/Modelling)	2 or 3		
2.8. Assessment for New Sensors (existing 13)	As required:			
	<ul style="list-style-type: none"> • VIIRS * 	3		
	<ul style="list-style-type: none"> • High resolution web services 	3		
	<ul style="list-style-type: none"> • Sentinel 1 	2 or 3		
3. Processing Systems, Product Distribution <i>Long term tasks/ongoing development and maintenance</i>				
3.1. Processing system for satellite and aerial imagery including; Landsat, SPOT, Sentinel 2, ADS imagery, aerial imagery, radar?	Develop systems for import, radiometric and geometric correction:			
	<ul style="list-style-type: none"> • Sentinel 2 	1		
	<ul style="list-style-type: none"> • Sentinel 1 	2 or 3		
	<ul style="list-style-type: none"> • Sentinel 3 	3		
	Implement methods for new products – P1 for Landsat-Sentinel cross-calibration.	1		

		Priority	Timeline	Status
3.2. Software Development and Maintenance	Update and testing of:			
	• Image analysis tool suite	2		
	• Repository	2		
	• Wikis	2		
	Evaluate RS software and platforms?			
	• SAR processing systems (existing 28b)	2 or 3		
	• Sentinel 1,3 Toolbox	3		
	• AGDC evaluation	3		
3.3. LiDar Processing System	PyLidar improvements (existing 37b)	2		
	Processing system for ground-based Lidar			
	• Operational field protocols and pre-processing*	1		
	• Algorithms for ground classification, vegetation structure and aboveground biomass	1		
	• Riparian, gully and erosion mapping and monitoring	2		
	Processing system for Airborne Lidar			
	• Operational system for standardised L0, L1, L2 products (DEMs, Vegetation height and cover, foliage profiles/structure, FPC/LAI)	1 or 2		
	• Operational systems to validate Landsat/Sentinel 2 (??) FPC	1		
3.4. Field Data Systems	• Algorithms for ground classification and vegetation structure (higher level products)	2		
	Upkeep of Cimel Sun Photometer			
	Collection, management and delivery (existing 40) * (ongoing)			
	Field data synchronisation automated update (existing 40a) * (ongoing)			
	Ground based lidar data management * (relates to Lidar systems above)	1 or 2		
	Open Data Kit and Enketo field forms * (ongoing)			
3.5. Product Distribution Systems	New field methods (GoPro, Phenocams, VegNet)	2		
	Maintain and enhance RDS Queensland Node infrastructure *	1 or 2		
	• VM integrity *			
	• Software systems inc Geoserver and PostGIS*			
	Maintain production of Landsat 8 seasonal surface reflectance	1		
	Maintain production of Fractional cover and derived products: (ongoing)	1		
	• Persistent Green*			

		Priority	Timeline	Status
	• Ground cover Landsat*			
	• Seasonal Deciles*			
	Build improved Data Discovery, Delivery portal and online tools:*			
	• Field Data portal *	2		
	• Biomass data portal *	2		
	• AusCover API *	2 or 3		
	○ Sub-setting tools *			
	○ Statistical APIs *			
	○ Discovery database			
	Point cloud, airborne data delivery (e.g., potree) * - P2 (P1 for standard ALS products for QLD)	1 and 2		
4. Communication				
4.1. Scientific Quality and Defensibility (existing 15)	Scientific publications from research projects (link to publication plan)	1		
4.2. Engagement	National engagement:			
	• Australian Earth Observation Community Coordination Group (AEOCCG)	2		
	• SCIN *	3		
	• NCI *	2		
	• CSIRO *	2 or 3		
	Private sector engagement (existing 16)	3		
	International engagement:			
	• CEOS*	2 or 3		
	• TLSIIG *	3		
	• GeoGLAM	3		
	End user workshops *	2		

5 AusCover for the Terrestrial Ecosystem Research Network (TERN)

JRSRP is responsible for delivering the Brisbane Node activities for TERN's Auscover facility. AusCover is the remote sensing data facility of the [Terrestrial Ecosystem Research Network \(TERN\)](#). TERN was initially set up and directed as a group, led by Professor Stuart Phinn, and involved a large number of the principles from the Joint Remote Sensing Research Program.

AusCover provides a national expert network and data delivery service for provision of Australian biophysical remote sensing data time-series, continental-scale map products, and selected high spatial resolution datasets (such as LiDAR and hyper-spectral imagery) over TERN sites supported by field data collection. Coordinated by a network of nodes from each state, AusCover supports a nationally consistent approach to the delivery and calibration/validation of key current and future core satellite-derived datasets. The primary goal is to assist in the generation of ecosystem science data products designed specifically for Australian conditions.

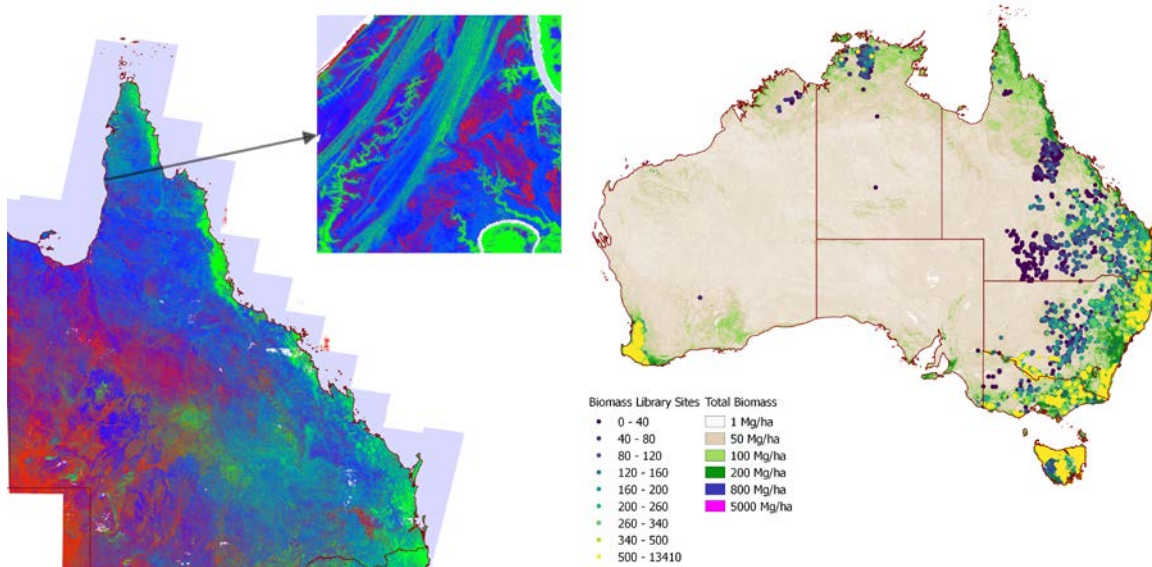
This activity builds on JRSRP work in Queensland and extends it nationally, to deliver new national products for environmental monitoring from remotely sensed data through Australia's national environmental data infrastructure.

The main activities delivered by the TERN AusCover Brisbane node during 2016-17 have been:

Work Package	Project	Budget	Project Status
WPA1b	Fractional cover - Landsat and Persistent Green (woody) Cover <ul style="list-style-type: none"> Regular and timely updates of seasonal FC, GC, PG, FC deciles specific soil/veg type validation RT 	10,000	Complete
WPA1f	Aboveground Biomass (woody) <ul style="list-style-type: none"> Support maintenance of ground-based Biomass data library Maintenance of ground-based biomass data library; delivery of veg height; upload form for biomass library (ODK/Enketo) RT 	7,500	Complete
WPA2b	Improved data discovery and delivery and online tools Data Collation and Metadata <ul style="list-style-type: none"> Update: Maintain field data portal; AusCover API (inc. chopper/vegmachine); Ops data systems for applications; - Enketo server; point cloud, airborne data delivery (e.g., potree) RT 	20,000	In Progress
WPA4a	Fractional cover from Sentinel-2 and recalibration. Note: This is in <i>collaboration</i> with GA. <ul style="list-style-type: none"> Production of Seasonal, continental FC test product from S-2 	15,000	Complete
	<ul style="list-style-type: none"> Coordinating processing approaches (preferably on the Australian Geoscience DataCube) across partners (GA, USGS, NASA, etc.) NF 		In Progress
WPA5	Airborne Data QC and Processing <p>Coordination among partners around specific product, processing approaches to produce e.g. base landcover map for all sites from</p>	10,000	In Progress

Work Package	Project	Budget	Project Status
	airborne and LiDAR vegetation structural parameters for each site collected. KJ		
WPA7a	Aboveground biomass (rangeland and grasslands), including field campaign costs. Note: This is in <i>collaboration</i> with UQ, UNE, UNSW & CSIRO., as well as NRM Spatial Hub:	40,000	
	<ul style="list-style-type: none"> Operationalizing of seasonal rangeland/grassland biomass product production. 		Not Started
	<ul style="list-style-type: none"> Document a sampling procedure and ODK form. 		In Progress
	<ul style="list-style-type: none"> Demonstration data delivered for grass/rangeland biomass quadrants at following sites: Fowler's Gap, Liveringa, Armidale Smart-Farm, Spyglass. 		Not Started
WPA9	Field data collation and Metadata Note: This is in <i>collaboration</i> with QLD DSITI, CSIRO & UTas RF: <ul style="list-style-type: none"> Set up field data clearing house for all new UAS, ODK data (DSITI point of truth) AusCover site details management Finalise all field data collected to date; Scope and support (where appropriate) additional validation datasets, e.g. national TLS, AusPlots, non-TERN data; Separate AusCover field and biomass library DBs on AusCover QLD server 	15,000	In Progress

5.1. Example Outputs



Left image shows Sentinel two fractional cover for summer 2016 2017 with inset showing mangrove zonation detail around the northern gulf. **Right image** shows locations of biomass library field sites along with a national biomass map.

6 Australian Earth Observation Community Coordination Group (AEOCCG)

The AEOCCG is Australia's primary coordination group for developing and applying earth observation applications, linking all levels of government, private industry, non-government organisations and research institutions.

Professor Stuart Phinn established the AEOCCG in 2013 and chairs this group, which is formally constituted through the Commonwealth Government's Satellite Utilisation Policy (www.aeoccg.org.au).

This group was formed to enable **ALL** of the people who collect and use earth observation data to have a forum to present and discuss their activities and define their needs for support from industry, academia and government. This is not a government focused, spatial-science special interest group. It is meant to span all disciplines and provide an inclusive and collaborative resource to improve access to and use of earth observation data for Australia.

6.1. AEOCCG Activities

2016 has seen the AEOCCG grow in membership, momentum and in the range of activities. A summary of what has been happening:

- Whole of Community Meetings: we hold periodic, interactive and inclusive meetings for all of the Australian earth observation community to attend. These meetings include updates, presentations and group discussions covering wide ranging EO related topics.
- Studies and activities: The AEOCCG provides a platform for the EO community to provide their feedback and opinions on current studies going on within and outside of the group. During 2016 contributions were received from a wide range of activities including:
 - Australian Earth Observation Community Plan: Beyond 2021. The process to develop the plan was coordinated by the AEOCCG and the majority of the material in the plan was derived from contributions from across the Australian Earth Observation community.
 - Auscover Feedback Survey: The AEOCCG community was asked to contribute in shaping the future activities of AusCover (www.auscover.org.au), which provides national level image data, biophysical map products, field data and research development capacity for Australia
 - "The Use of Spatial Agricultural Information across the Supply Chain". The AEOCCG was asked to contribute to assist in determining what the key areas of operation and spatial information needs are, across all sectors, within the agricultural supply chain.
- Technical Capacity Building Webinars and Workshops. In 2016 we launched the platform for the technical capacity building; this initiative has been well received across the EO community.
 - "Accessing AusCover Data" presented by Dr Peter Scarth. This webinar provided technical demonstrations on how to discover some of the many data sets openly available on the NCI and query them using web services.
 - "Australian Geoscience Data Cube" presented by Alexis McIntyre of Geoscience

Australia. This webinar demonstrated how to access national collections of Earth Observation data on the National Computational Infrastructure (NCI), and use the Australian Geoscience Data Cube in a virtual desktop environment on the NCI.

- Establishment of Working Groups:
 - Australian Satellite Calibration Working Group
 - Unmanned Airborne Systems Group
 - Australian Marine Remote Sensing Group
 - EC Horizon 2020 Program
- Coordination - EO Australian Earth Observation Community Plan - 2026
In 2016 AEOCCG lead the development and implementation of Australia's first community driven plan to significantly build its EO activities government, research and private sector applications for the next 10 years. This process involved extensive consultation nationally and the development of a community driven plan.

The Plan delivers a unifying focus to motivate and guide the Australian Earth Observation community to take coordinated action towards achieve the vision that: ***By 2026, the Australian Earth Observation sector will develop and deliver high-quality Earth Observation information, infrastructure, and services that are used widely by government, industry, research and the community in Australia and internationally.***

The Plan has been prepared through open consultation with the Earth Observation community, including key stakeholders from universities, Earth Observation industry, and government bodies.

The plan was prepared by a steering committee lead by Professor Stuart Phinn and launched as part of the Committee on Earth Observation Satellites (www.ceos.org) annual meeting in November 2016. The plan is now its implementation phase.

6.2. Implementing the Australian Earth Observation Community Plan - 2026

Implementation of the AEOCP-2026 (www.aeoccg.org.au/aeocp-the-plan) requires the establishment of AEOCCG operations, governance, funding and a path to becoming a formally established, independently funded private-public entity.

The list below sets out the main stages of the process in a summary form. The implementation is intended to progressively build capacity and resources to create an enduring resource supporting EO application by Australia's governments, industry research and education sectors

1. Convene a group to establish and implement revised AEOCCG and AEOCP Implementation Terms of Reference and Governance (Feb-Mar 2017)
2. Establish revised terms of reference, positions, and operational plan for the AEOCCG (Feb-April 2017)
3. Implement revised terms of reference, positions, and operational plan for the AEOCCG (Apr-Jul 2017)
4. Form and Commence AEOCP Implementation Group operations (August 2017).

The table below outlines the main steps we are currently following:

Action	Time line
1. Distribute meeting summary, Business Plan Draft Format and schedule to AEOCCG Steering Committee	24/03/17
2. AEOCCG whole of community meeting to discuss “AEOCCG Draft Business Plan 2017-2026” and its implementation	11/04/17
3. Writing team meeting in person and by webinar to agree on sections to write and set writing tasks and timing “AEOCCG Draft Business Plan Outline 2017-2026” from material presented on 21/3/17 (S.Phinn, J.Edkins, S.Michael, G.Campbell, J.Ross, C.Ong, W.Thompson H.Holewa, and volunteers)	10-12/05/17
4. Compile “AEOCCG Draft Business Plan Outline 2017-2026” from material presented on 21/3/17 (S.Phinn, J.Edkins, S.Michael, G.Campbell, J.Ross, C.Ong, W.Thompson H.Holewa, and volunteers)	12/05/17 – 12/06/17
5. Present “AEOCCG Draft Business Plan 2017-2026” for review to AEOCCG Steering Committee and revise based on feedback	13/06/17 – 27/06/17
6. Send “AEOCCG Draft Business Plan 2017-2026” draft to entire AEOCCG community email list to ask for reaction and feedback. 7. Prepare groups to respond to high priority activities: 8. Space Agency formation 9. NCRIS research infrastructure facility proposal	28/06/17 – 14/07/17
10. Send “AEOCCG Draft Business Plan 2017-2026” to AEOCCG and cognate professional societies and agencies for comment by 19/05/17	01/08/17
11. Final draft and Implement “AEOCCG Draft Business Plan 2017-2026”	01/09/17
12. Make initial appointments and begin process of securing funds and approvals	01/09/17 -
13. Address AEOPCP 2026 implementation priorities	01/09/17 -
14. Make an impact with Australian EO...	01/09/17 -

6.3. Other National Coordination Activities where RSRC Provide Leadership

Our national leadership role also includes participation at high levels in the following national activities for EO in Australia:

- **Critical Infrastructure Resilience Program:** S.Phinn is a long term member and contributor to the Space Cross Sectoral Interest Group:
 - www.ag.gov.au/NationalSecurity/InfrastructureResilience/Pages/default.aspx
 - www.tisn.gov.au/Pages/Space-Group.aspx
- **2026 Spatial Industry Transformation and Growth Agenda:** S.Phinn is a member of the working g group that established this and its ongoing leadership group
<https://2026agenda.com/>

6.4. AEOCCG Participation and Use Statistics

We have witnessed significant growth in membership during the 2016-17 period with a current AEOCCG membership of 330. The communities' website www.aeoccg.org.au also serves as a central component in sharing information of group activities. Statistics for the 2016 calendar year (sourced for Google Analytics):

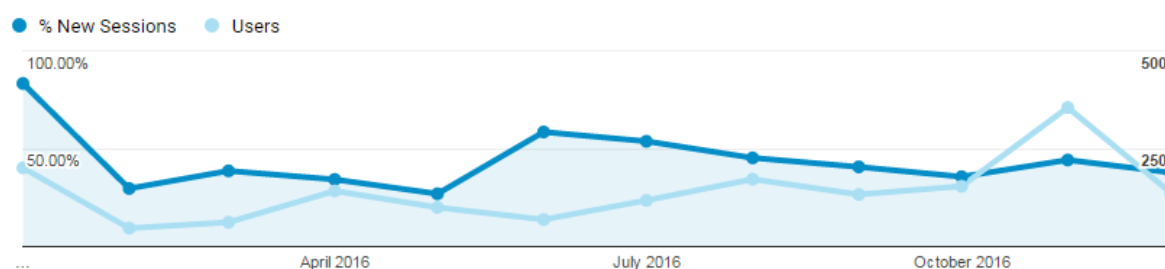


Figure 1: 2016 audience overview of % new sessions (an estimate of the percentage of first time visits) vs users (users who have initiated at least one session during 2016).

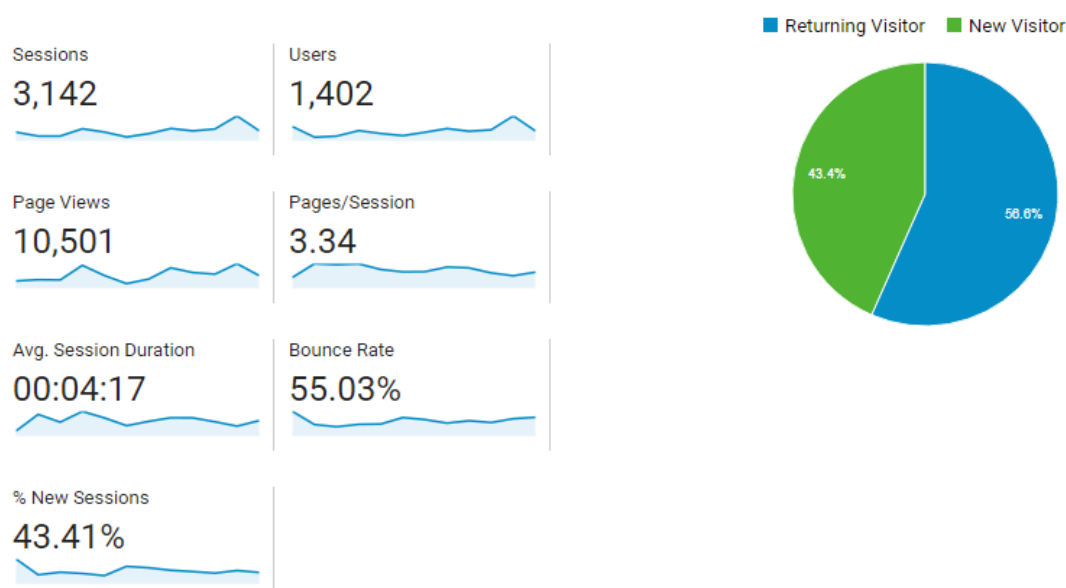


Figure 2: 2016 performance statistics.

7 Teaching and Capacity Building

7.1. Undergraduate and Postgraduate Courses

Centre academic and research staff, postdoctoral appointments and RHD students all participate in teaching activities within the school. Teaching activities are closely linked to our focus research areas and research training. RHDs are given the opportunity to be demonstrators for the remote sensing courses and, if they are interested in pursuing academic careers, given further guidance.

7.2. Courses Coordinated and Taught by Centre Staff

Course	Title	Semester
GEOS6001	Research Philosophy, Design and Implementation	1 and external
GEOS3102	Global Change: Problems and Prospects	2
GEOM2000/7000	Introduction to Earth Observation Sciences	1 and external
GEOM3001/7001	Advanced Earth Observation Sciences	2
MARS2014	Introduction to Oceanography	1
MARS3012	Physical and Biological Oceanography	1
UQX – MOOC 101x	Tropical Coastal Ecosystems	1

7.3. Research Higher Degree (RHD) Students

RHD students are an essential part of the centre since their inception – our centre provides an internationally unique and highly regarded RHD program that links students with industry, government and research groups to conduct their work and build careers.

We conduct systematic and regular meetings and activities with our RHD students to build a strong cohort who learn from one another and are highly skilled. Since 2000 we have enabled 54 students to successfully complete their PhDs, all of whom are in remote sensing related positions in Australia and around the world.

8 2016 - 2017 Publications and Impacts

8.1. Publication and Citation Statistics

RSRC staff have published 346 journal articles, 323 of which have been published between 1999 - 2016. The Centre's publications are being widely circulated and have been cited 6,458 times.

Figures 1, 2 and 3 show the distribution of publications between the key RSRC researchers. Prof. Stuart Phinn, Dr Peter Scarth, Dr Chris Roelfsema, Dr Kasper Johansen and Dr Scarla Weeks are the leading researchers in terms of publications and this reflects expertise and experience in their fields and leadership roles within the centre.

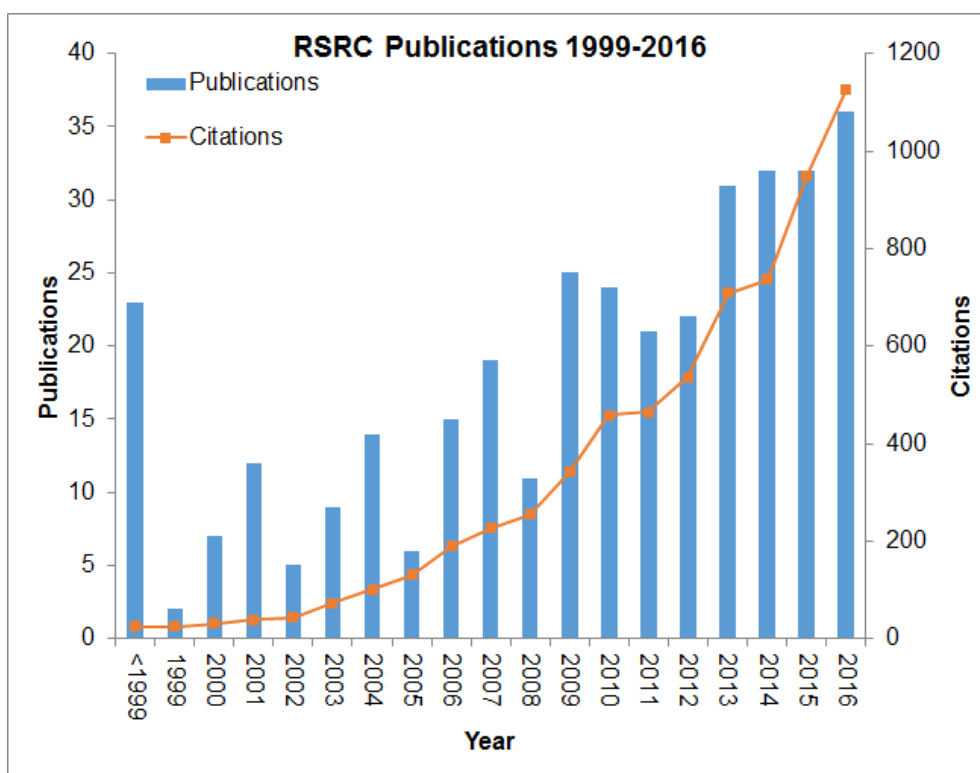


Figure 1: RSRC journal publications and citations since 1996 (sourced from Scopus).

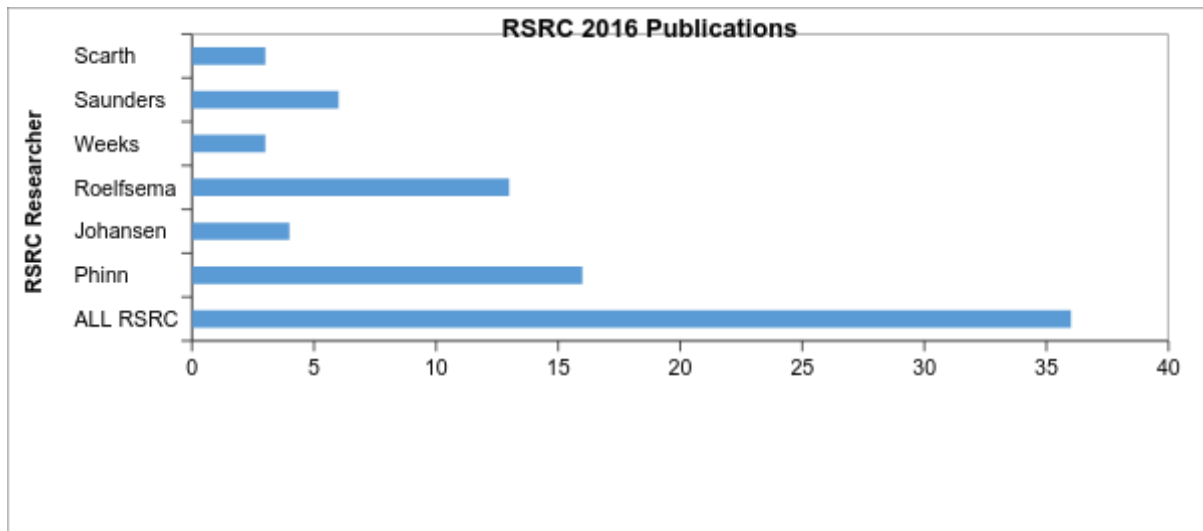


Figure 2: RSRC 2016 journal publications by author (sourced from Scopus).

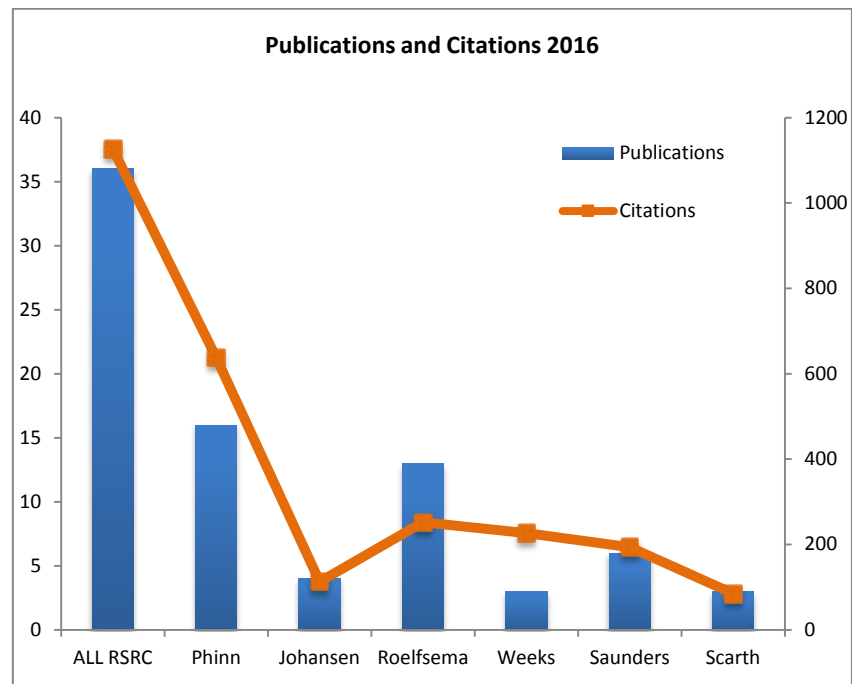


Figure 3: Journal publications (blue) and citations (orange) of key RSRC researchers.

8.2. Journal Articles

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Joint Remote Sensing Research Program Journal Publications

- **Dawson, S., Fisher, A., Lucas, R., Hutchinson, D., Berney, P., Keith, D., Catford, J., & Kingsford, R. (2016).** [Remote Sensing Measures Restoration Successes, but Canopy Heights Lag in Restoring Floodplain Vegetation](#). *Remote Sensing*, 8, 542. doi: 10.3390/rs8070542. *Open Access*
- **Fisher, A., Day, M., Gill, T., Roff, A., Danaher, T., & Flood, N. (2016).** [Large-area, high-resolution tree cover mapping with multi-temporal SPOT5 imagery, New South Wales, Australia](#). *Remote Sensing*, 8, 515. doi: 10.3390/rs8060515. *Open Access*
- **Fisher, A., Flood, N., & Danaher, T. (2016).** [Comparing Landsat water index methods for](#)

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- Schmidt, M., Pringle, M., Devadas, R., Denham, R., & Tindall, D. (2016). [A Framework for Large-Area Mapping of Past and Present Cropping Activity Using Seasonal Landsat Images and Time Series Metrics](#). *Remote Sensing*, 8, 312. doi:10.3390/rs8040312. *Open Access*

8.3. Conference Keynotes and Papers

Invited Keynote Presentations

- **Phinn, S.R.** (2017) - Opening Keynote, Surveying and Spatial Sciences Institute of Australia, Queensland Conference, May 4-5 2017, www.cvent.com/events/queensland-surveying-and-spatial-conference-2017/custom-19-bcb31301cb974f01b4d97b00d804412c.aspx
- **Phinn, S.R.** (2016) Keynote, STEMx 2016 Conference - Brisbane, November 3 2016, www.stemx.events/speakers.html
- **Phinn, S.R.** (2015) Keynote, PIVOTAL 2015 Conference - Brisbane, June 29- July 1 2015, www.pivotal2015.org/speakers/
- **Phinn, S.R.** (2015) Keynote, International Ocean Colour Science (IOCS) Conference - "Applications of Ocean Colour from Climate to Water Quality" San Francisco, June 15-18 2015, iocs.iocccg.org/keynote-speakers/

Presentations and Conference Proceedings

- **Candra, D. S., Phinn, S., and Scarth, P.** 2016. Cloud and Cloud Shadow Masking using Multi-temporal Cloud Masking Algorithm in Tropical Environmental, *Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci.*, XLI-B2, 95-100, doi:10.5194/isprs-archives-XLI-B2-95-2016, 2016.
- **Deb, J.C., Phinn, S., McAlpine, C., & Butt, N.** (2016). Predicting climate suitability for three major deciduous trees and forest ecosystems in tropical Asia. In, *Proceedings of the 101st Ecological Society of America (ESA) Annual Conference 2016*.
- **Hoque, M. A., Phinn, S., Roelfsema, C., & Childs, I.** (2016). Modelling tropical cyclone hazards under climate change scenario using geospatial techniques. *Paper presented at the IOP Conference Series: Earth and Environmental Science*.
- **Kamal, M., Phinn, S., Johansen, K., & Adi, N. S.** (2016). [Estimation of mangrove leaf area index from ALOS AVNIR-2 data \(A comparison of tropical and sub-tropical mangroves\)](#). Paper presented at the AIP Conference Proceedings.
- **Kovacs, E. M., Roelfsema, C., Phinn, S. R., and Lyons, M.** (2016). A Decade of Coral Reef Benthic Community Dynamics from High Spatial Resolution Satellite Imagery and Field Survey Data. *ICRS 2016*.
- **Perez, D.I., Phinn, S., Roelfsema, C.** (2016). Mapping Coral Reef Primary Production and Calcification with In-Situ and Remotely Sensed Data. *GPEM Research Showcase*.
- **Perez, D.I., Phinn, S., Roelfsema, C., Shaw, E.** (2016). Variability of coral reef primary

production and calcification complicates scaling up rates on Heron Island reef flat in southern Great Barrier Reef, Australia. *13th International Coral Reef Symposium, Honolulu, HI.*

8.4. Books and Book Chapters

- Souter, N., **Johansen, K.**, and Reid, M. (2016). Monitoring and Assessment of Vegetation in Australian Riverine Landscapes. *In: Vegetation of Australian riverine landscapes: biology, ecology and management* (Eds. S. Capon; C. James; M. Reid). CSIRO Publishing, ISBN: 9780643096318

8.5. Datasets

- TERN Auscover: see www.auscover.org.au
- **Roelfsema**, C.M., Bansemmer, C., McMahon, K. & Joyce, K. (2016). 2003 Habitat Maps derived from Grey Nurse Shark (GNS) Project of Wolf Rock, Double Island Point, Queensland, Australia. University of Queensland Underwater Club, Brisbane, Australia, [doi:10.1594/PANGAEA.864211](https://doi.org/10.1594/PANGAEA.864211)
- **Roelfsema**, C.M., **Phinn**, S.R. & Joyce, K. (2016). Spectral reflectance library of algal, seagrass and substrate types in Moreton Bay, Australia. [doi:10.1594/PANGAEA.864310](https://doi.org/10.1594/PANGAEA.864310)
- **Roelfsema**, C.M., Selgrath, J.C., Gergel, S.E., Vincent, A.C.J. & **Phinn**, S.R. (2016). Habitat map of Danajon Bank, Philippines, derived from a high-spatial-resolution multi-spectral satellite image and georeferenced point intercept transect and spot-check survey field data, using an object-based image classification method. [doi:10.1594/PANGAEA.864306](https://doi.org/10.1594/PANGAEA.864306).
- Samper-Villarreal, J., **Roelfsema**, C.M., Adi, N., Saunders, M.I., Lyons, M.B., **Kovacs**, E.M., Mumby, P.J., Lovelock, C.E. & **Phinn**, S.R. (2016). Morphometrics of seagrasses at species level, Moreton Bay, Australia determined from core samples collected in 2012-2013. [doi:10.1594/PANGAEA.864316](https://doi.org/10.1594/PANGAEA.864316).

9 2016 Financial Statement (Calendar Year)

	Revenue			Expenditure			Year to Date Actuals
	Carry forward	Internal allocations	External revenue	General salaries	Academic salaries	Other expenditure	
RSRC		107,381		43,517	52,985	10,879	0
JRSRP	730,834		523,761	53,647	384,246	6,977	809,725
HIA	202,454		255,000		61,401	142,101	253,952
AusCover	27,205		303,750	75,723	60,093	47,824	147,315