



2018 Final Report

Promoting the uptake of the modern sampling theory in
agriculture research and extension applications

Project Leader: Dr Olena Kravchuk, University of Adelaide

Project Report Period:

April 10, 2018 to December 25, 2018

Promoting the uptake of the modern sampling theory in agriculture research and extension applications

Project leadership:

Dr Olena Kravchuk, University of Adelaide, Prof Jennifer Brown, University of Canterbury, Prof Silinthone Sacklokhom, National University of Laos

Acknowledgements:

The project team greatly acknowledge: the advice and encouragement from Dr Kim Alexander, James Cook University, on building collaborations with NUoL; the assistance of Mr Samuel Rogers, University of Adelaide, in building and maintaining the website of the Ranked Set Symposium; the assistance of Ms Yiwen Li and Mr Peter Kasprzak, University of Adelaide, in delivering the sampling workshops; the enthusiasm and time of the staff from the NUoL attending the Symposium and contributing to discussions about the future of the collaboration. Lastly, the team is appreciative of the great effort and enthusiasm of Dr Ray Correll, Rho Environmetrics, and the Biometry Hub staff of the University of Adelaide in making the Ranked Set Sampling a success.

Executive summary

Robust and efficient collection of data in field underpins the quality of research, policy advice and the return on investment in agriculture. In the last two decades, there has been a significant development in the theory of ranked set sampling (RSS). The RSS methods almost always outperform traditional systematic or simple random samples, thus enabling better quality decisions with fewer resources. This make the methodology attractive both in high and low income countries. An effort is necessary from the statistical community to disseminate RSS to the agricultural research and extension community.

This project promoted the uptake of statistical sampling theory by applied statisticians and researchers in agriculture. The project consisted of two components: an international symposium on ranked set sampling and a series of professional skills development workshops in the principles of sampling.

The two-day international symposium in Adelaide, September, 2018, brought together applied statisticians and leading researchers in the theory of ranked set sampling. Participants discussed various practical and methodological aspects for how the RSS theory can be applied in the context of modern agriculture data. There were two round-table discussions embedded in the symposium: a discussion with Australian agricultural researchers at the Waite campus of the University of Adelaide about their practices of field data collection, and a discussion with academics from the National University of Laos about statistical practices in their teaching and research. The program and presentations are available online at <https://rankedsetsymposium2018.website/>

Materials for sampling workshops were developed and two workshops delivered to groups of applied statisticians and agriculture researchers in Australia, and Laos. The workshops presented basic principles of design-based sampling and computational solutions for planning and analysing ranked set sampled data. The workshop in New Zealand will be presented in 2019, following the initial visit to the University of Canterbury by a member of the University of Adelaide in December, 2018.

Additional sponsorship and interest was raised from the Statistical Society of Australia and the Crawford Foundation to contribute to the activities in this project. The success of the project was promoted at their websites. The project has identified ways for further collaborations between the universities.

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Project achievements and further collaborations

The project has provided a great opportunity for statistical groups in the University of Adelaide, Australia, and the University of Canterbury, NZ, to start working closely together on opening a productive dialogue with agricultural researchers in both countries and in the National University of Laos about statistical practices in field sampling. The seed funding has been used strategically, and more sponsorship was attracted to expand the activities of the project beyond those planned in the proposal. In particular, additional initiatives include 1) a day-long sampling tour in Adelaide Hills organized by an experienced statistician Dr Ray Correll following the Symposium, 2) round table discussions with agricultural researchers about their current sampling practices and the principles of more efficient solutions, 3) creating video materials that can be used for teaching and research in sampling across the three countries (with sub-titles in the Lao language), 4) focus group discussions with research staff from Laos on ways for establishing and supporting local Biometry providers in the country.

The project has contributed to the statistical science in ranked set sampling. Leading researchers, Profs Omer Ozturk and Doug Wolfe (Ohio State University, USA), Jennifer Brown (University of Canterbury, NZ) and Amer Al-Omari (Al al-Bayt University, Jordan) presented keynotes at the Symposium (<https://rankedsetsymposium2018.website/programme/>), highlighting the current developments and trends in the theory of ranked set sampling. A website was developed for the Symposium, <https://rankedsetsymposium2018.website>, where all the talks and discussions are captured and publicly available.

A special edition of the Application section of the Australian and New Zealand Journal of Statistics has been initiated and agreed on with the editorial board to further expand the research discussions started at the Symposium. The call for papers for the special edition is now open till October, 2019. Jennifer Brown and Olena Kravchuk are guest editors in that edition. The seed funding from AC21 will be acknowledged in the editorial note.

Original training materials were developed aiming at presenting statistical principles for data collection to practitioners in field research. The workshop on sampling methods was delivered in Adelaide in September, 2018 (in conjunction with the Australian Soil Disease Conference), to a group of Laos researchers visiting Adelaide in October, 2018, and it will be delivered in NZ early in 2019. The training materials are available upon request from Dr Olena Kravchuk, olena.kravchuk@adelaide.edu.au. Currently Dr Kravchuk is updating the notes following the feedback and suggestions from the participants and statisticians attending the Ranked Set Sampling Symposium.

A group of three academics from the National University of Laos was nominated by Prof Silinthone Sacklokham as emerging agricultural research leaders in the University. The group visited Adelaide in September – October, 2018. The visit was sponsored by the Crawford Foundation. Mr Oula Bouphakaly (Agribusiness), Mr Khonesavanh Phialathounheuane (Plant Science) and Mr Bounsanong Chouangthavy (Entomology) participated in round table discussions in the Symposium, met with researchers and statisticians in Adelaide and completed a workshop ‘Introduction to R’ with Ms Wendy Li and a workshop on sampling principles with Dr Olena Kravchuk and Ms Wendy Li. They reflected on their experience in the Symposium and their many meetings and the two workshops and made insightful and interesting recommendations on further collaborations that can span from this project. It is now planned that a staff member from the University of Adelaide, Mr Peter Kasprzak, will visit the National University of Laos in February, 2019, to meet with the faculty and students in the School of Agriculture and the School of Mathematics, present a seminar and distribute teaching

aids being developed in the Lao language. In preparation to this visit in February, 2019, Dr Olena Kravchuk and Ms Wendy Li also conducted a focus-group discussion in December, 2018 with research students from Laos in the University of Adelaide to seek their opinion, insights and suggestions for promoting good statistical practices in the university teaching and agricultural research.

Many interesting opportunities have been identified during the Symposium for research collaboration between the Biometry Hub, University of Adelaide, and the School of Mathematics, University of Canterbury. Ms Wendy Li has visited the University of Canterbury, NZ, in December 2018 and presented a talk on the research and research training opportunities in relation to the ideas spanning from this project. In addition to the exciting opportunity of the special edition on ranked set sampling, co-edited by Dr Olena Kravchuk and Prof Jennifer Brown for the Australian and New Zealand Journal of Statistics in 2019-2020, student research visits were identified as another collaborative action. Ms Li also met with researchers from AgResearch, NZ, and discussed the opportunity to present our sampling workshop to their statisticians. We plan to do this before April, 2019.

The project has been a great success and a genuine example of mutually enriching collaborations. The project leadership group are confident that the collaborations will grow, promoting best statistical practices in sampling to students and researchers in Laos, Australia and New Zealand.

Financial report and carry-forward request

The funding of \$13,144.06 Australian dollars was received on 10, April, 2018. The funding of \$10,325 AUD was realized by 20, December, 2018. The remainder of \$2,818 is requested to be carried forward to enable the visit by the staff of the University of Adelaide to the National University of Laos in February, 2019, and to deliver a sampling workshop in NZ early in 2019. The delay is due to the logistics of the teaching semesters in the three countries. The visit to Laos was initially planned in November, 2018, but it became apparent that the visit will be more efficient in February, 2019. Similarly, the workshop in NZ will be more efficient early in a year.

Detailed transactions are available upon request from the financial department of the University of Adelaide, in relation to the project 18Academic Consortium_AC21.

Item	Requested, USD	Expenditure, AUD
Travel for two keynote speakers (Doulg Wolfe and Omer Ozturk, USA)	\$4,000	\$6,773
Symposium catering for 15 participants	\$1,500	\$1386
Travel for workshop instructors to Laos	\$1,900	-
Travel for workshop instructors to Adelaide	\$1,200	\$510
Travel for workshop instructors to New Zealand	\$1,200	\$1,500
Stationery and printing	\$200	\$157
Carry-forward		2,818.00
Total	\$10,000	\$13,144.06

Unsolicited comments from various parties

“This was a very successful symposium. I know how much effort goes into organization of this type of event. I would like to thank you and all the people make this symposium a success. During the symposium I see that there is a great enthusiasm among the people in revitalizing the ranked set sampling and related sampling designs” – Prof Omer Ozturk

“Thanks for all of your hard work on the Symposium!! In my view it was a big success and all of us learned a lot during those three days—in very large part due to your excellent organization and dedication. Please thank all of your staff for their wonderful help, which made our lives a good deal easier with their support. Also, please let Ray know that I enjoyed the tour of the field trials on Saturday—very interesting” – Prof Doug Wolfe

“Dear Olena, First of all, on behalf of the Faculty of Agriculture, I would like to express my sincere thanks to you and your team for providing the opportunity my colleagues (Oula, Khone and Nong) of the NUOL to attend the symposium and to discover and practice the advance sampling method and statistics in Australia, the University of Adelaide. I agree as our early plan to continue our collaboration by organizing your school visits to National University of Laos.” – Prof Silinthone Sacklokham

“The experience of participating in the Symposium was the first experience about ranked set sample. It’s a wonderful symposium for me. I got a new knowledge and experience from symposium including: how to prepare the data, sampling, how to analysis the data. I met many statisticians from different institute in many counties so, I got knowledge and experience from them. It will be good chance for network and collaboration in the future. The knowledge and experience from symposium was useful for me to approve my knowledge and skill about statistic. It help me to more understand about statistic especially, set sampling in my research and teaching my student in Laos.” – Mr Khonesavanh Phialathounheuane

Project photos



Photo 1: Group photo of ranked set sampling workshop participants, Waite Campus, University of Adelaide, Adelaide, South Australia, September, 2018.



Photo 2: Participants in the Ranked Set Sampling Symposium listening to a presentation. First row: Dr Chris Brien (University of Adelaide), Prof Amer Al Omari (University of Al al-Bayt), Prof. Omer Ozturk (Ohio State University)



Photo 3: Discussion of statistics in teaching and research in Laos. The presenter is Mr Oula Boupakaly, National University of Laos



Photo 4: Round-table discussion between statisticians and agricultural researchers on the statistical principles and practice of field sampling. Participants at the front table, anticlockwise: Mr Oula Boupakaly, National University of Laos, Dr Kym Perry, South Australia R&D Institute, Dr Helen Brodie, South Australia R&D Institute, Ms Phuong-Cac Nguyen, University of South Australia, Dr Andy Timmins, University of Adelaide



Photo 5: Ranked Set Sampling Symposium dinner at Edinburgh Hotel, Mitcham, South Australia



Photo 6: Visitors from the National University of Laos on the beach in Glenelg, Adelaide, September, 2018. From right to left: Mr Oula Boupakaly, Mr Khonesavanh Phialathounheuane and Mr Bounsamong Chouangthavy



Photo 7: A sampling tour in Adelaide Hills in September, 2018. The tour facilitator, statistician Dr Ray Correll (Rho Environmetrics) is pictured in the center. The location pictured is an experimental site for rare weeds sampling.



Photo 8: Statisticians in the field. Dr Marg Evans (South Australia R&D Institute) explaining the principles of soil samples to participants in the sampling day tour in conjunction with the International Ranked Set Sampling Symposium. Pictured, from left to right: Prof Al Omari (Al al-Bayt University), Dr Ray Correll (Rho Environmetrics) and Dr Suman Rakshit (Curtin University)



Photo 9: Focus-group discussions of statistics support in Laos. From left to right: Dr Olena Kravchuk, Miss Manilitphone Thephavanh (University of Technology Brunei), Ms Manilitphone Thephavanh (University of Adelaide)



Photo 10: Keynote presenters and the organizing committee of the Ranked Set Sampling Symposium. From left to right: Prof Omer Ozturk (USA), Prof Jennifer Brown (NZ), Dr Ray Correll (Australia), Dr Olena Kravchuk (Australia, the Chair of the organizing committee), Prof Doug Wolfe (USA), Prof Al Omari (Jordan)

Appendix A: AC21 Special Project Fund application criteria

1. Purpose

The AC21 Special Project Fund (SPF) was created in order to promote the development of research and educational exchange between AC21 members by providing "seed funding" for a variety of collaborative research projects and activities. Although research collaboration between AC21 members is important, this fund is not intended to support particular or individual research projects. It is awarded to projects that include as many participants as possible. For example, a symposium jointly held by three or more institutions, featuring speakers from these institutions, and open to all AC21 members, as well as to the general public, will serve our goal of internationalization and cooperation between members more effectively compared to simple research projects conducted by one or two individuals per institution. Events can include mini-symposia, mini-workshops, schooling projects, start-up funds for long term research projects, or small international forums, as well as traditional research proposals that attempt to include as wide a circle of contacts and participants as possible.

2. Application Eligibility

Applicants must be academic staff members of an eligible AC21 member institution who hold faculty positions. Students of an AC21 member institution, either undergraduate or graduate, shall not be eligible to apply for the SPF.

If a student has a research project that meets the purpose of the SPF and wishes to have the project submitted, the student must consult with his or her advisor in advance for review of the project and, upon approval thereof, the application shall then be prepared and submitted by said advisor.

AC21 member institutions with unpaid membership fees are ineligible. A list of AC21 members eligible for this year's SPF can be found in the Appendix on page 6.

3. SPF Award

- Up to 10,000USD per project
- Maximum of three awards per year; however, if the AC21 Steering Committee (STC) determines, based on the review results, that the proposals demonstrate high standards across all criteria in **6. Review/Selection Process**, up to two additional awards may be considered.
- Awarded in April, as a single payment, to a designated bank account

4. Application Period

November 1, 2017 to January 31, 2018

5. Requirements and Restrictions

- 1) **The application deadline must be observed. Late applications will not be accepted.**
- 2) Each project shall have a Project Group Leader who acts as a representative applicant to fill out and sign the Application Form. The university which the Project Group Leader is affiliated with will also be regarded as a representative of the project.
- 3) Applications should include:
 - a) a completed Application Form (designated form in MS Word Format); and
 - b) a detailed Budget Proposal (free form).Incomplete applications will not be considered.
- 4) Projects should include at least **three** AC21 member universities, from at least **two** different

countries.

- 5) As the SPF is intended to serve as "seed money" to help launch new projects, a proposal designed as a continuation of a past SPF-awarded project may not be submitted.
- 6) In order to avoid any confusion or multiple submissions, Project Group Leaders shall submit a complete set of application materials to their affiliated university's **AC21 Communicator** (see **page 5**), who shall then submit it to the AC21 General Secretariat.

6. Review/Selection Process

- 1) A peer-review process will NOT be used to evaluate SPF applications.
- 2) All applications will be reviewed and scored by the AC21 Steering Committee (STC), in accordance with the criteria and weighting described below.
- 3) Based on the STC's evaluations, the General Secretariat will announce the final selection results to the applicants in late March.

[Evaluation Criteria and Weighting]

Applications will be evaluated and selected according to the following criteria:

· **Contribution to AC21 activities** **40%**

Does the proposal stimulate international collaboration that involves as many member universities from as many different countries as possible, and have the potential to be developed as an ongoing AC21 project contributing to the fields of research, education, management and international exchange?

· **Quality of the proposal** **20%**

Does the quality and theme of the event or project reflect positively on the goals and missions of AC21 as a motivator for international exchange and collaboration?

· **Accountability of the budget** **20%**

Is the budget spending plan realistic and legitimate? Budget plans may not include salaries, scholarships for students, course fees, or office equipment (computers, furniture, etc.), as specified in the application guidelines.

· **Sustainability and continuation of proposed collaboration** **20%**

Does the proposal have the potential to continue as a long-term project with academic and public impacts? Are there any expected outcomes which could serve as a basis for future collaborations? How can the proposal be financially sustainable? Are there any plans to continue the project if you do not receive the SPF?

7. Project Examples

- ✓ Forum for graduate students
- ✓ Small international forums
- ✓ Mini workshops
- ✓ Joint mini-symposia related to certain research areas
- ✓ Joint research between small groups of researchers
- ✓ "Seed" funds for schooling projects
- ✓ "Seed" funds for startup long-term research projects or centers
- ✓ Any other project that meets the objectives of the fund

8. Guidelines for Budget Use

- 1) Expenses may include:
 - Forum expenses
 - Travel expenses
 - Stationary and other consumables
 - Other costs directly related to the project

- 2) Expenses may **NOT** include:
 - Salaries
 - Scholarship for students
 - Course fees
 - Office equipment (PCs, furniture, etc.)

9. Fund Recipient Obligations

- 1) Fund Recipients must submit **three final documents by December 25** of the project year:
 1. **A final project report**
 2. **A final financial report**
 3. **A 400-600 word article for the use in the AC21 Newsletter**Failing to submit these documents will render applicants ineligible for future applications.

- 2) Fund Recipients are requested to acknowledge the support received from AC21 in presentations, publications, events and publicity materials.
(e.g. AC21 logos to be placed on each document)

10. Consent to Disclosure

Applicants must consent to the disclosure of information, details of which can be found below. The submission of applications will be regarded as acceptance thereof.

- The following information will be disclosed via email to unsuccessful applicants who submit individual requests, limited to if and when the request is received and approved by the General Secretariat:
 1. The content of each successful proposal as provided in their Application Forms, excluding personal information such as names and contacts, etc.
 2. A list of successful proposals with the total scores indicated, along with the total score of the requestor's proposal

11. Submission

- **Applicants (Project Group Leader) should submit applications to their university's AC21 Communicator**, who will then collectively submit all applications from the university to the AC21 General Secretariat by January 31, 2018. The submission should be made via email both in **original (MS Word, Excel, etc.) and PDF** formats.

AC21 Communicator Contact Details (For distribution in your university)

Name: Glen Stafford

E-mail: glen.stafford@adelaide.edu.au

Tel: +61 404 178 417

Applications (both in original and PDF formats) should be submitted by the AC21 Communicator indicated above to the AC21 General Secretariat via email at **office@ac21.org**

AC21 General Secretariat, Nagoya University, Furo-cho, Chikusa-ku, Nagoya 464-8601, Japan

Email: office@ac21.org

<http://www.ac21.org/english/index>

Promoting the uptake of the modern sampling theory in agriculture research and extension applications

<p>1. Project Title</p>	
<p>2. Project Description</p>	
<p>3. Contribution to AC21</p>	<p>Efficient and robust statistical methods for collecting experimental evidence in agriculture and environment research in field sampling are needed for quality decisions in research, business and government.</p> <p>The project brings together two research groups in statistics in the University of Adelaide and the University of Canterbury. Both groups have a strong focus on applied statistics in agriculture and environmental sciences, and are interested in the theory of ranked set sampling. The research group from the National University of Laos are a leading research and education provider in the areas of crop production, plant protection, climate change adaptation, natural resource uses and management, agricultural policies etc. The group will bring to the project current examples of sampling challenges in the agriculture research in Laos.</p> <p>This combination of theoretical developments, applied statistical skills and real-life challenges in field sampling in developed and developing worlds makes this proposal a unique and encompassing research project, aiming at translating the advances of statistical theory to applied research, as well as investigating practical challenges requiring new theoretical developments.</p> <p>The collaboration established in the project will sustain well after the project through new joint research and research training projects.</p>

<p>4. Partner Institution/s</p> <p>Include the full name, university and department of a responsible researcher of each participating institution</p>	<p>Additional AC21 Members:</p> <ol style="list-style-type: none"> 1. Prof Jennifer Brown, School of Mathematics and Statistics, University of Canterbury; jennifer.brown@canterbury.ac.nz 2. Dr. Silinthone Sacklokham, Faculty of Agriculture, National University of Laos; s.sacklokham@nuol.edu.la
	<p>Other non-AC21 Institutions (if any):</p> <p><i>(Please include the country location)</i></p> <p>Not applicable</p>
<p>5. Total Project Budget:</p>	<p>Grant amount sought: (Up to \$10,000) (Attach a separate detailed itemized budget)</p> <p>The total amount sought is \$10,000.</p> <p>If the project application is successful, there is a cash contribution from the University of Canterbury to sponsor the travel of Dr Abdul Haq (https://www.gau.edu.pk/profile.php?id=822013) to the symposium; the University of Adelaide will contribute in-kind the preparation time for the workshops and the facilities for the symposium. The National University of Laos will contribute in-kind to organizing the training workshop in Laos.</p> <p>University in charge of budget management (please note that the grant will be paid into the bank account of the Project Group Leader's affiliated university): University of Adelaide</p>

6. Timeline of Activities

<p>April</p>	<p>Project initiation</p>
<p>May</p>	<p>Workshop material development in collaboration between the three universities</p>
<p>June</p>	<p>Workshop material development in collaboration between the three universities</p>

July	Workshop material development in collaboration between the three universities
August	Preparation of the symposium
September	Ranked Set Sampling: translating the theory to agriculture applications Symposium in Adelaide, target of 15 leading researchers
October	Field sampling in agriculture research Workshop in Adelaide, target of 15 – 30 practitioners
November	Field sampling in agriculture research Workshop in Vientiane, target of 15 – 30 practitioners
December	Field sampling in agriculture research Workshop in New Zealand, target of 15 – 30 practitioners

**Ranked Set Sampling:
translating the theory to applications in agriculture and natural sciences**

Symposium, 27 – 28 September, 2018
Waite Campus, University of Adelaide,
Adelaide, South Australia

Symposium website: <https://rankedsetsymposium2018.website>

Biometry Hub website: <https://agwine.adelaide.edu.au/research/biometry-bioinformatics/>

The Ranked Set Sampling Symposium is bringing together theoretical and applied statisticians and practitioners interested in promoting and enabling the uptake of new statistical methods in agriculture and environmental field research and computations. The discussion will be focused on identifying best ways for adopting the ranked set sampling (RSS) methodology by the natural resources industries and research organizations.

Collecting field data in a representative way by marrying the ideas of random sampling and judgement order was suggested as a field sampling method by G.A. McIntyre in 1952 in his paper in the *Australian Journal of Agricultural Research*. The theory of RSS has expanded tremendously since the 1960's, presenting nowadays various generalizations of the method as well as narrow specializations for numerous distributional assumptions and design constraints. The RSS method has the true potential to substantially increase the accuracy and efficiency of estimation of population moments and quantiles in the natural science field work as well as in computational experiments with complex “big” data.

In the Symposium, reflecting on the work and life of G.A. McIntyre, we will share ideas on how to encourage the adoption of RSS in agriculture and environmental sampling and on what can be done to make this valuable theoretical resource more accessible to practitioners, including applications in precision agriculture and remote sensing.

September-October is a spring time in Adelaide - fresh and crisp air and blue sky, with the temperature at the historical 18 – 20 degrees C. The Symposium is hosted by the Waite Campus of the University of Adelaide. The Waite is a world-known plant science research center. The Waite strengths are in the grains, soil and wine research, and we will endeavor to demonstrate the ranked set sampling techniques in glasshouses and vineyards on the campus.

The Symposium is currently sponsored by the Academic Consortium for the 21st Century (AC21), the University of Adelaide, and the University of Canterbury, NZ.

Abstract submission and registration are soon to be open at

<https://rankedsetsymposium2018.website>. For more information please contact Olena Kravchuk directly at olena.kravchuk@adelaide.edu.au or +61 8 83137252.

Organizing committee: Dr Olena Kravchuk, Peter Kasprzak (The University of Adelaide, Australia), Dr Ray Correll (Rho Environmetrics, Australia) and Prof Jennifer Brown (The University of Canterbury, NZ)

Tentative program at 5, September, 2018; check for updates at <https://rankedsetsymposium2018.website>

Time	Topic	Speaker
Day 1, 27/09/2018		
9:00 – 9:10	Symposium opening	
9:00 – 9:30	Opening address: Reflecting on thoughts and writing by G.A. McIntyre	Olena Kravchuk
9:30 – 10:30	Ranked Set Sampling: rationale and historical development	Doug Wolfe
10:30 – 11:00	Morning tea	
11:00 – 12:00	Design Based Inference in Ranked Set and Judgment Post Stratified Sampling Designs	Omer Ozturk
12:00 – 12:30	Embedding Ranked Set Sampling in design of experiment	Richard Jarrett
12:30 – 13:00	Commonalities between Latin Squares Sampling and Ranked Set Sampling	Ray Correll
13:00 – 14:00	Lunch	
14:00 – 17:30	Round-table discussion at Aroma Café, Waite Campus, Uni of Adelaide	
14:00 – 14:30	Working together on creating Ranked Set Sampling designs: researcher-statistician knowledge transfer	Olena Kravchuk
14:30 – 17:30	Round-table discussion with Agricultural and Biological Scientists and grain growers	
18:30 – 21:30	Symposium dinner at Edinburgh Hotel	

Day 2, 28/09/2018		
9:30 – 10:30	Ranking methodologies in Ranked Set Sampling	Amer Al-Omari
10:30 – 11:00	Morning tea	
11:00 – 12:00	Adoption of RSS in ecological and field surveys	Jennifer Brown Ray Correll
12:00 – 12:20	Case-studies of typical agronomy sampling	Peter Kasprzak Ray Correll
12:20 – 12:40	Latency of Fruit Yield Response to the Environmental Factors	Myung Hwan Na
12:40 – 13:00	Big data and HPC in grains research	Andy Timmins
13:00 – 14:00	Lunch Poster session	
14:00 – 14:30	The use of Coombe vineyard in teaching and professional development training in field sampling	Olena Kravchuk, Eileen Scott
14:30 – 14:50	Multiphase Design and Linear Mixed Model Analysis of NIR Scanning Data	Sharon Nielsen
14:50 – 15:10	Shiny RSS app for a dialogue with field researchers	Peter Kasprzak
15:10 – 15:30	Modern technology in field sampling	Rhiannon Schilling
15:00 – 15:30	Afternoon tea	
15:30 – 17:30	Round-table discussion on sampling and survey methodology in the practice of agriculture research and education in South-East Asia	
17:30 – 17:40	Symposium closing.	
18:00 – 19:30	Farewell drinks. Science networking.	
19:30 – 21:30	Webinar: reflecting on the discussions in the Symposium	Facilitators: Jennifer Brown and Olena Kravchuk

Invited speakers

Prof Doug Wolfe

Prof Wolfe is an Emeritus Professor of Statistics at the

Prof Omer Ozturk

Omer Ozturk is a Professor of Statistics in the Department of Statistics at The Ohio State University. His research interest in statistics lies in developing inference under a set of relaxed distributional assumptions that may include parametric, nonparametric and robust inference under different sampling conditions. He currently serves as an associate editor for *Environmental and Ecological Statistics*, *Statistics and Probability Letters*, *Communications in Statistics - Data Analysis and Simulation*, and *Theory and Methods*. He is frequently invited to US Census Bureau as a Summer at Census Scholar. He is an elected fellow of the American Statistical Association.

Prof Jennifer Brown

Prof Amer Al-Omari

Prof Richard Jarrett

Prof You-Gan Wang

Professor Wang is a Capacity Building Professor in Data Science at the Queensland University of Technology (QUT). After his PhD from the University of Oxford, he worked for CSIRO, Australia, the National University of Singapore, Harvard University, and the University of Queensland as the Director of the Centre for Applications in Natural Resource Mathematics.

Professor Wang has extensive experience in initiating multidisciplinary research collaboration with environmental researchers, marine biologists and life scientists, in which he provides expert contribution in designing surveys and experiments and data analysis and modelling.

Professor Wang is interested in developing methodologies in the main stream of statistics, particularly in the area of clustered/longitudinal data analysis to model the covariance and model selection criteria. He has published more than 150 papers in international journals, and his work is usually motivated by practical need and has been published in [*Biometrika*](#), [*Biometrics*](#), [*Journal of the American Statistical Association*](#), [*Statistical Methods in Medical Research*](#), [*Annals of Statistics*](#), [*Statistics in Medicine*](#) and [*Biostatistics*](#). In knowledge-based applied statistics, he has contributed as a lead author in publication in life sciences, including publications by [*Journal of Hydrology*](#), [*Water Resources Research*](#), [*Geophysical Research Letters*](#), [*Environmental Science & Technology*](#), [*Phytopathology*](#), and [*Fisheries*](#).

Professor Wang has published more than 150 papers in international journals with 3000+ citations and h-index 31 (<http://scholar.google.com.au/citations?user=MNUkTMQAAAJ&hl=en>).

Dr Olena Kravchuk

Dr Ray Correll

Round-table discussion in the International Symposium on Ranked Set Sampling,
University of Adelaide, Waite Campus,
28 September, 2018

About potential benefits from using ranked set sampling in field assessment in comparative
agronomic experiments

Ranked set sampling in applications, from McIntyre, 1952, to today, 2019

Review of published research and CSIRO reports

Paper presented, CSIRO conference, the mode of dissemination of information

Uptake by researchers in pasture and forestry divisions

Dissemination into international journals

Identified constraints

Discussion of efficiencies (Dell)

Modern technologies

In general, representative sampling

Sampling examples and sampling uncertainty in estimating the average or total of population

Main message: the sampling design affects the accuracy and bias of the field estimation. The accuracy of the estimation can be interpreted as the uncertainty between repeated sampling.

Demo with samples and sampling distribution of the sample mean.

Tables of probabilities for SRS with and without replacement, stratified sample, cluster sample, systematic sample, ranked set sample.

Case-study: application of different sampling schemes and the corresponding budget