

NCCC-170
Research Advances in Agricultural Statistics
Annual meeting held virtually by Zoom
June 25, 2021

Members Present: Nora Bello (KS), Bruce Craig (IN, Admin.), Xin Dai (UT), Philip Dixon (IA), Sara Duke (USDA-ARS), Susan Durham (UT), Ed Gbur (AR), Carla Goad (OK), Kathy Hanford (NE), Clark Kogan (WA), Matt Kramer (USDA-ARS), Xuelin Luo (GA), Raul Macchiavelli (PR), Larry Madden (OH), Gayla Olbricht (MO), Julia Piaskowski (ID), Bill Price (ID), Guilherme Rosa (WI), Daniel Runcie (CA), Julia Sharp (CO), Rob Tempelman (MI)

Others Present: Arianna Bunnell (UT), Nick Keuler (WI), Neil Paton (Cargill), Hannah Phillips (MN), Hans-Peter Piepho (Germany), Aaron Rendahl (MN), John Stevens (UT), Walt Stroup (NE emeritus), Edzard van Santen (FL)

2021 Officers: Nora Bello, chair; Susan Durham, secretary (minutes); Nora Bello, program chair; Nora Bello, “local” arrangements (virtual); Ed Gbur, report preparation.

NCCC-170 Website: <https://nccc170.uark.edu>

NIMSS Website: <https://www.nimss.org/projects/view/mrp/outline/17816> for the 2016-2021 project

Minutes:

Technical program: The meeting began at 9:00 a.m. CT on Friday, June 25, 2021, with a welcome and opening remarks by Nora Bello, followed by a round of self-introduction of attending members. Presentations ended at about 10:15 a.m.

The technical program consisted of the following presentations and subsequent discussions:

Arianna Bunnell and John R. Stevens	Extending the Stuart-Maxwell test to account for ordinal category levels
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Daniel Runcie and Hao Cheng	Pitfalls and remedies for cross validation with multi-trait genomic prediction methods
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Group discussion: Discussion began about 10:20 a.m. and ended at about 10:45 a.m.

Group discussion led by Walt Stroup	Progress update on <i>SAS for Mixed Models</i> , 3 rd edition, Volume 2 <i>Advanced Applications</i> by G. Milliken, E. Claassen, R. Wolfinger and W. Stroup)
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SAS[®] for Mixed Models: Introduction and Basic Applications (3rd ed, Vol 1) was released in 2018. Walt reported that the second volume *Advanced Applications* was placed on hold in 2019 when it no longer was a component of the SAS Publishing plan. More focus was on the JMP platform, with the publication of *JMP[®] for Mixed Models* in 2021. Consequently, the authors of Vol 2—Walt Stroup, George Milliken, Elizabeth Claassen, and Russ Wolfinger—have decided to self-publish, with details yet to be determined. The target publication date is the end of the year. Walt shared the tentative chapter list.

In response to his question about whether there was a demand for such a text, the group concurred. Walt solicited volunteers from the group for peer review, possibly toward the end of summer. Ideas were pitched for on-demand printing; guest authors as case study editors; biomedical data for more case studies; combining case studies with a similar “theme” into fewer chapters; covering all or most obvious options in case studies. Walt will keep the group informed.

Business meeting: The business meeting began at about 10:45 a.m. Nora Bello presided. The following items were discussed:

(1) Nora announced that the NCCC-170 project for 2021-2026 has been approved. She thanked Bruce and Ed for their efforts, and Bruce thanked Nora for hers.

(2) Nora welcomed new members. In regards to project objective 2, she encouraged the group to identify additional colleagues. She noted the silver lining to Zoom meetings that allows people to participate from a broad geographic range without regard to travel cost or time constraints.

(3) The last annual report for the 2016-2021 NCCC-170 project and corresponding impact statement are due this fall. Nora will soon request accountings from group participants of all activities (workshops, papers, presentations, grants, awards, teaching related items, etc.) from October 1, 2020 to September 30, 2021 (or since last year's report) that are related to or inspired by participation in NCCC-170.

Ed noted that reviewers of the new project commented on the lack of joint publications by group participants. Nora opined that criticism might have been a consequence of confusion created by the original wording of objective 1; the revision of the wording was apparently acceptable. The revised objective under the 2021-2026 NCCC-170 project now reads: "To identify, foster and coordinate educational and research efforts in statistics among statisticians serving food and agriculture research programs, thus enhancing their relevance to collaborative research teams at their home institutions."

Bruce noted that reviewers of the new project were curious as to what benefits NCCC-170 offers above and beyond a standard conference. Nora noted the group's focus on mentoring and cited, as an example, the white paper "Overview of statistics as a scientific discipline and practical implications for the evaluation of faculty excellence" (<https://www.amstat.org/asa/files/pdfs/POL-Statistics-as-a-Scientific-Discipline.pdf>) written by NCCC-170 members and endorsed by the Board of the American Statistical Association. The value of mentoring was better articulated in the revision of the project proposal that was accepted.

(4) The 2022 meeting will be held at Oklahoma State University June 9-10, 2022, with Carla Goad as the local host and Clark Kogan as program chair. The 2023 meeting is tentatively planned for University of Puerto Rico (with Raul Macchiavelli as host), Purdue University (with Bruce Craig as host), or Iowa State University (with Philip Dixon as host).

(5) Nora took a group photo, a la "Brady Bunch". Submitted as accompanying document to this report.

The business meeting adjourned at approximately 11:15 a.m.

Participants socialized until about 12:00 p.m.

Specific goals for the 2016-2021 NCCC-170 project, relevant to this report:

- (1) To identify, foster and coordinate cooperative research efforts in statistics among statisticians serving food and agriculture research programs.
- (2) To provide continuing education and statistical support to the scientific community in the review and editorial process.
- (3) To address the statistical design and analysis issues associated with studies involving technologies that typically produce a large number of spatially and/or temporally correlated variables per observations but small sample sizes (e.g., -omics, informatics, and -metrics).
- (4) To address concerns associated with the development and implementation of generalized linear mixed model techniques and software used by statisticians and researchers.
- (5) To address meta-analysis issues associated with multi-location, multi-investigator projects including those in which study treatments and/or designs may differ by location.

Accomplishments: Statisticians who consult and do research in an Agricultural Experiment Station environment enable land grant institutions to perform their agricultural research missions more effectively and efficiently than would otherwise be possible. However, most stations have at most one or two professional statisticians who are not, and cannot be expected to be, experts in every area of statistics. This multi-state committee brings together statisticians to work cooperatively to determine the best current approaches to common statistical problems and to help guide future directions of sound statistical practice. In addition to producing group outputs such as workshops, the committee serves as a resource for its members and a sounding board for new ideas in their applied statistical research. As a result, all members are able to provide more effective assistance to agricultural researchers addressing national research priorities than they would without NCCC-170.

Outputs:

Workshops / Short Courses:

Nora Bello, Bruce Craig, Robert Tempelman. Invited Short Course on Mixed Models (July 2021). Workshop delivered in conjunction with the Annual Meetings of the American Dairy Science Association.

Nora Bello (July 2020). Invited Short Course on Mixed Models. National University of Litoral, Corrientes, Argentina. Postponed due to COVID-19 shut-down.

Nora Bello (July 2020) Invited Short Course entitled: At the frontier of Mixed Models: Scope, limitations and challenges. National University of Buenos Aires, Buenos Aires, Argentina. Postponed due to COVID-19 shut-down.

Macchiavelli, R. Strategies for the Statistical Analysis of Spatial Correlated Data. Short course (20 hours) *Special Topics Course in the Master's Program in Applied Statistics*. National University of Córdoba (Argentina). August-September, 2021 (remote course).

Guilherme J. M. Rosa. Statistical Modeling in Animal Breeding and Genetics. Sao Paulo State University (UNESP) - Jaboticabal, Brazil. August 10-14, 2020. (remote course)

Guilherme J. M. Rosa. Quantitative Genetics. 25th Summer Institute in Statistical Genetics, University of Washington, Seattle - WA. July 20-22, 2020. (remote course)

Guilherme J. M. Rosa. Mixed Models in Quantitative Genetics. 25th Summer Institute in Statistical Genetics, University of Washington, Seattle - WA. July 22-24, 2020. (remote course)

Walter W Stroup. 2021 Bayesian Analysis of GLMMs Using PROC BGLIMM SAS Global Forum 2021: Tutorial.

Presentations:

Nora Bello “Statistics for Reproducible Research in Companion Animal Nutrition”. Invited talk at the Companion Animal Symposium: Experimental Design and Statistics Applied to Companion Animal Nutrition, at the American Society of Animal Science (ASAS) and Canadian Society of Animal Science (CSAS) Annual Meeting and Trade Show. Virtual platform. July 15, 2021.

Nora Bello “Thoughts on Modern Quantitative Literacy for the Agricultural Sciences”. Invited Seminar, Department of Animal Sciences, Ohio State University. Virtual platform. June 9, 2021.

Nora Bello “Systems Modeling for Integrated Animal Production”. Invited Seminar, Department of Animal Sciences, Ohio State University. Virtual platform. June 8, 2021.

Nora Bello “On Transdisciplinary Research and Education at K-State: A Personal Snapshot”. Department of Statistics Seminar Series, Kansas State University. Virtual platform. April 22, 2021.

Nora Bello “Statistics for Reproducible Research: Transition Cows”. Invited talk at the 39th American Dairy Science Association (ADSA) Discover Conference on Food Animal Agriculture: The transition period – from physiology to management. Virtual platform. October 28, 2020.

Nora Bello “Excellence in Engaged Scholarship: Thoughts for the Animal Sciences of the 21st Century”. Invited talk, Department of Animal Sciences, Purdue University. Virtual platform. October 16, 2020.

P.M. Dixon. “Where do Bayesian methods fit in an applied statistician’s toolbox?” Conference on Applied Statistics in Agriculture and Natural Resources, May 2021 (virtual)

P.M. Dixon “How and where does Bayesian inference fit in our statistical toolbox?” Agronomy Society of America annual meeting November 2020 (virtual)

Bianchi-Santiago, J., D. Valdés, R. Macchiavelli . « KABCO Severity Cost Estimation by Cluster Analysis for Injury-Only Crashes in Puerto Rico”, Refereed Oral Presentation, Transportation Safety Board 100th Annual Meeting, January 24-28, 2021.

Macchiavelli, R. “Seed Rain” in a Caribbean Forest: Generalized Linear Mixed Models for Count Data. XXV Jornadas de Investigaciones en la Facultad de Ciencias Económicas y Estadística de la Universidad Nacional de Rosario, April, 28, 2021. (Virtual Invited Talk)

Macchiavelli, R. Modern Methods for Statistical Analysis in the Big Data Era. *Jornadas de Aniversario, Escuela de Ingeniería Agronómica de la Universidad Autónoma de Santo Domingo*. Santo Domingo (Dominican Republic), October 27, 2020 (Virtual Talk)

Adjei, R. and Stevens J.R. Comparative Analysis of Statistical Methods for Single-Cell RNA Sequencing Data. Conference on Applied Statistics in Ag and Natural Resources, virtual via University of Florida. May 19, 2021.

Madden, L. V. Purdue University Seminar: “The cost of plant disease prediction”. November 2020.

Madden, L. V. Ohio State University invited Seminar: “Following my passions in plant disease epidemiology: The director’s cut”. Dept. of Plant Pathology, Fall 2020.

Madden, L. V. Invited keynote presentation: “Model ensembles for plant disease prediction”. Plant Science Symposium 2021, The Ohio State University. March 26, 2021.

Bruce Craig Invited speaker at American Statistical Association sponsored webinar: Advice for the Promotion of Collaborative Statisticians in Research and Teaching Institutions. May 26, 2021.

Khanal, P. and R.J. Tempelman. 2021. Diagnosing the pregnancy status of dairy cows using milk spectral data. Presented (virtual) at the Conference on Applied Statistics in Agriculture and Natural Resources, May 20, 2021. <https://conference.ifas.ufl.edu/applied-stats/>

Tempelman, R.J. 2021. Using genetic relationships to improve the design and analysis of animal science studies. Invited paper (virtual) given at the 56th Meeting of the Brazilian Society of Animal Science. August 19, 2021 56a Reunião SBZ

Tempelman, R.J. 2020. Making the journey from frequentist to Bayesian analysis. Invited paper (virtual) presented at the American Society of Agronomy International Annual Meetings, November 11, 2020.

Walter W Stroup. 2021 Bayesian Analysis of GLMMs Using PROC BGLIMM SAS Global Forum 2021: Paper 1146-2021 (presented virtually)

Lipka, A.E. 2021. Using simulations to assess the performance of quantitative genetics models in crops. Soil and Crop Sciences and Ag Bio Seminar Series at Colorado State University (Presented virtually because of the COVID-19 pandemic). March 10, 2021. (Invited speaker)

Lipka, A.E. 2020. The performance of genotype-to-phenotype models accounting for large-effect loci, epistasis, and pleiotropy. International Conference of the Genetics Society of Korea Asia Pacific Chromosome Colloquium 7, Busan, Korea (Presented virtually because of the COVID-19 pandemic). November 26, 2020. (Invited speaker)

Lipka, A.E. 2020. Using simulations to assess the performance of genotype-to-phenotype models accounting for pleiotropy, epistasis, large-effect loci, and interspecific breeding material. 2020 ACES (Virtual) Global Academy Seminar Series, presented to partner universities in Brazil (Federal University of Lavras and Federal University of Viçosa). November 18, 2020. (Invited speaker)

Books and Book Chapters:

Goad, Carla L., SAS Programming for Elementary Statistics: Getting Started, CRC Press, 2021. DOI:10.4324/9780429491900, ISBN: 9780429491900 (ebook), ISBN-13: 978-1138589094 (hardcover), ISBN-13: 978-1138589025 (paperback)

Duree, T., Brye, K., Wood, L. and E. Gbur (2020). Soil moisture regime and mound position effects on soil water and vegetation in a native tallgrass prairie in the mid-southern United States. In *Grasses and Grassland*. V.M. Kindomihou (ed). London, UK: IntechOpen. DOI:10.5772/intechopen.89043. 25 pp.

Kidd, M.T., E.E, Gbur, J. Caldas, L.A. Mozzoni and C.W. Maynard (2021). Quantitative analysis of branched-chain amino acid independent data using an all possible subset regression meta-analysis. In: Branched-Chain Amino Acids: Metabolism, Benefits and Role in Disease. Ed. M.T. Kidd. Nova Scientific Publishers, New York, USA.

Hutchins, J., Hueth, B. and Rosa, G. J. M. Quantifying Heterogeneous Returns to Genetic Selection: Evidence from Wisconsin Dairies. In: Economics of Research and Innovation in Agriculture, National Bureau of Economic Research, Inc., 2020.

Publications:

Schwan, C., K. C. Desiree, N. M. Bello, L. Bastos, L. Hok, R. K. Phebus, S. Gragg, J. Kastner and J. Vipham. 2021. "Prevalence of *Salmonella enterica* isolated from food contact and non-food-contact surfaces in Cambodian informal markets". Journal of Food Protection <https://doi.org/10.4315/JFP-20-112>

Chitakasempornkul, K., A. Jager, G. J. M. Rosa and N. M. Bello. 2020. "Hierarchical modeling of structural coefficients for heterogeneous networks, with an application to animal production systems". Journal of Agricultural, Biological and Environmental Statistics (JABES). DOI: 10.1007/s13253-020-00389-0. (Invited paper for a Special Issue of JABES titled "Recent Advances in Design and Analysis of Experiments and Observational Studies in Agriculture").

Desiree, K., C. Schwan, K. Ayub, N. M. Bello and J. Vipham. 2020. "Investigating *Salmonella enterica*, generic *Escherichia coli* and coliforms on fresh vegetables sold in informal markets in Cambodia." Journal of Food Protection. doi: 10.4315/JFP-20-219.

Wang, X., P. Silva, N. M. Bello, D. Singh, B. Evers, S. Mondal, F. Espinosa, R. P. Singh and J. Poland. 2020. "Improved accuracy of high-throughput phenotyping from unmanned aerial systems by extracting traits directly from orthorectified images". Frontiers in Plant Science <https://doi.org/10.3389/fpls.2020.587093>

Murphy, M.L., D. S. Hodgson and N. M. Bello. 2020. "Accuracy of oxygen delivery through bubble humidifiers and nasal catheters". Veterinary Anaesthesia and Analgesia 47: 356-367. DOI: <https://doi.org/10.1016/j.vaa.2020.01.004>

Gallart, M., S. Sabates, H. Tetreault, A. DeLaCruz, J. Bryan^s, J. Alsdurf, M. Knapp, N. M. Bello, S. Baer, B. Maricle, D. A. Gibson, J. Poland, P. St Amand, N. Unruh, O. Parrish and L. Johnson. 2020. "Adaptive genetic potential and plasticity of trait variation in the foundational prairie grass *Andropogon gerardii* across a US Great Plains' climate gradient: Implications for climate change and restoration". Evolutionary Applications 00:1-24. DOI: <https://doi.org/10.1111/eva.13028>

Sheppard-Olivares, S., E. Woods, B. J. Biller, S. E. Hocker, N. M. Bello and R. M Wouda. 2020. "Toceranib phosphate (Palladia ®) in the treatment of canine thyroid carcinoma: 42 cases (2009-2018)". Veterinary and Comparative Oncology. DOI: <https://doi.org/10.1111/vco.12571>.

Li, Y., R. A. Cloyd and N. M. Bello. 2020. "Predation of western flower thrips (Thysanoptera: Triptidae) pupal population by rove beetle, *Dalotia coriaria* (Kraatz) (Coleoptera:Staphylinidae) adults". Journal of Entomological Science 55(2): 219-233. <https://doi.org/10.18474/0749-8004-55.2.219>.

Li, Y., R. A. Cloyd, J. R. Nechols and N. M. Bello. 2020. "Predation efficacy of rove beetle (Coleoptera:Staphylinidae) adults in response to western flower thrips (Thysanoptera:Triptidae) pupal

stage, predator-prey ratio and searchable area". *Journal of Entomological Science* 55(3): 350-365. <https://doi.org/10.18474/0749-8004-55.3.350>

Bartel, C.A., Archontoulis, S.V., Lenssen, A.W., Moore, K.J., Huber, I.L., Laird, D.A., Fei, S., and Dixon, P.M., 2020. Modeling perennial groundcover effects on annual maize grain crop growth with the Agricultural Production Systems sIMulator. *Agronomy Journal* 112(3):1895-1910

Lang, B.J., Widrechner, M.P., Dixon, P.M., and Thompson, J. 2020. Can climatic variables improve phenological predictions for butterfly species? *Journal of Insect Conservation* 24(2): 375-383.

Hinnah FD, Sentelhas PC, Gleason ML, Dixon PM, Zhang X. 2020. Assessing Biogeography of Coffee Rust Risk in Brazil as Affected by the El Niño Southern Oscillation. *Plant Disease* 104(4):1013-1018. doi: 10.1094/PDIS-01-19-0207-SR. Epub 2020 Feb 17.

Fisher, K.E., Dixon, P.M., Han, G., Adelman, J.S., Bradbury, S.P. 2021. Locating small animals using automated VHF radio telemetry with a multi-antennae array. *Methods in Ecology and Evolution* 12:494-506(180)

Abendroth, L., Miguez, F., Castellano, M.J., Carter, P., Messina, C., Dixon, P., Hatfield, J. 2021, Lengthening of maize maturity time is not a widespread climate change adaptation strategy in the U.S. Midwest. *Global Change Biology* 20:2426-2440, <https://doi.org/10.1111/gcb.15565>

Oladzad, A., A. González, R. Macchiavelli, C. Estevez de Jensen, J. Beaver, T. Porch, P. McClean (2020). Genetic Factors Associated with Nodulation and Nitrogen Derived from Atmosphere in a Middle American Common Bean Panel. *Frontiers in Plant Science* vol. 11 (15 December 2020) | <https://doi.org/10.3389/fpls.2020.576078>

Celestin, F., Mylavarapu, R., Hochmuth, G., Li, Y., Jeune, W. and van Santen, E. 2020. Response of black bean (*Phaseolus vulgaris* L.) to phosphorus fertilization in acidic and alkaline soils in Haiti. *Journal of Plant Nutrition*, 43(7), 1016-1024. doi:10.1080/01904167.2019.1702208.

Hinz, F. O., van Santen, E., Fisher, P. R. and Wilson, P. C. (2020). Losses of selected pesticides in drainage water from containerized ornamental plants. *Journal of Environmental Quality*, 49(5), 1334-1346. doi:10.1002/jeq2.20115

Jalpa, L., Mylavarapu, R. S., Hochmuth, G. J., Wright, A. L. and van Santen, E. (2020). Apparent Recovery and Efficiency of Nitrogen Fertilization in Tomato Grown on Sandy Soils. *HortTechnology hortte*, 30(2), 204. doi:10.21273/horttech04480-19

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Gross, Megan A., Claire Andresen, Amanda Holder, Alexi Moehlenpah, Carla Goad, Harvey C. Freetly, Paul A. Beck, Eric A. DeVuyst, David L. Lalman (2020), 127 Predicting Dry Matter Intake of Gestating and Lactating Beef Cows, *Journal of Animal Science* 98(Supplement_2):58-58, OI:10.1093/jas/skz397.132. [2.077]

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Other project related activities:

Nora Bello. Invited participation on the National Science Foundation Convergence Accelerator Workshop on Digital and Precision Agriculture. Virtual platform. May 10, 12, 14, 21, 2021.

Nora Bello. Invited discussion panel on: “The Changing Future of Data and Research: Cross-Disciplinary Problem Solving”. 2021 Conference of the Coalition for Advancing Digital Research and Education (CADRE) at Oklahoma State University. Virtual platform. April 14-16, 2021.

Nora Bello. Invited Podcast: “Statistical Principles for Pig Research: Myths and Facts” <https://www.swineit.com/blog/statistical-principles-in-pig-research-facts-and-myths-dr-nora-bello> Swine-it Podcast Show, hosted by Dr. Laura Greiner and Dr. Marcio Goncalves, June 21, 2021.

Nora Bello (Co-PI) “Reducing foodborne pathogen contamination of vegetables in Cambodia: Innovative research, targeted interventions and impactful Cambodian-led engagement”. Lead investigators: Jessie Vipham, Animal Sciences and Industry, Kansas State University; and Paul Ebner, Department of Animal Sciences, Purdue University. 2020-2024. USAID Award #: 21-0968.

Nora Bello (Co-PI). "RII Track-2 FEC: Building Field-based Ecophysiological Genome-to-Phenome Prediction". Principal Investigator: Stephen Welch, Department of Agronomy, Kansas State University. 2018-2021. National Science Foundation – EPSCoR Research Infrastructure Improvement Program, Program Award #: 1826820.

P.M. Dixon (Co-PI) Monitoring invasive Asian carp in Iowa (PI, Michael Weber, ISU) USGS 2020-2021

Carla Goad. Validation and Delivery of Integrated Natural Enemy + Sugarcane Aphid Economic Thresholds and Monitoring Protocols in Grain Sorghum. USDA 2021 (grant end date unknown)

Bruce Craig, Robert Tempelman, Guilherme Rosa, Xin Dai, Linda Young, Edzard van Santen and Nora Bello served on the organizing committee for the 2021 Conference on Applied Statistics in Agriculture and Natural Resources held virtually on May 17-20, 2021. <https://conference.ifas.ufl.edu/applied-stats/>

Bruce Craig began as a Senior Fellow, National Institute of Statistical Sciences collaborating with National Agricultural Statistics Service on July 1, 2020.

Hans-Peter Piepho, Emlyn Williams and Robert Tempelman were guest editors for the special issue entitled "Recent Advances in Design and Analysis of Experiments and Observational Studies in Agriculture" in the Journal of Agricultural, Biological, and Environmental Statistics.

Impacts:

- (1) Education of members leading to cooperative research efforts and improved consulting and teaching by individual members.
- (2) Cooperative research efforts among some members and information exchange on new developments among all members in the areas of generalized linear mixed models and the analysis of high dimensional, large volume data (i.e., Big Data).
- (3) Members continuing to offer workshops and, where appropriate, alternative means of continuing education and support for subject matter scientists, reviewers, and technical editors on valid design and statistical analysis of studies.