Appendix 1: Members of the National Research Support Program-9 (NRSP-9)

Coordinating Animal Nutrition Committee:

Phil Miller (Chair)

- University of Nebraska
- Swine

Merlin Lindemann (Past Chair)

- University of Kentucky
- Swine

Gary Cromwell (Chair emeritus)

- University of Kentucky
- Swine

Don Beitz

- Iowa State University
- Dairy, Metabolism

Joel Caton

- North Dakota State University
- Beef, Small Ruminant

Delbert Gatlin

- Texas A&M University
- Aquaculture

Arthur Goetsch

- Langston University
- Small Ruminant

Ryan Dilger (Representing the Feed Composition Committee)

- University of Illinois
- Swine, Poultry

Luis Tedeschi (Representing the Modeling Committee)

- Texas A&M University
- Beef

Nancy Irlbeck

- Washington State University
- Horse, Small Ruminant

Heidi Rossow

- University of California-Davis
- Dairy

Brian Small

- University of Idaho
- Aquaculture

Carey Williams

- Rutgers State University
- Equine

Feed Composition Committee:

Ryan Dilger (Chair)

- University of Illinois
- Swine, Poultry

William Dozier

- Auburn University
- Poultry

Mark Edwards

- Cal-Poly – San Luis Obispo
- Equine, Small Ruminant

Tara Felix

- Pennsylvania State University
- Beef

Andrew Foote

- Oklahoma State University
- Beef

Alexander Hristov

- Pennsylvania State University
- Dairy

Brooke Humphrey

- Phibro Animal Health
- Swine, Poultry

Woo Kyun Kim

- University of Georgia
- Poultry

Fredric Owens

- Oklahoma State University
- Beef

Brian Small

- University of Idaho
- Aquaculture

Sandra Solaiman

- Tuskegee University
- Small Ruminant

Modeling Committee:

Luis Tedeschi (Chair)

- Texas A&M University
- Beef

Dominique Bureau

- University of Guelph
- Aquaculture

Todd Callaway

- University of Georgia
- Micro

Peter Ferket

- North Carolina State University
- Poultry

Arthur Goetsch

- Langston University
- Small Ruminant

Tim Hackmann

- University of Florida
- Rumen Microbiology

Mark Hanigan

- Virginia Tech University
- Dairy

Hector Menendez

- South Dakota State University
- Beef

Edgar Oviedo-Rondon

- North Carolina State University
- Poultry

Emiliano Raffrenato

- RUM&N Consulting
- Dairy, Beef, Industry

Aline Remus

- Agriculture and AgriFood Canada
- Swine

Heidi Rossow

- University of California-Davis
- Dairy

Mike VandeHaar

- Michigan State University
- Dairy

Robin White

- Virginia Tech
- Beef, Dairy

Sarah White-Springer

- Texas A&M University
- Horse

Climate Smart Feed Management Committee:

Luis Tedeschi (Chair)

- Texas A&M University
- Ruminant Nutrition

Matthew R. Beck

- USDA-ARS Livestock Nutrient Management Research
- Ruminant Nutritionist

Ellen Dierenfeld

- World Wildlife Fund
- Sustainable Feed Innovations

Mary Drewnoski

- University of Nebraska
- Beef Systems Specialist

Andrew Foote

- Oklahoma State University
- Ruminant Nutrition

Elizabeth French

- USDA-ARS Dairy Forage Research Center
- Dairy Nutrition, Precision Feeding

Karun Kaniyamattam

- Texas A&M University
- Livestock Data Analytics, Artificial Intelligence

Jim MacDonald

- University of Nebraska
- Ruminant Nutrition, Beef Systems

Hector Menendez

- South Dakota State University
- Ruminant Grazing Systems

Heidi Rossow

- University of California-Davis
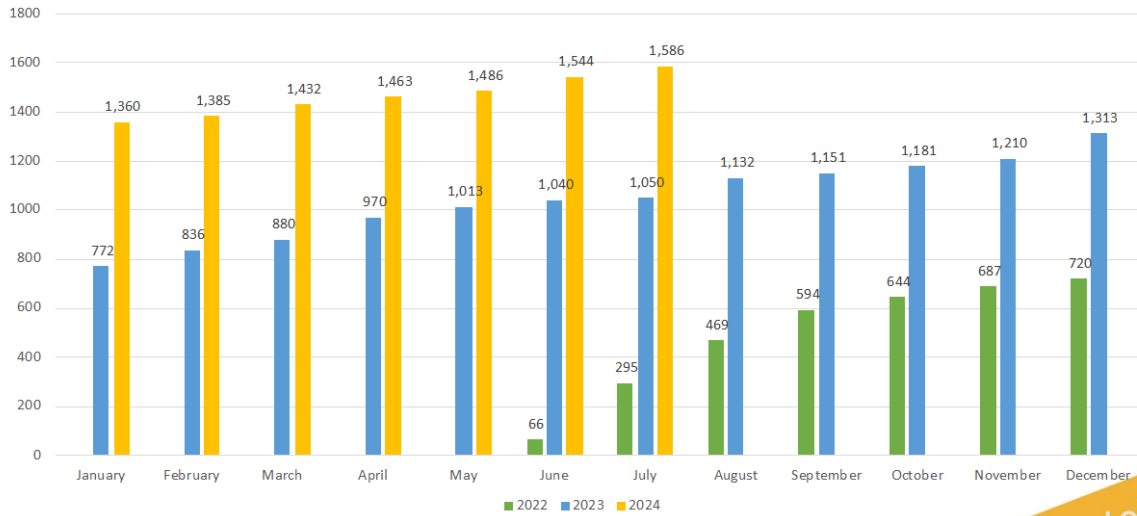- Ruminant Nutrition Management

Jerry Shurson

- University of Minnesota
- Swine Nutrition

Elias Uddin

- University of Connecticut
- Life Cycle Assessment

Appendix 2. Impact of the NRSP-9 social media efforts. Values represent total individuals among all social media platforms.

Audience Growth
June 2022 – July 2024

Legend: ■ 2022 ■ 2023 ■ 2024

Month	2022	2023	2024
January		772	1,360
February		836	1,385
March		880	1,432
April		970	1,463
May		1,013	1,486
June	66	1,040	1,544
July	295	1,050	1,586
August	469	1,132	
September	594	1,151	
October	644	1,181	
November	687	1,210	
December	720	1,313	

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Appendix 3
CITATIONS
Since 2019, there are 20 peer-reviewed papers that were cited 233 times. We used the metrics from the Journal and the Web of Science Citation tool.

Reference	Citations/Views and Notes
2023	
Brennan, J., H. M. Menendez, III, K. Ehlert, and L. O. Tedeschi. 2023. ASAS-NANP symposium: mathematical modeling in animal nutrition—Making sense of big data and machine learning: how open-source code can advance training of animal scientists. J. Anim. Sci. 101:skad317. doi: 10.1093/jas/skad317	3 / 1,267
Kaniyamattam, K., and L. O. Tedeschi. 2023. ASAS-NANP symposium: mathematical modeling in animal nutrition: Agent-based modeling for livestock systems: the mechanics of development and application. J. Anim. Sci. 101:skad321. doi: 10.1093/jas/skad321	1 / 890
Muñoz-Tamayo, R., and L. O. Tedeschi. 2023. ASAS-NANP symposium: Mathematical modeling in animal nutrition: the power of identifiability analysis for dynamic modeling in animal science - a practitioner approach. J. Anim. Sci. 101:skad320. doi: 10.1093/jas/skad320	3 / 827
Tedeschi, L. O., H. M. Menendez, III, and A. Remus. 2023. ASAS-NANP SYMPOSIUM: Mathematical modeling in animal nutrition: Training the future generation in data and predictive analytics for sustainable development. A summary of the 2021 and 2022 symposia. J. Anim. Sci. 101:skad318. doi: 10.1093/jas/skad318	0 / 1,313
2022	
Jacobs, M., A. Remus, C. Gaillard, H. M. Menendez, III, L. O. Tedeschi, S. Neethirajan, and J. L. Ellis. 2022. ASAS-NANP SYMPOSIUM: MATHEMATICAL MODELING IN ANIMAL NUTRITION: Limitations and potential next steps for modeling and modelers in the animal sciences. J. Anim. Sci. 100 (6):1-15. doi: 10.1093/jas/skac132	10 / 831 80% of its citations have been received in the past two years, which is higher than you might expect, suggesting that it is currently receiving a lot of interest.
Menendez, H. M., III, J. R. Brennan, C. Gaillard, K. Ehlert, J. Quintana, S. Neethirajan, A. Remus, M. Jacobs, I. A. M. A. Teixeira, B. L. Turner, et al. 2022. ASAS-NANP SYMPOSIUM: MATHEMATICAL MODELING IN ANIMAL NUTRITION: Opportunities and challenges of confined and extensive precision livestock production. J. Anim. Sci. 100 (6):1-19. doi: 10.1093/jas/skac160	15 / 4,125 93% of its citations have been received in the past two years, which is higher than you might expect, suggesting that it is currently receiving a lot of interest.

	Compared to other publications in the same field, this publication is extremely highly cited and has received approximately 9.9 times more citations than average.
Tedeschi, L. O. 2022. ASAS-NANP SYMPOSIUM: MATHEMATICAL MODELING IN ANIMAL NUTRITION: The progression of data analytics and artificial intelligence in support of sustainable development in animal science. J. Anim. Sci. 100 (6):1-11. doi: 10.1093/jas/skac111	15 / 2,853 86% of its citations have been received in the past two years, which is higher than you might expect, suggesting that it is currently receiving a lot of interest.
2021	
Gerrits, W., M. Schop, S. de Vries, and J. Dijkstra. 2021. ASAS-NANP symposium: digestion kinetics in pigs: The next step in feed evaluation and a ready-to-use modeling exercise. J. Anim. Sci. 99 (2):1-8. doi: 10.1093/jas/skab020	14 54% of its citations have been received in the past two years, which is higher than you might expect, suggesting that it is currently receiving a lot of interest.
Morota, G., H. Cheng, D. Cook, and E. Tanaka. 2021. ASAS-NANP SYMPOSIUM: prospects for interactive and dynamic graphics in the era of data-rich animal science. J. Anim. Sci. 99 (2):1-17. doi: 10.1093/jas/skaa402	10 / 2,391 50% of its citations have been received in the past two years.
Stephens, E. C. 2021. ASAS-NANP SYMPOSIUM: Review of systems thinking concepts and their potential value in animal science research J. Anim. Sci. 99 (2):1-7. doi: 10.1093/jas/skab021	6 / 869 33% of its citations have been received in the past two years.
Tedeschi, L. O., D. P. Bureau, P. R. Ferket, and N. L. Trottier. 2021. ASAS-NANP SYMPOSIUM: Mathematical modeling in animal nutrition: training the future generation in data and predictive analytics for sustainable development. A Summary. J. Anim. Sci. 99 (2):1-3. doi: 10.1093/jas/skab023	1 / 1,695
Wang, Z., S. Shadpour, E. Chan, V. Rotondo, K. Wood, and D. Tulpan. 2021. ASAS-NANP SYMPOSIUM: Applications of machine learning for livestock body weight prediction from digital images. J. Anim. Sci. 99 (2):1-15. doi: 10.1093/jas/skab022	48 / 7,336 68% of its citations have been received in the past two years, which is higher than you might expect, suggesting that it is currently receiving a lot of interest. Compared to other publications in the same field, this publication is extremely

	highly cited and has received approximately 20 times more citations than average.
2020	
Tran, H., A. Schlageter-Tello, A. Caprez, P. S. Millerm M. B. Hall, W. P. Weiss, and P. J. Kononoff. 2020. Development of feed composition tables using a statistical screening procedure. J. Dairy Sci. 103:P3786-3803. doi:10.3168/jds.2019-16702	13
Schlageter-Tello, A., G. C. Fahey, T. Freel, L. Koutsos, P. S. Miller, and W. P. Weiss. 2020. ASAS-NANP Symposium: Ruminant/Nonruminant Feed Composition: Challenges and opportunities associated with creating large feed ingredient composition tables. J. Anim. Sci. 98. doi:10.1093/jas/skaa240	1 / 2,718
Menendez III, H. M. and L. O. Tedeschi. 2020. The characterization of the cow-calf, stocker and feedlot cattle industry water footprint to assess the impact of livestock water use sustainability. J. Agric. Sci. doi:10.1017/S0021859620000672	13 / 1,530
Mark D. Hanigan and Veridiana L. Daley. 2020. Use of Mechanistic Nutrition Models to Identify Sustainable Food Animal Production. Annu. Rev. Anim. Biosci. 8:355-376. doi:10.1146/annurev-animal-021419-083913	5
2019	
Daley, V. L., L. E. Armentano, P. J. Kononoff, and M. D. Hanigan. 2019. Modeling fatty acids for dairy cattle: models to predict total fatty acid concentration and fatty acid digestion of feedstuffs. J. Dairy Sci. 103:6982-6999. doi:10.3168/jds.2019-17407	11
C.F Nicholson, A.R.P. Simões, P.A. LaPierre, M.E. Van Amburgh. 2019. ASN-ASAS Symposium: Future of Data Analytics in Nutrition: Modeling complex problems with system dynamics: applications in animal agriculture. J. Anim. Sci. 97:1903–1920. doi:10.1093/jas/skz105	8 / 2,208 62% of its citations have been received in the past two years.
L.O. Tedeschi. ASN-ASAS Symposium: Future of Data Analytics in Nutrition: Mathematical modeling in ruminant nutrition: approaches and paradigms, extant models, and thoughts for upcoming predictive analytics. J. Anim. Sci. 7:1921–1944. doi:10.1093/jas/skz092	56 / 7,163 42% of its citations have been received in the past two years, which is higher than you might expect, suggesting that it is currently receiving a lot of interest.
Total	233 citations

Appendix 4
WORKSHOPS & SYMPOSIA
There were 46 invited speakers, representing national and international universities, industry, and government.

Year	Meeting	Speaker	Institute
2024	**ASAS-CSAS-WSASAS Annual Meeting, Calgary, Canada**		
1	Introduction	L. O. Tedeschi	Texas A&M University
2	Precision livestock farming: Harnessing artificial intelligence for animal management	I. C. F. S. Condotta	University of Illinois at Urbana-Champaign
3	Combining dynamic models with deep learning through time series analysis	H. M. Rekabdarkolaee	South Dakota State University
4	Applying system dynamics to develop "flight simulators" for sustainable animal production	H. M. Menendez III	South Dakota State University
5	Environmental evaluation of feeding strategies with agent-based modeling and life cycle assessment: from theory to practice	F. Garcia-Launay	INRAE UMR PEGASE
6	Introduction to developing Python computational pipelines for predictive machine learning modeling of livestock data	D. Tulpan	University of Guelph
2023	**ASAS-CSAS-WSASAS Annual Meeting & Trade Show, Albuquerque, NM**		
1	Introduction	L. O. Tedeschi	Texas A&M University
2	Advantages, difficulties, and pitfalls of processing and combining different types of real-time data	T. Brown-Brandl	University of Nebraska-Lincoln
3	Satellite-based decision support tools to assist grazing cattle production	M. H. M. R. Fernandes	São Paulo State University
4	Overview of poultry modeling evolution	E. O. Oviedo-Rondon	North Carolina State University
5	Building an Agent-Based Model in AnyLogic	W. McDonald	University of Saskatchewan
6	The role of system dynamics modeling for sustainable livestock production	A. S. Atzori	University of Sassari
7	Building digital twins for precision livestock farming: Data analytics and big data challenges	J. Tao	Texas A&M University
2023	**NANP Nutrition Models Workshop at ADSA Annual Meeting, Ottawa, Canada**		
1	Model validation	J. Chen	Virginia Tech
2	Building a nutrient requirement model	M. D. Hanigan	Virginia Tech
3	Meta-analysis	R. J. Tempelman	Michigan State University
2022	**ASAS-CSAS Annual Meeting & Trade Show, Oklahoma City, OK**		
1	Introduction	L. O. Tedeschi	Texas A&M University
2	The Power of Theoretical and Practical Identifiability Analysis for Modeling (micro-) Biological Processes	R. Muñoz-Tamayo	INRAE-AgroParisTech, University Paris-Saclay
3	Automation, Machine Learning and Computer Vision as Decision Support	S. McClain	SAS Institute

4	Building Models for Animal Production and Management with System Dynamics Modeling: A Basic Introduction to System Dynamics Modeling	B. L. Turner	Texas A&M University-Kingsville
5	Hands-on: Agent-Based Modeling in Agriculture	K. Kaniyamattam	Texas A&M University
6	Hands-on: Making Sense of Big Data, Machine Learning, and Modeling	J. Brennan	South Dakota State University
2021	**ASAS-CSAS-WSASAS Annual Meeting & Trade Show, Louisville, KY**		
1	Introduction	L. O. Tedeschi	Texas A&M University
2	Opportunities and Limitations of Modeling and Data Analytics for Precision Livestock Farming	A. Remus	Agriculture and Agri-Food Canada
3	Application of Precision Sensor Technologies, Real-time Data Analytics, and Dynamic Models on Extensive Western Rangeland Grazing Systems	H. M. Menendez III	South Dakota State University
4	Mapping Resilience Indicators and Measuring Emotions of Farm Animals Using Sensor Data	S. R. Neethirajan	Wageningen University & Research
5	The Adoption of AI in the Core Scientific Cycle of Feed Research	M. Jacobs	Trouw Nutrition
6	Integrating Mechanistic Models with AI for Precision Feeding of Sows	C. Gaillard	PEGASE, INRAE, Institut Agro
7	EnROADS: Overview of Climate Change Modeling	C. Jones	Climate Interactive
8	Statistical Graphics and Interactive Visualization in Animal Science	G. Morota	Virginia Polytechnic Institute and State University
9	A Brief Overview, Comparison and Practical Applications of Machine Learning Models	D. Tulpan	University of Guelph
2021	**NANP Nutrition Models Workshop at ADSA Annual Meeting (VIRTUAL)**		
1	Tutorial on R	T. J. Hackmann	University of California, Davis
2	Parameter estimation: Lecture and exercises	K. F. Reed	Cornell University
3	Cross-validation and bootstrapping: Lecture and exercises	R. Appuhamy	Iowa State University
4	Automated model selection: Lecture and exercises	V. L. Daley	Land O'Lakes, Davis
5	Molly and other dynamic models: Lecture and exercises	H. A. Rossow	University of California, Davis
2020	**ASAS-CSAS-WSASAS Annual Meeting & Trade Show (VIRTUAL)**		
1	Introduction	L. O. Tedeschi	Texas A&M University
2	Building models using system dynamics methodology: applications to animal science	E. C. Stephens	Agriculture and Agri-Food Canada
3	Modelling digestion kinetics in pigs	W. Gerrits	Wageningen University & Research
4	A brief overview, comparison and practical applications of machine learning models (theoretical background, demos, instructions + hands-on examples)	D. Tulpan	University of Guelph

5	Statistical graphics and interactive visualization in animal science	G. Morota	Virginia Polytechnic Institute and State University
2020	**NANP Nutrition Models Workshop at ADSA Annual Meeting (VIRTUAL)**		
1	Tutorial on R	V. L. Daley	Land O'Lakes
2	Model construction	T. J. Hackmann	University of California, Davis
3	Evaluating model predictions	H. van Lingen	University of California, Davis
4	Meta-analysis	V. L. Daley	Land O'Lakes, Davis
5	Building a nutrient requirement model	M. D. Hanigan	Virginia Tech
2019	**Satellite workshop: 9th Workshop on Modelling Nutrient Digestion and Utilization in Farm Animals (MODNUT)**		
1	Linear Models and Meta-Regression (Theoretical background including instructions for practical, followed by hands-on examples)	K. Reed	Cornell University
2	Mechanistic Models (Theoretical background including instructions for practical, followed by hands-on examples)	M. D. Hanigan	Virginia Tech
3	Install R and RStudio - NANP and Virginia Tech	V. L. Daley and Members of Dr. Hanigan's Lab (Xinbei, Alvaro, Leticia, Jacquelyn, Alexis)	Virginia Tech
2019	**ASAS-CSAS Annual Meeting & Trade Show, Austin, TX**		
1	ASAS-NANP Symposium Introduction		
2	Introduction to mathematical models	M. D. Hanigan	Virginia Tech, Virginia, USA
3	Building Models for Animal Production and Management with System Dynamics Modeling	B. L. Turner	Texas A&M University-Kingsville
4	Introduction to R and R Scripting	R. R. White	Virginia Tech
5	Assessing the predictive adequacy of simple and complex mathematical models	L. O. Tedeschi	Texas A&M University
6	Overview and Case Studies of Cutting Edge Artificial Intelligence Techniques	H. M. Menendez III	Texas A&M University
2019	**NANP Nutrition Models Workshop at ADSA Annual Meeting, Cincinnati, OH**		
1	Welcoming remarks	J. McNamara	Washington State University
2	Tutorial on R	T. J. Hackmann	University of California, Davis
3	Estimation of Parameter Values: lecture	M. D. Hanigan	Virginia Tech
4	Lesson 1: Estimation of Parameter Values: exercises	M. D. Hanigan	Virginia Tech
5	Bootstrap and Cross-Validation: lecture	R. Appuhamy	Iowa State University Ames
6	Lesson 2: Bootstrap and Cross-Validation: exercises	R. Appuhamy	Iowa State University Ames

7	Automated Model Selection: lecture	V. L. Daley	University of Kentucky
8	Lesson 3: Automated Model Selection: exercises	V. L. Daley	University of Kentucky
9	Molly and other dynamic models: lecture	H. A. Rossow	University of California, Davis
10	Lesson 4: Molly and other dynamic models: exercises	H. A. Rossow	University of California, Davis
2018	**ASAS-CSAS Annual Meeting & Trade Show, Vancouver, Canada**		
1	Relevance and Collaboration with the National Research Council	M. D. Lindemann	University of Kentucky, National Animal Nutrition Program (NANP)
2	Food and Agriculture Cyberinformatics and Tools	C. K. Baer	National Institute of Food and Agriculture US Department of Agriculture
3	The evolution of mathematical models for animal nutrition: what to expect next?	L. O. Tedeschi	Texas A&M University
4	Combining simplicity and complexity: creating user-applications from mechanistic nutritional models	J. van Milgen	INRA
5	Modeling the impact of climate change on whole farm systems	A. D. Moore	Digiscape Future Science Platform, CSIRO
6	Decision support for foot-and-mouth disease emergency preparedness: the use of computer modeling and visual analytical tools to evaluate control strategies	L. K. Holmstrom	USDA-NAHMS
7	Modeling complex problems with system dynamics: Applications in Animal Agriculture	C. Nicholson	Cornell University
8	Innovative ways to see data	J. C. Hart	University of Illinois at Urbana-Champaign
2018	**NANP Nutrition Models Workshop at ADSA Annual Meeting, Knoxville, TN**		
1	Introduction and model construction (Part I and II)	T. J. Hackmann, M. D. Hanigan, V. L. Daley	University of California, Davis, Virginia Tech
2	Model evaluation (Part I and II)	E. Kebreab	University of California, Davis
3	Meta-analysis (Part I)	R. R. White	Virginia Tech
4	Opportunities for federal funding of modeling research	S. I. Smith	USDA
2017	**NANP Nutrition Models Workshop at ADSA Annual Meeting, Pittsburgh, PA**		
1	Welcoming remarks		
2	Purposes and types of models	M. D. Hanigan	Virginia Tech
3	Dynamic deterministic models	T. J. Hackmann	University of California, Davis
4	Estimation of parameter values in nutrition models	L. E. Moraes	University of California, Davis
5	Model evaluation	E. Kebreab	University of California, Davis

| 6 | Example models for ruminant digestion and metabolism | H. A. Rossow | University of California, Davis |
| 7 | Meta-regression analysis of animal nutrition literature | R. R. White | Virginia Tech |

There were 46 invited speakers, representing national and international universities, industry, and government.