National Animal Nutrition Program:
Feed Ingredient Nutrient Composition – What's in it for Equids

Mark S. Edwards

Andres Schlageter

Equine Science Society Symposium

05 June 2019 ● Asheville, NC

https://animalnutrition.org/

National Animal Nutrition Program

Leveraging Resources, Linking Researchers

Outline

- National Animal Nutrition Program (NANP)
- Feed composition tables
- Database
  - Literature dataset
  - Commercial laboratories dataset
- Work in progress
- Take home message

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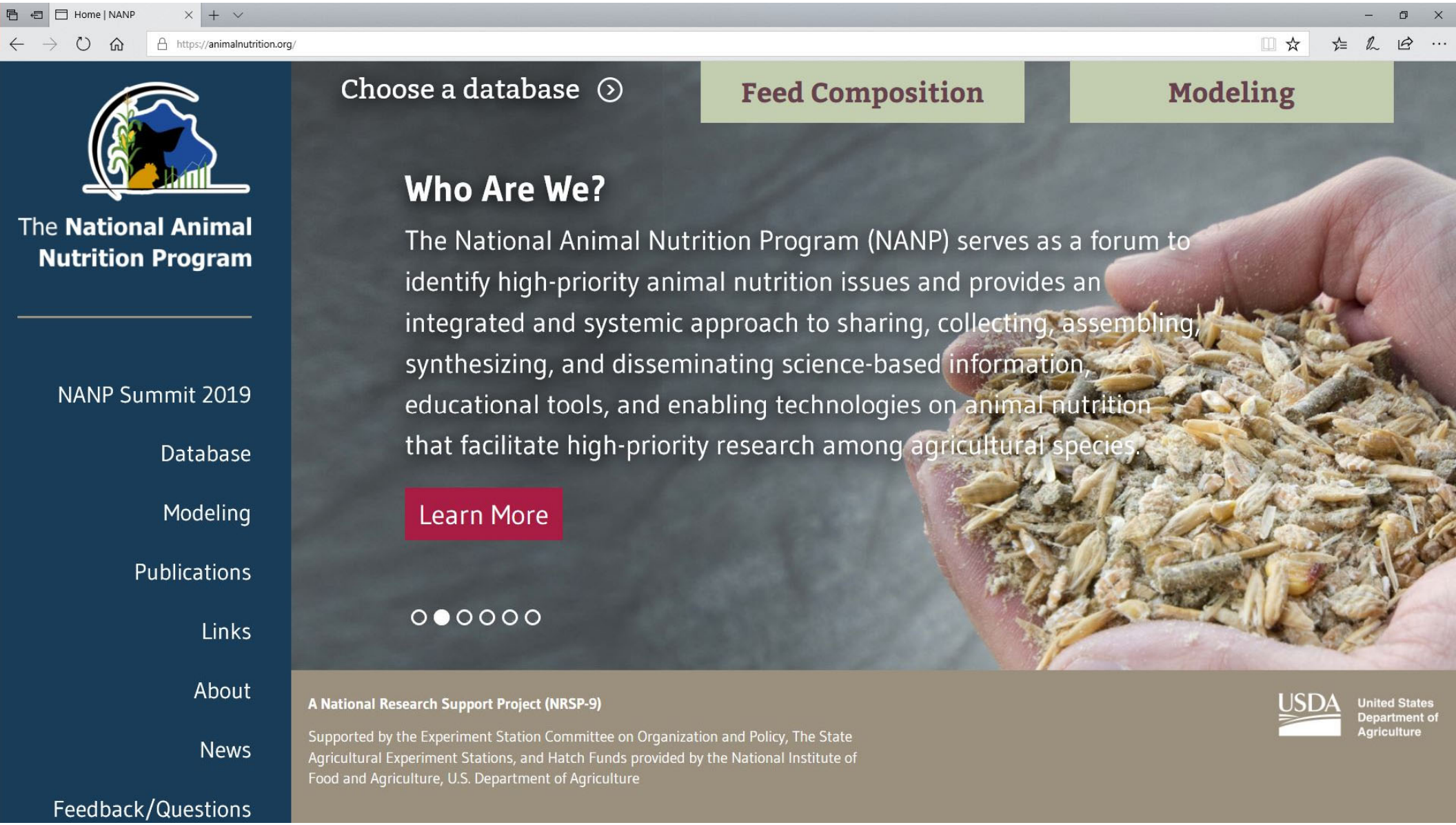
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Who Are We?
The National Animal Nutrition Program (NANP) serves as a forum to identify high-priority animal nutrition issues and provides an integrated and systemic approach to sharing, collecting, assembling, synthesizing, and disseminating science-based information, educational tools, and enabling technologies on animal nutrition that facilitate high-priority research among agricultural species.
Learn More
A National Research Support Project (NRSP-9)
Supported by the Experiment Station Committee on Organization and Policy, The State Agricultural Experiment Stations, and Hatch Funds provided by the National Institute of Food and Agriculture, U.S. Department of Agriculture
USDA
United States Department of Agriculture

National Animal Nutrition Program Organizational Structure

- Coordinating Committee – M. Lindemann (UK)
  - Oversee and coordinate the work of the feed composition and modeling groups, to advise the National Academies on critical national priorities, and to provide a forum to address research support needs
- Feed Composition Committee – P. Miller (UNL)
  - Bring together data and research resources on feed composition, to foster communication among those collecting feed composition information, and to facilitate efficiencies and consistencies in data collection and maintenance
- Modeling Committee – M. Hanigan (VT)
  - To serve the animal nutrition research community by improving the use of predictive technologies and tools, to best utilize available platforms, and to work with researchers to effectively share, combine, manage, manipulate, and analyze models and modeling information.

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Feed Composition Committee

- Phil Miller (Chair), University of Nebraska-Lincoln (Swine)
- Andres Schlageter – University of Kentucky/University of Nebraska (Data)
- Ryan Dilger, University of Illinois (Poultry)
- Bill Dozier, Auburn University (Poultry)
- Mark Edwards, California Polytechnic State University (Equine)
- Alexander Hristov, Pennsylvania State University (Dairy)
- Brian Small, University of Idaho (Fishes)
- Mark Nelson, Washington State University (Beef)
- Casey Bradley, DSM (Swine)
- William Weiss, The Ohio State University (Dairy)

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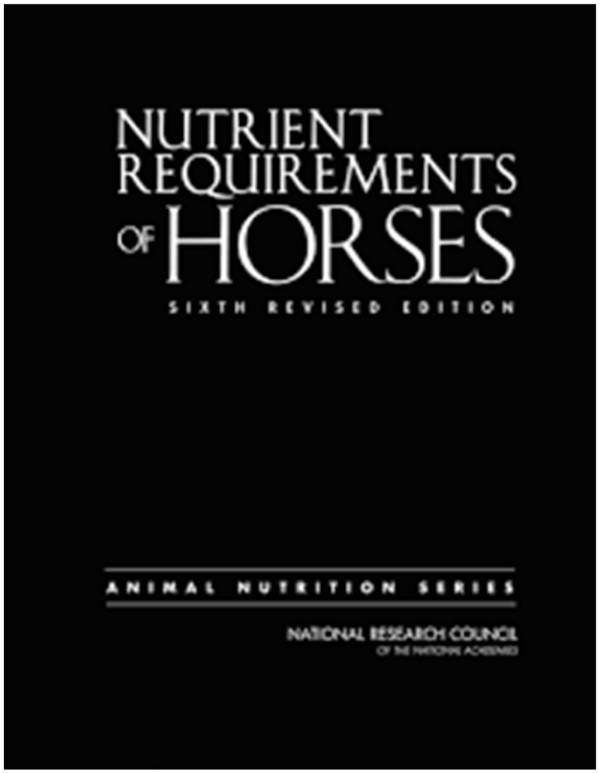
Feed Composition Tables

- Composition of selected feeds (Nutrient Requirements of Dairy Cattle. NRC, 2001)
- Predicted digestible energy (Fonnesbeck, 1981; Pagan, 1998; Zeyner and Kienzle, 2002)
- Composition of inorganic mineral sources
- Fixed values



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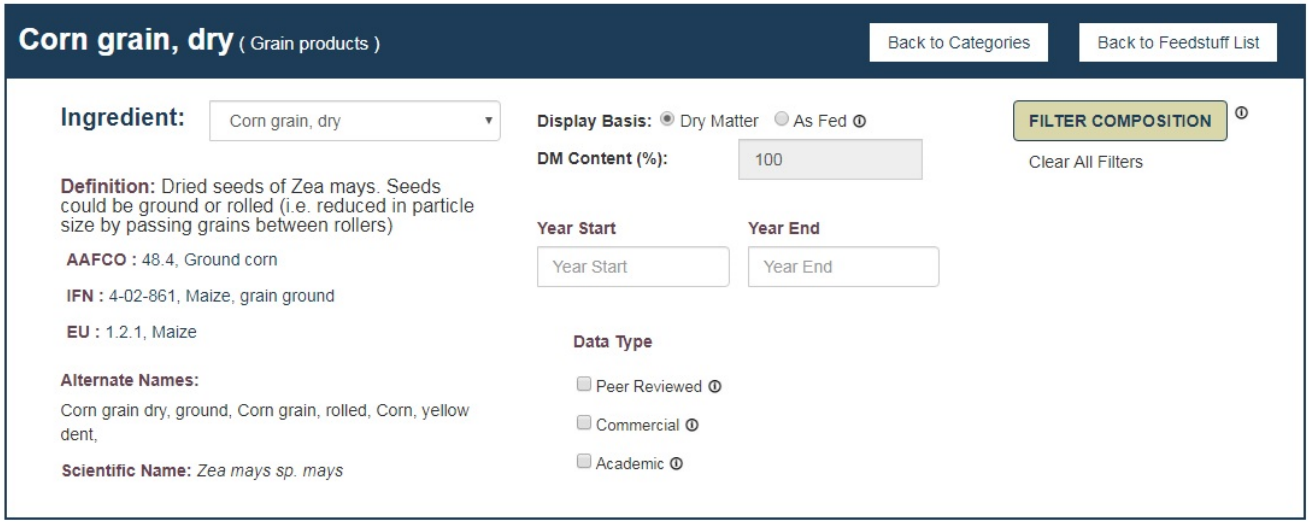

Main Constituents | Carbohydrates | Proteins | Lipids | Minerals | Vitamins

Main Constituents

Nutrient (percentage of dry matter)	n	Mean	SD	CV	10th Percentile	90th Percentile
Actual Dry Matter (DM, %)	400	88.10	2.00	2.27	85.81	90.38
Crude Protein (CP, %)	395	9.21	1.24	13.42	7.82	10.71
Crude Fiber (CF, %)	153	2.19	1.12	51.13	1.15	3.30
Ether Extract (EE, %)	306	3.99	1.07	26.72	3.01	5.00
Acid Ether Extract (AEE, %)	27	4.41	1.25	28.37	3.06	6.80
Ash (%)	227	1.60	1.06	66.24	1.16	1.80
Gross Energy (GE, kcal/kg)	90	4,543.60	223.19	4.91	4,396.97	4,836.66

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Current Database: Structure

Feed composition (127 nutrients)
- 7 Main constituents
- 28 Carbohydrates
- 22 Protein related nutrients
- 30 Lipid related nutrients
- 23 Minerals
- 17 Vitamins

Feed names:
- NANP
- AAFCO
- International Feed Nomenclature
- European Union
- Definition

Nutritive values (in progress)
- AME and Aa digestibility (Poultry)
- NE and digestibility CP, Aa, P (Swine)
- NEl, NEm and degradability CP, NDF (Dairy)
- NEg, NEm and degradability CP (Beef)

Nutrient definition (in progress)
- 127 Nutrients
- 128 nutritive values

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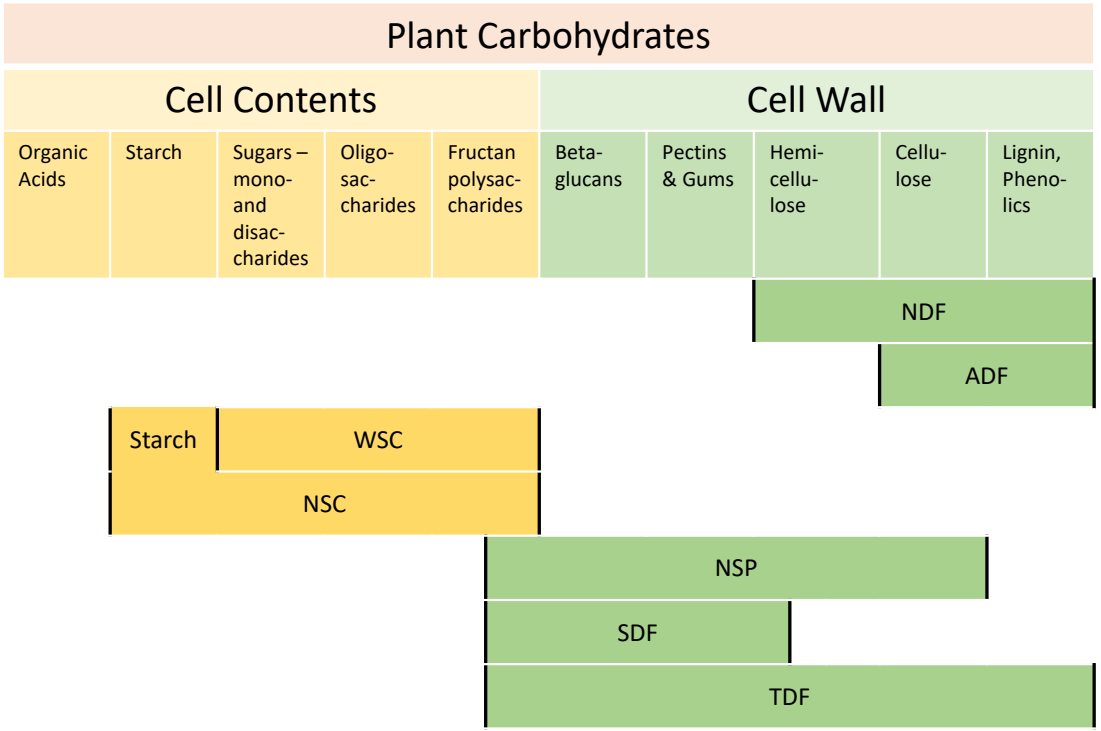
Current Database: Structure

- "Future Proofing"
- Carbohydrates
  - Total Dietary Fiber
    - Insoluble Dietary Fiber
    - Soluble Dietary Fiber
  - Non-starch polysaccharides
  - Water-soluble CHOs
  - Alcohol-soluble CHOs
  - Starch
- Minerals
  - Phytate-P
  - Nonphytate-P



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Current Database: Datasets

- Initially consolidating datasets from different NASEM/NRC committees
  - Literature data (swine, poultry)
  - Commercial laboratory data (beef, dairy)
- Current "Literature Data" dataset
  - 4,807 feed samples
  - 99 different ingredients
  - 67 unique nutrients
- Near future dataset
  - ≈ 2 million feed samples
  - 371 different ingredients
  - 137 unique nutrients
- Complete dataset is available upon request

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Dataset: Literature Data

- Literature data from systematic literature reviews
- Nutrient Requirements of Swine (NRC, 2012)
  - Articles published between 1998 - 2011
  - 2,777 feed samples
  - 147 unique ingredients
  - 67 nutrients
- Database Update: Nutrient Requirements of Poultry (NASEM, In review)
  - Articles (> 30K) published between 2011-2018
  - 2,130 feed samples
  - 131 different ingredients
  - 91 unique nutrients

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Dataset: Literature Data

- Advantages
  - Better method to obtain unbiased data?
  - Smaller datasets, easy to manage (MS Excel)
  - Obtain information of nutrients not commonly analyzed (AAs, FAs, NSPs)
- Disadvantages
  - Values may not be representative of a feed (specially in feeds with low number of samples)
  - Time intensive (gather and review data)
  - Potential errors
    - Keystroke
    - Units % DM or % CP - % or g/Kg

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Dataset: Commercial Lab Data

- Nutrient Requirements of Beef (NASEM, 2016)
  - 3 commercial laboratories
  - 1.1 million feed samples
  - > 200 unique ingredients
  - 33 different nutrients
- Nutrient Requirements of Dairy (NASEM, In Review)
  - 4 commercial laboratories
  - 2.7 million feed samples
  - > 200 unique ingredients
  - 37 different nutrients

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Laboratories, Inc.

WARD
Laboratories, Inc.

ROCK RIVER
LABORATORY, INC.
AGRICULTURAL ANALYSIS

CVAS
Cumberland Valley Analytical Services

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Dataset: Commercial Lab Data

- Advantages
  - Large datasets ensure analytes are more representative of the nutrient composition of feedstuffs being evaluated
- Disadvantages
  - Datasets have millions of data and have errors
  - File formats, data structure, and feed classifications differ among the feed testing laboratories.
  - Data management requires computer codes and high processing power.

Data management is difficult!!!

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Commercial Lab Data: Pre-screening

- Delete invalid samples
  - Unidentified samples
  - Samples without values
  - Repeated samples
  - Samples referring to total mixed ration, concentrate, commercial brands or minerals
  - Non-feed samples (water and manure)
- Standardize different sources
  - Standardize dataset structures (arrange columns in same order)
  - Standardize feed names
  - Standardize nutrient names and units

Pre-screening represents 60% screening procedure time

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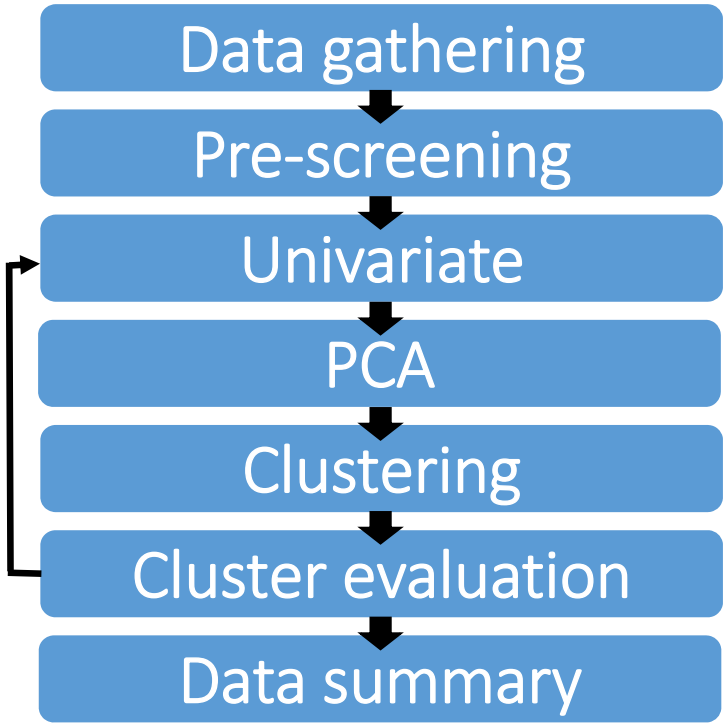
Screening Procedure for Large Datasets



H. Tran, A. Caprez, P. J. Kononoff, P.S. Miller, W. P. Weiss. 2016. Automation of statistical procedures to screen raw data and construct feed composition databases. Journal of Animal Science. 94, Suppl. 5/Journal or Dairy Science. 99, Suppl. 1 p. 670

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Work In Progress

- Non-starch polysaccharides
  - Systematic literature review
- Nutritive values for ingredients commonly used with different species
  - Poultry
    - Apparent ME
    - Apparent ME nitrogen corrected
    - Apparent ileal AA digestibility
    - Standard ileal AA digestibility
  - Fish
  - Horses
  - Small ruminants

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Take Home Message

- National Animal Nutrition Program (NANP) is creating a living, dynamic database of feed composition datasets and tables.
  - Data on ingredients commonly fed to each species drives data improvement to benefit all species
- Feed composition tables are constructed using nutrition information from peer-reviewed literature, commercial and academic laboratories.
- All information created by NANP can be found at http://animalnutrition.org/
- Datasets are available upon request

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