
NIRS FORAGE & FEED
TESTING CONSORTIUM

NIRSConsortium

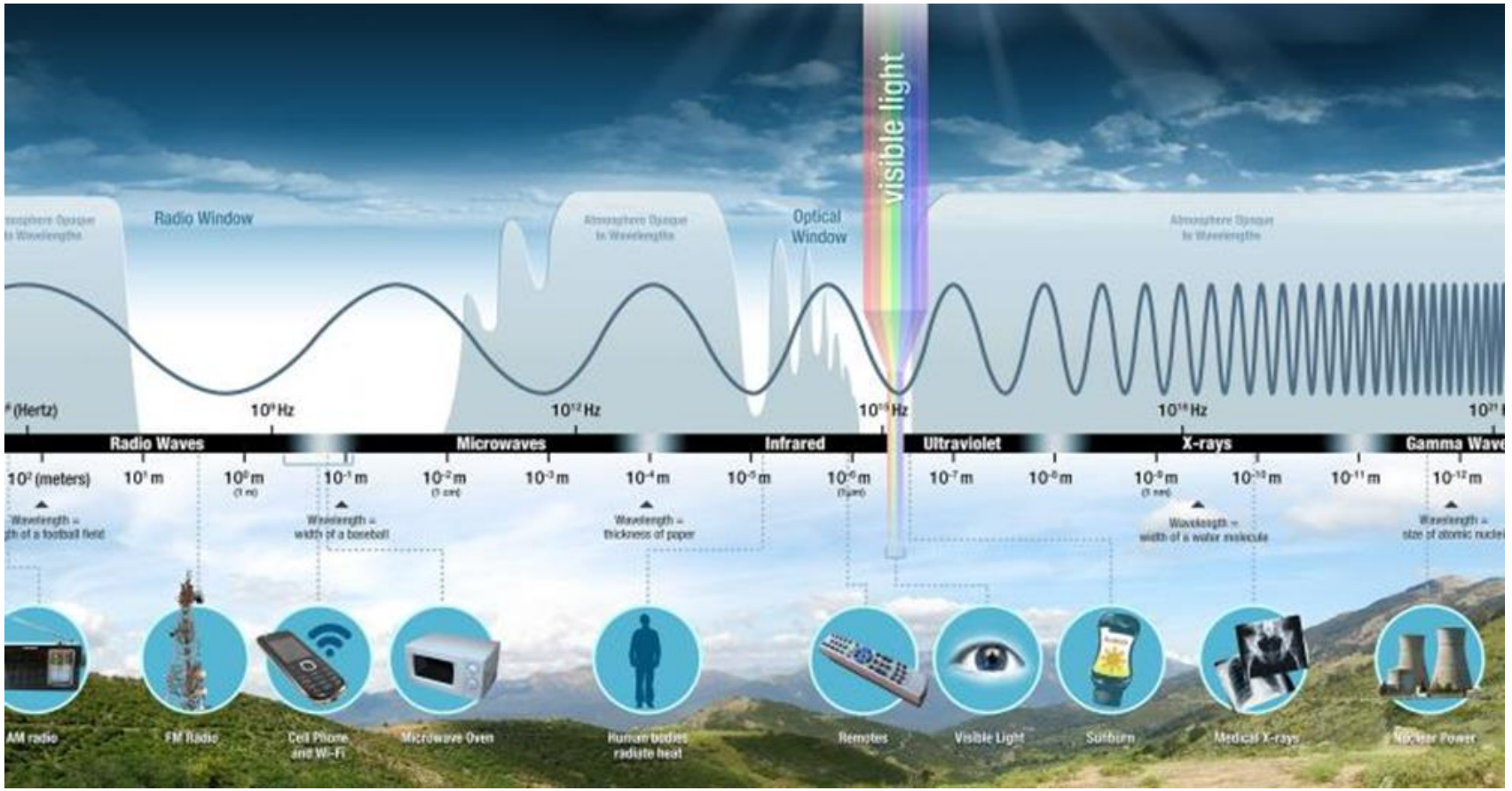
Forage and Feed

AN ASSOCIATION OF COMMERCIAL LABS, UNIVERSITIES, GOVERNMENT GROUPS, PLANT BREEDERS, PRODUCERS, AND INSTRUMENT COMPANIES ALL USING NIRS FOR FORAGE ANALYSIS

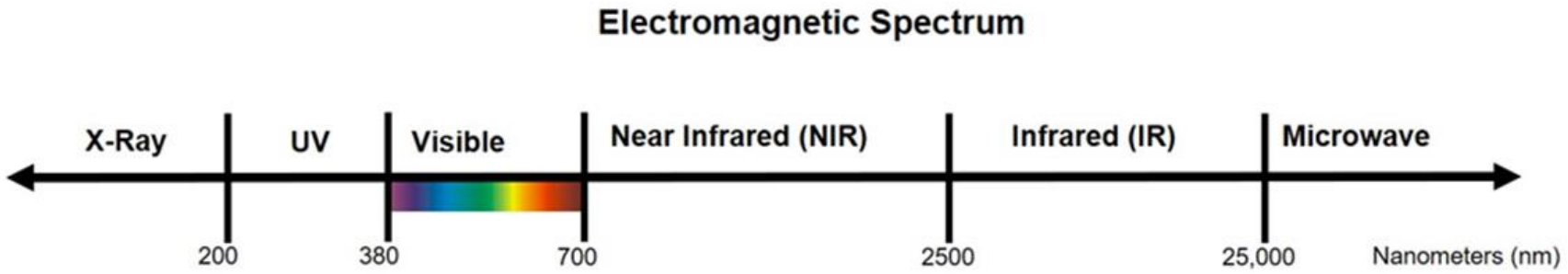
What is NIRS?

Near Infrared Reflectance Spectroscopy

Spectroscopy: the branch of science concerned with the investigation and measurement of spectra produced when matter interacts or emits radiation



Electromagnetic Spectrum

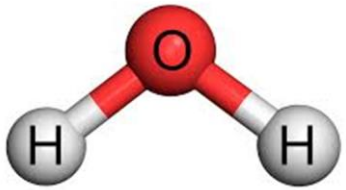


NIR = 780-2500nm

Forage analysis = 1100-2500nm

NIRS is based on molecular overtone and combination vibration & stretching of bonds

*Especially good at picking up those of C,H,O, bonds



History of NIRS

-1800 Near Infrared radiation was first identified by William Herschel

-1939 NIRS was described in scientific literature, but neglected

-1968 Karl Norris & USDA associates first used NIRS to describe characteristics of agricultural products. The first to combine the right spectrometer, computer, and advanced mathematics to create prediction calibrations.

-1970s Wet chemistry methods were being developed and commonly used by labs to describe nutritional characteristics of forages.

-1976 Karl Norris's group started to take chemical reference data, spectra, and chemometrics to predict CP, ADF, NDF. Meanwhile John S. Shenk & colleagues at Penn State University were developing advanced software for this analysis.

-1980s both hardware & software were available for use in labs, but used with much variation

The Magic Box Misconception

Sample

100% Accurate Result

Why doesn’t it work?

My results don’t match **yours!**

HISTORY OF THE NIRSC

1978 - A group of USDA-ARS scientists at six locations created the National NIRS Forage Research Network. They worked for nearly a decade to gather information and summarize findings of differences in NIRS practice across labs.

1990 - A group led by John S. Shenk was formed to evaluate this variation among testing labs and determine ways to standardize NIRS instrument and software methodology.

1992 - This group became the NIRS Forage & Feed Testing Consortium.

2002 - The group elected its first board of directors, created by laws and established the non-profit organization.

Brighter Skies Ahead Through Education & Collaborative Efforts

NIRSC Goals

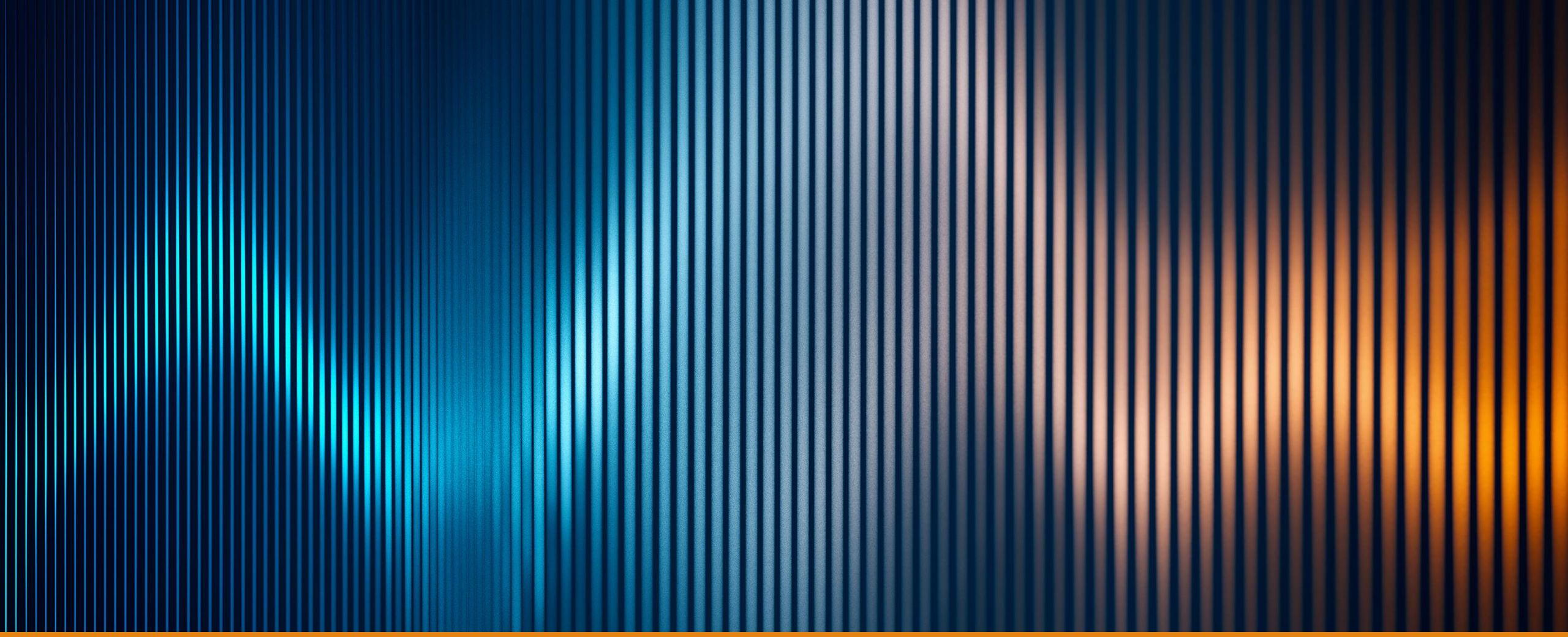
Standardize the use of NIRS

Educate about proper methods and capabilities of NIRS

Collaborate

Advance forage calibration performance

Increase confidence in NIRS use within the industry



In reality NIRS is a complex technology that can be easily understood to generate accurate results.

A simple Approach to Understanding NIRS

1) The very basics of spectroscopy

- Spectra results from the interaction between light & matter.
- Understand why moisture content & grind size is important in regard to light & matter.
- Understand what can and cannot be done by NIRS.

2) The very basics of calibration development

- Understanding that spectra paired with lab reference chemistry is used to create a calibration.
- Understand that a calibration is built with actual samples. Therefore, to analyze an unknown sample, there must have been a sample like it included in the calibration set.
- Sample range creates robustness in calibrations.

3) Always compare like to like

- Samples prepared like those in the calibration dataset.
- Chemistry methods for comparison are like those used in the calibration sample set.
- Reported values are in a like format to those used in comparison.

NIRSC Today

MISSION

To promote and standardize the use of NIRS through development of robust, accurate prediction calibrations.

ADVANTAGE

Membership shares in the efforts and costs to produce forage calibrations for industry use.

TYPES OF MEMBERSHIP

COMMERCIAL

UNIVERSITY RESEARCH/NON-PROFIT

NON-COMMERCIAL

SPONSORSHIP

INSTRUMENT PARTNER

BREEDER

MEMBERSHIP UTILIZATION OF NIRSC CALIBRATIONS

NIRSConsortium
Forage and Feed

Included with annual membership

Unlimited use - No per sample fees

Technical support

INSTRUMENT PARTNERS

Foss

Blue Sun Scientific

KPM Analytics

Supported NIRS Instrumentation

Foss

XDS

5000

6500

DS2500

DS2500 F

DS3

DS3 F

KPM

2600XT-R

2600XT-1

Blue Sun

Phoenix 5000

Phoenix 6000

	NIRSC Calibrations					
Constituents Offered	**Grass Hay**	**Mixed Hay**	**Legume Hay**	**Haylage**	**Fermented Corn Silage**	**Unfermented Corn Silage**
Dry Matter	DM	DM	DM	DM	DM	DM
Crude Protein	CP	CP	CP	CP	CP	CP
Acid Detergent Fiber	ADF	ADF	ADF	ADF	ADF	ADF
Neutral Detergent Fiber	aNDF	aNDF	aNDF	aNDF	aNDF	aNDF
Neutral Detergent Fiber ash free	aNDFom	aNDFom	aNDFom	aNDFom	aNDFom	aNDFom
Digestible Neutral Detergent Fiber 24 Hour						dNDF24
Digestible Neutral Detergent Fiber 30 Hour	dNDF30		dNDF30	dNDF30	dNDF30	dNDF30
Digestible Neutral Detergent Fiber 48 Hour	dNDF48	dNDF48	dNDF48	dNDF48	dNDF48	dNDF48
Ash	Ash	Ash	Ash	Ash	Ash	Ash
Fat	Fat	Fat	Fat	Fat	Fat	Fat
Lignin	Lignin	Lignin	Lignin	Lignin	Lignin	Lignin
Fructan	Fructan	Fructan	Fructan			
Starch	Starch	Starch	Starch	Starch	Starch	Starch
Ethanol Soluble Carbohydrates	ESC	ESC	ESC	ESC	ESC	ESC
Water Soluble Carbohydrates	WSC	WSC	WSC	WSC	WSC	WSC
In-vitro True Dry Matter Digestibility 24 Hour						IVTDMD24
In-vitro True Dry Matter Digestibility 30 Hour	IVTDMD30		IVTDMD30	IVTDMD30	IVTDMD30	IVTDMD30
In-vitro True Dry Matter Digestibility 48 Hour	IVTDMD48	IVTDMD48	IVTDMD48	IVTDMD48	IVTDMD48	IVTDMD48
Calcium	Ca	Ca	Ca	Ca	Ca	
Phosphorus	P	P	P	P	P	
Potassium	K	K	K	K	K	
Magnesium	Mg	Mg	Mg	Mg	Mg	
Acid Detergent Insoluble Crude Protein	ADICP	ADICP	ADICP	ADICP	ADICP	ADICP
Neutral Detergent Insoluble Crude Protein	NDICP	NDICP	NDICP	NDICP	NDICP	NDICP
Insoluble Crude Protein	Insol CP	Insol CP	Insol CP	Insol CP	Insol CP	Insol CP
In-vitro Undigested Neutral Detergent Fiber 240 Hour	uNDF240	uNDF240	uNDF240	uNDF240	uNDF240	uNDF240
In-vitro Undigested Neutral Detergent Fiber ash free 240 Hour	uNDF240om	uNDF240om	uNDF240om	uNDF240om	uNDF240om	uNDF240om
*2025 NIRSC Calibrations						

NIRSC Databases

CALIBRATION SAMPLES COME FROM MEMBERSHIP LABORATORIES

Geographic Range

Altitude & Climate Range

Varying Soil Types

Varying Harvest Timepoints (geographical)

Varying Forage Use

NIRSC CALIBRATIONS HAVE BEEN DEVELOPED OVER DECADES WITH FREQUENT UPDATES

Growing Season Range

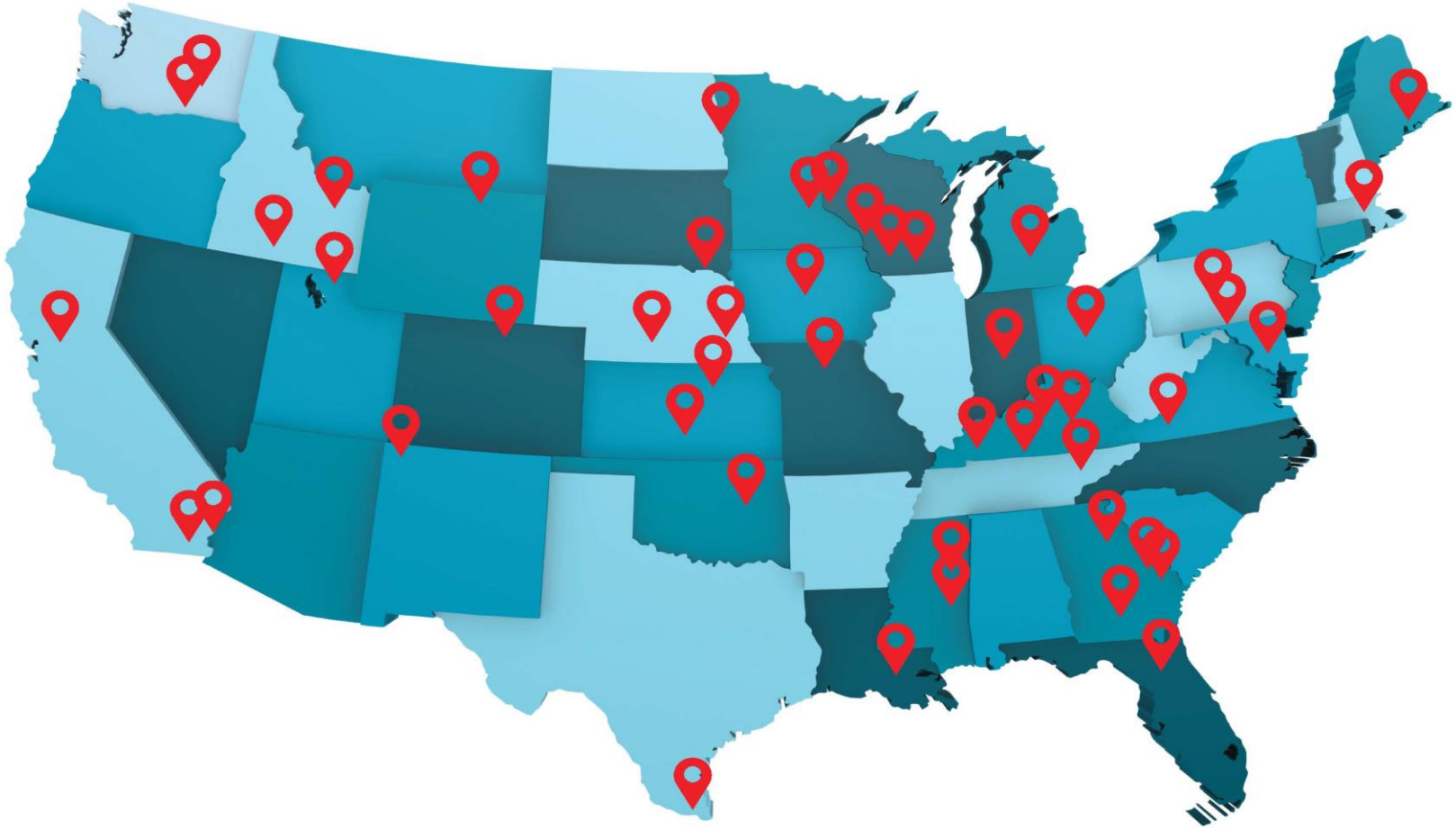
Varying Harvest Timepoints (weather)

Extreme Conditions Captured

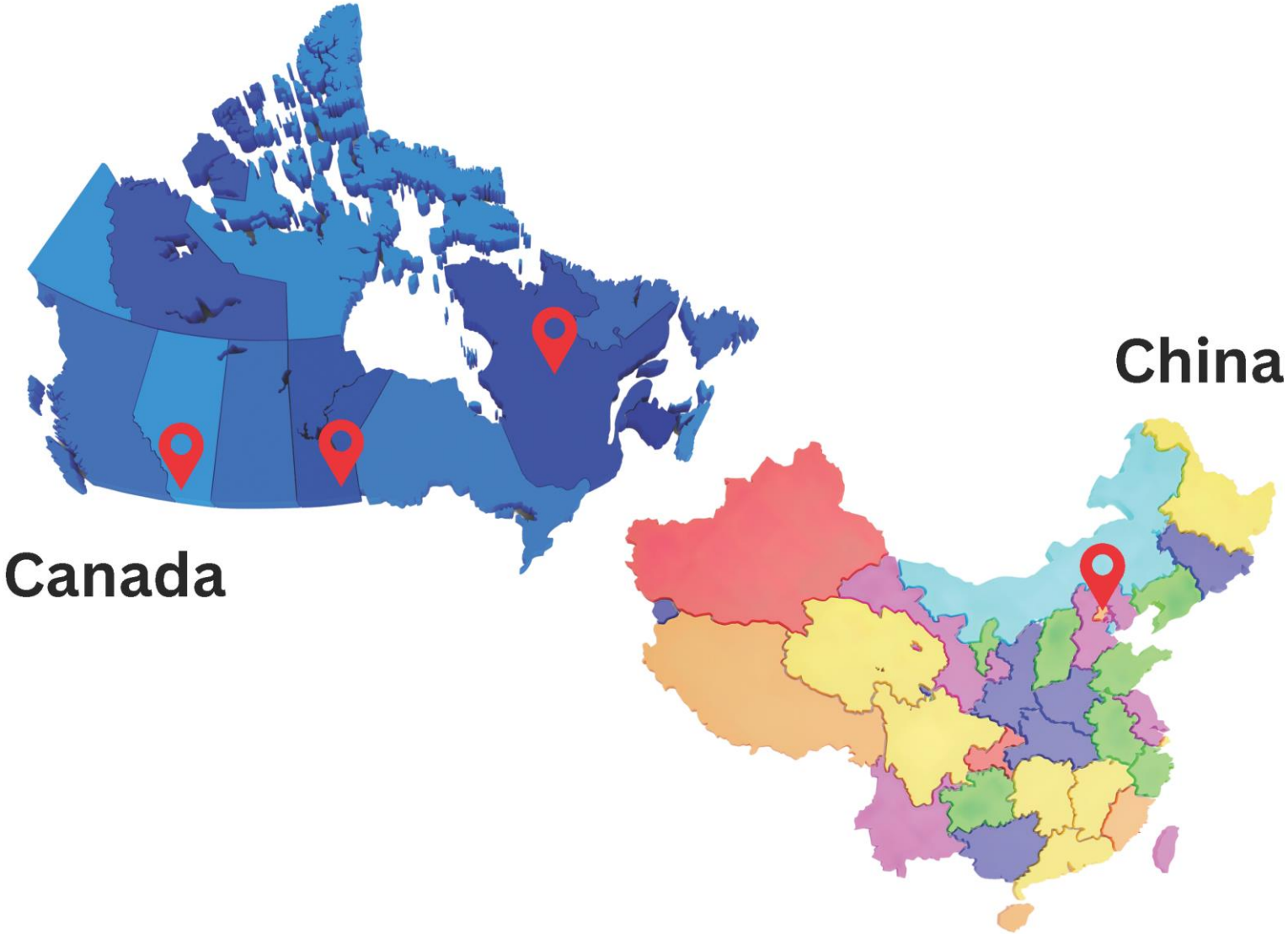
New Analytes Captured

New Technology Captured- Not only NIRS, but also laboratory reference methods & equipment

United States Membership



International Membership



Grass Hay (Dry hay)	Legume Hay (Dry Hay)	Mixed Hay (Dry Hay):	Haylage (Ensiled/Fermented)	Fermented Corn Silage	Unfermented Corn Silage
Alicia	Alfalfa all stages	Percentages of Grass & Legume	Percentages of Grass & Legume	BMR Traits	BMR Traits
Bahia	Alfalfa (Lower Lignin, Lower Sugars)	Percentages of Grass & Weeds	Percentages of Grass & Weeds	Corn Stalk Forage	Corn Stalk Forage
Bermudagrass	Bean Stubble	Percentages of Legume & Weeds	Percentages of Legume & Weeds	Corn Forage Cut to all Stages	Corn Forage Cut to all Stages
Big Bluestem (Forage to Dormant)	Birdsfoot Trefoil	Mixtures including:	Small Grain Silages	Lightly Fermented	Fresh Cut
Brome	Canola	Alfalfa all stages	Silage mixtures including:	Some Unfermented CS	Fresh Sweet Corn Silage
Cane	Clovers (All)	Alfalfa (Lower Lignin, Lower Sugars)	Alfalfa all stages	Strong Fermented	
Coastal Bermudagrass	Cowpea	Bahia	Alfalfa (Lower Lignin, Lower Sugars)	Sweet Corn Silage	
Common Bermudagrass	Lespedeza	Bean Stubble	Bahia		
Crabgrass	Pea	Bermudagrass	Barley Silage		
Crested Wheatgrass/Brome	Peanut	Big Bluestem (Forage to Dormant)	Bean Stubble		
Dwarf Forage Sorghum BMR	Percentages of Legume & Weeds	Birdsfoot Trefoil	Bermudagrass		
Endophyte Free Fescue	Sainfoin	Brome	Big Bluestem (Forage to Dormant)		
Fescue (Every type and E+ with E-/Free)	Soybean as Forage	Cane	Birdsfoot Trefoil		
Forage Sorghum	Sunn Hemp	Canola	Brome		
Gamagrass	Vetch	Clovers (All)	Cane		
Indiangrass (Forage to Dormant)	Any Legume/ Legume Mixtures	Coastal Bermudagrass	Canola		
Kochia		Common Bermudagrass	Clovers (All)		
Little Bluestem		Cowpea	Coastal Bermudagrass		
Meadow Brome		Crabgrass	Common Bermudagrass		
Millet Hay		Crested Wheatgrass/Brome	Cowpea		
Milo Hay		Dwarf Forage Sorghum BMR	Crabgrass		
Mixed Grasses (Not specified)		Endophyte Free Fescue	Crested Wheatgrass/Brome		
Oat Hay		Fescue (Every type and E+ with E-/Free)	Dwarf Forage Sorghum BMR		
Orchardgrass		Forage Sorghum	Endophyte Free Fescue		
Pasture Grass		Gamagrass	Fescue (Every type and E+ with E-/Free)		
Pearl Millet		Indiangrass (Forage to Dormant)	Forage Sorghum		
Percentages of Grass & Weeds		Kochia	Gamagrass		
Prarie Hay		Lespedeza	Indiangrass (Forage to Dormant)		
Quackgrass		Little Bluestem	Lespedeza		
Rye		Meadow Brome	Little Bluestem		
Ryegrass (Per and Ann)		Millet Hay	Meadow Brome		
Sorghum		Milo Hay	Millet Silage		
Sorghum Sudangrass		Mixed Grasses (Not specified)	Milo Silage		
Sorghum x Sudangrass BMR		Oat Hay	Mixed Grasses (Not specified)		
Straw		Orchardgrass	Oatlage		
Sudan Hybrid (Headless)		Pasture Grass	Orchardgrass		
Sudangrass		Pea	Pea Silage		
Switchgrass (Forage to Dormant) (Low and High)		Peanut	Peanut		
Teff		Pearl Millet	Pearl Millet		
Timothy		Prarie Hay	Quackgrass		
Triticale		Quackgrass	Ryelage		
Wheat Hay		Rye	Ryegrass (Per and Ann)		
Any Grass/Grass Mixtures		Ryegrass (Per and Ann)	Sainfoin		
		Sainfoin	Sorghum Silage		
		Sorghum	Sorghum Sudangrass		
		Sorghum Sudangrass	Sorghum x Sudangrass BMR		
		Sorghum x Sudangrass BMR	Soybean as Forage		
		Soybean as Forage	Sudan Hybrid (Headless)		
		Straw	Sudangrass		
		Sudan Hybrid (Headless)	Switchgrass (Forage to Dormant) (Low and High)		
		Sudangrass	Teff		
		Sunn Hemp	Timothy		
		Switchgrass (Forage to Dormant) (Low and High)	Triticale Silage		
		Teff	Vetch		
		Timothy	Wheatlage		
		Triticale			
		Vetch			
		Wheat Hay			

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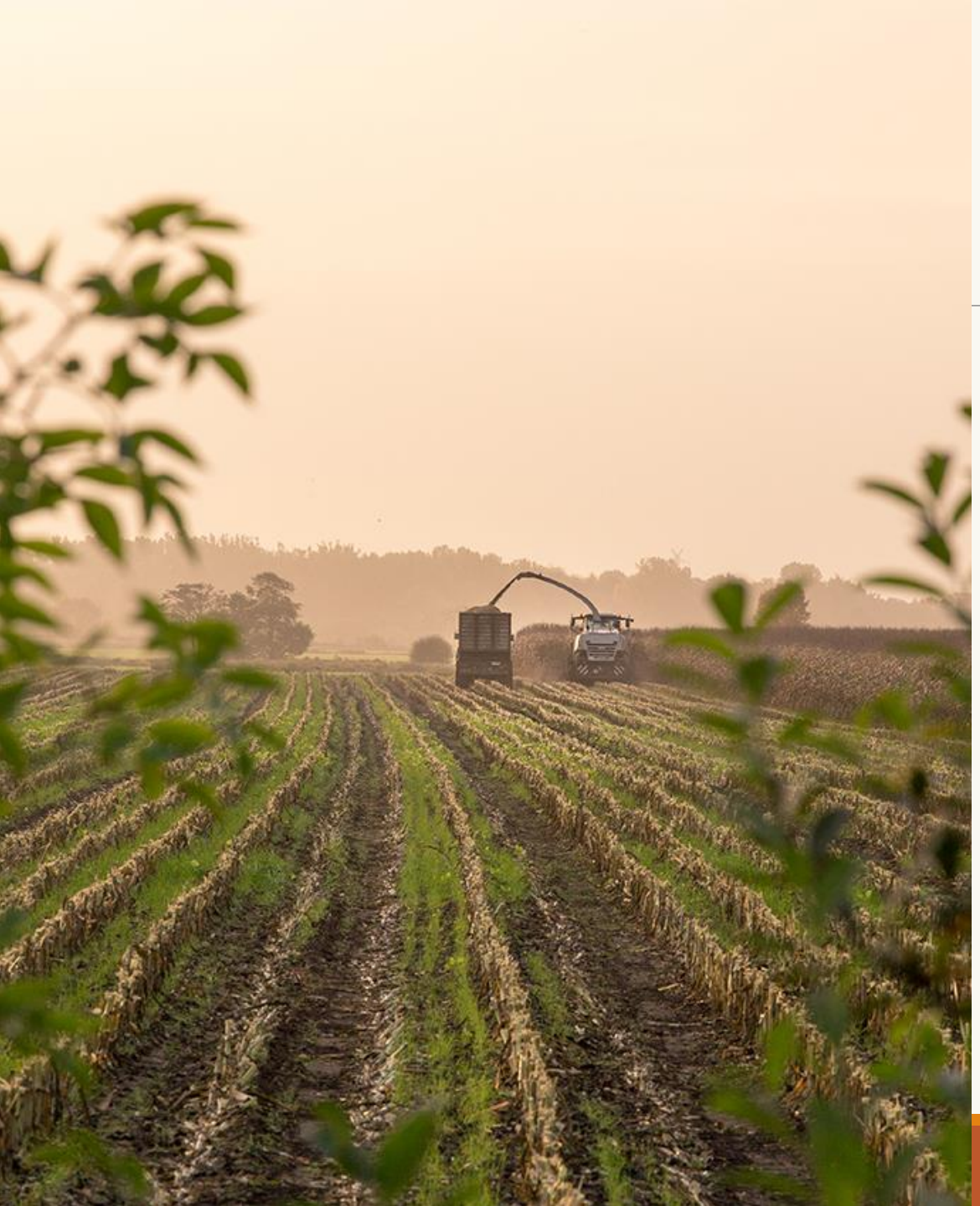
Sample Sets With Range

Create a robust calibration

Can accurately predict values on many species

Realistic for laboratory daily use

*Can sometimes create poor software generated calibration performance statistics that can be misleading!



STRATEGIC CALIBRATION WORK

CLEAN DATABASES

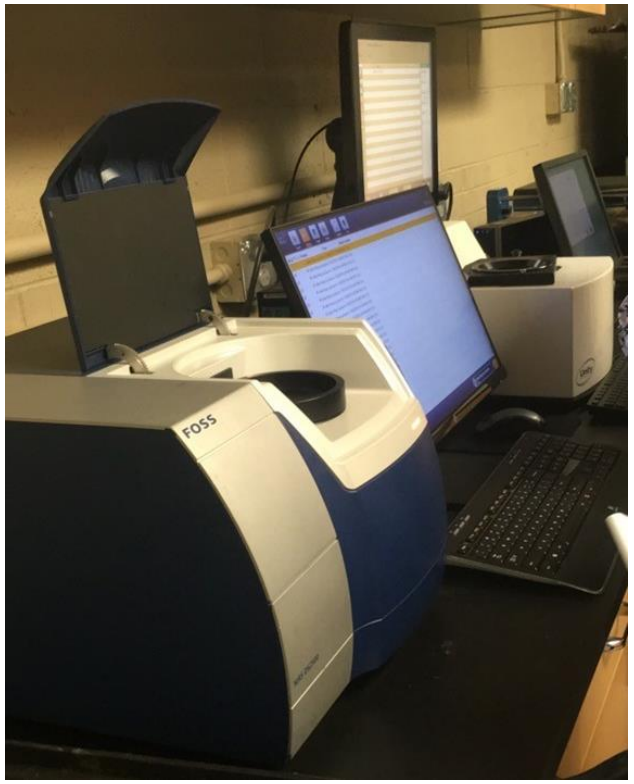
PROPER CALIBRATION TRANSFER

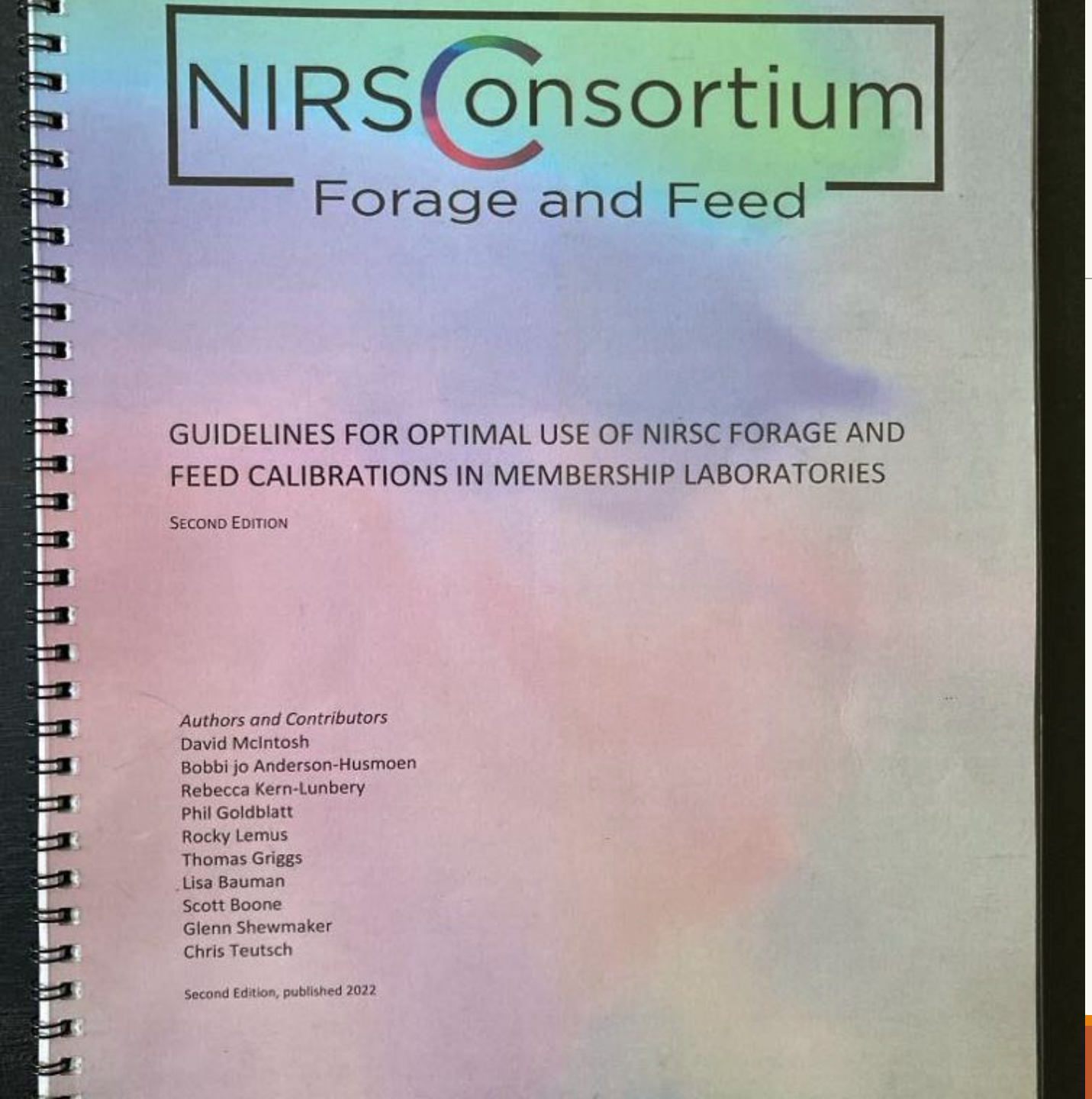
MINIMIZATION OF UNIT T0 UNIT VARIATION


NIRSC INSTRUMENT HUB

Master instruments in one location

- Consistent sample drying, grinding packing, and scanning of update samples.
- Instruments maintained well in a controlled environment.
- Effective monitoring of calibration performance across platforms.
- Hands on learning opportunities for members.





TRAINING OPPORTUNITIES

NIRSC Hub Event at University of Tennessee, Knoxville

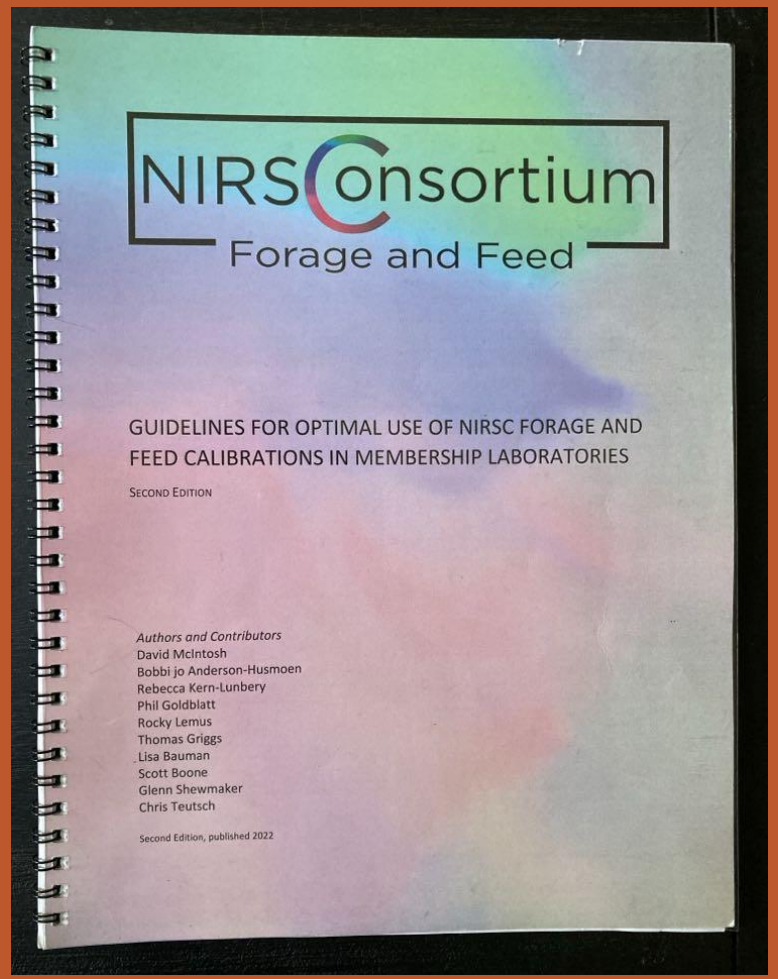
April 15th & 16th, 2026

NIRSC Annual Meeting at AFGC- American Forage & Grassland Conference

pre-conference workshop

January 2026

Guidelines set forth by NIRSC



Sample Preparation

Sample Handling

Instrument Health & Maintenance

Sample Scanning

Calibration Use

Other Notable Member Benefits

-Technical support to members

-Simple instrument & calibration installations

-Non-typical member support option

Learn more about the NIRSC

www.nirsconsortium.com

NIRSConsortium

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Thank you!

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