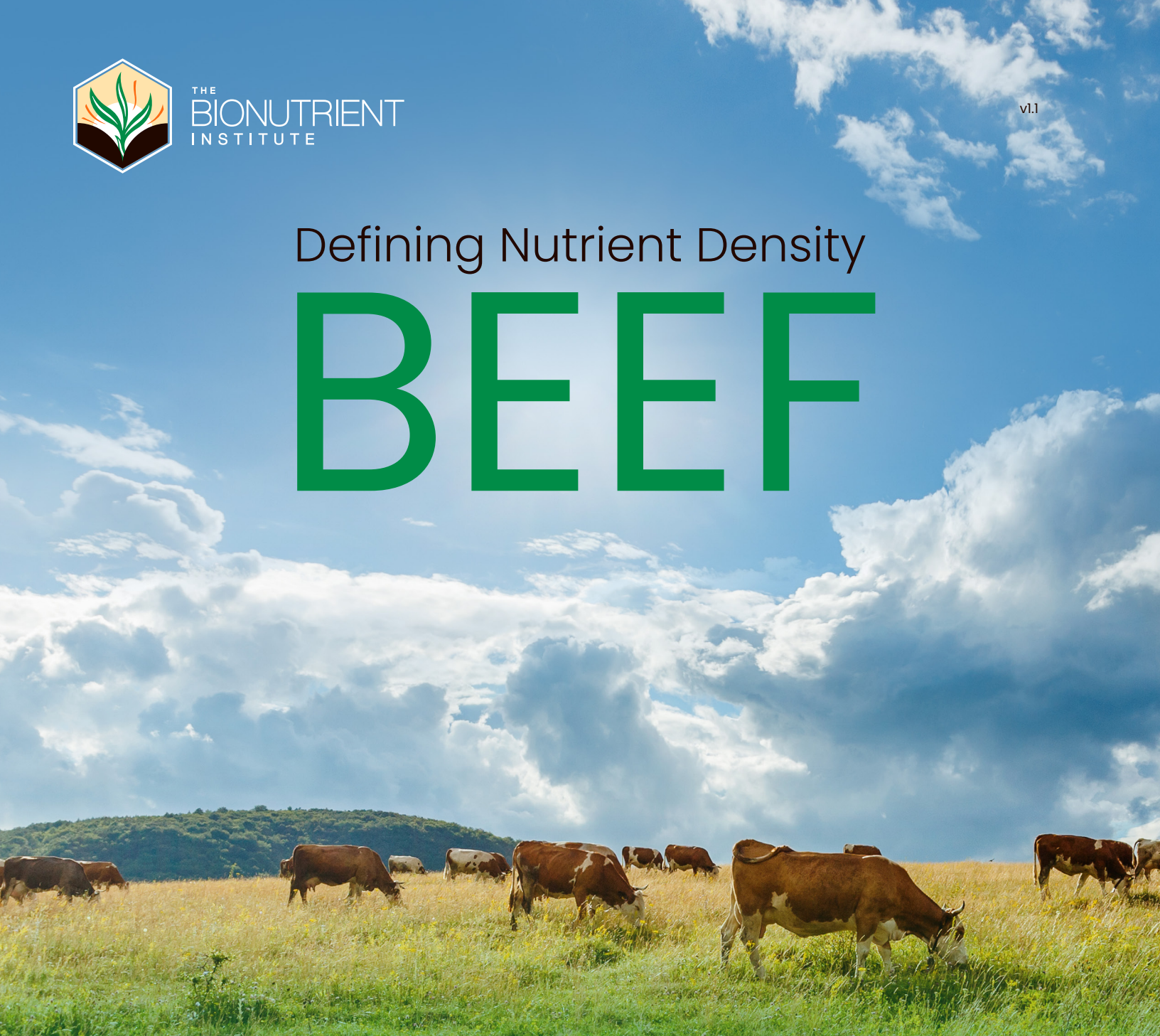
THE BIONUTRIENT INSTITUTE

v1.1

Defining Nutrient Density

BEEF



The Bionutrient Institute is leading a study
to define Nutrient Density in beef.
This work will also connect those nutrient variations in
beef to management, genetics, soil, forage & microbiome.

We are seeking partners & producers to join us in this study.

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INTRODUCTION

Since 2017, the Bionutrient Food Association has been engaged in a nation-wide survey of the U.S. food supply as part of our mission to improve quality in the food supply. First, by determining the variability, next by studying the causes of that variability and finally by providing meaningful models and measurement instrumentation that enable consumers, farmers and supply chain managers to participate in the research and make informed decisions.

In 2020, we expanded our survey to include areas of Europe.

The goals of identifying variation, the development of data structure and digestion, and engineering, calibrating, and disseminating of spectrometric tools, have been achieved. The results of our independent research are published on our website and available for the public and scientific research communities to build upon through our open-source data platform.

We operate as a non-profit, and the cost of our work is paid for through tax-deductible contributions and direct payments for services. We work with a vast network of farmers, independent scientists, public interest groups, companies and leaders in the environmental and agricultural communities.

THE NEXT FRONTIER: Defining Nutrient Density - Beef

Our work to date has been focused on crops that are roots, leaves, fruits and grains. We have identified nutrient variation and connected it to management and soil metrics. We are now engaging the next step in our work, which is to define Nutrient Density in a crop, starting with beef. The intention is not only to define nutrient density, but to connect it directly to the nuances of farm management practice, particularly as it pertains to animal forage and feed.

Through our research thus far, we know that the variability in food nutrient levels is immense. Specifically, we have found variations as large as 50x in minerals, and 200x in phytonutrients and secondary metabolites in the crops so far assessed.

Extending this research into meat is an exciting frontier. To date, the true nutritional variation of beef has never been defined, let alone the causes of that variation.

To apply:
BionutrientInstitute.org/beef

The design of this project integrates updated metabolomics analysis to probe phytochemicals as well as fatty acids, elements and other nutrients (roughly 200 per sample) in beef. In doing so, our work will provide a foundational—and currently undeveloped—definition of the overall nutrient density of beef. Also, we will develop and populate a structure to connect those nutrient density outcomes to causal factors.

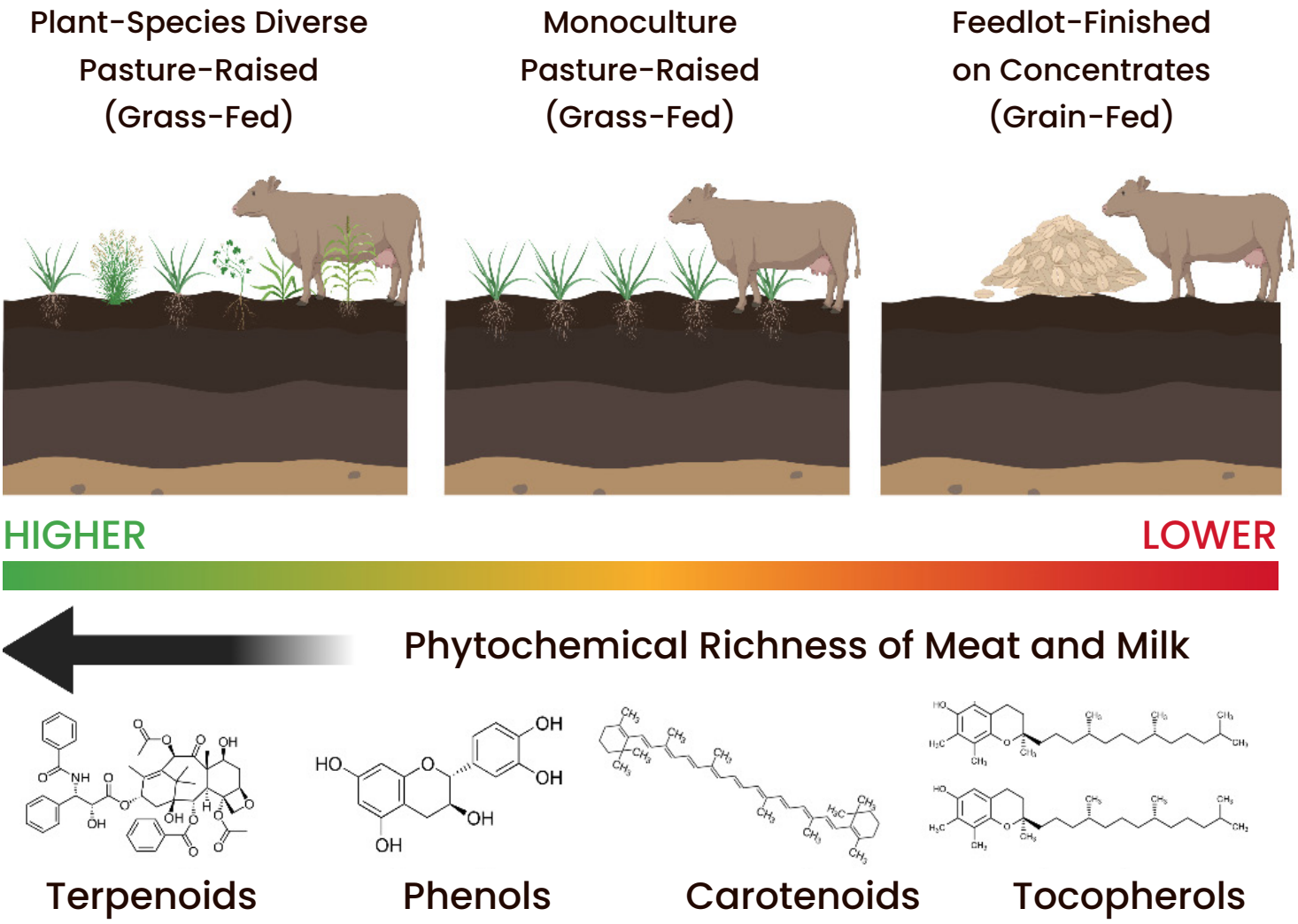

Fig. 2. The effects of grazing systems on the phytochemical richness of meat and milk.

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MANAGEMENT PRACTICES

To achieve our goal, we will test the following samples for:

MEAT:

Secondary Metabolites, Fatty acids minerals

(see Appendix for full list.)

STOOL:

16s RNA sequencing gut taxonomic profile

FORAGE:

Standard forage analysis, total minerals, phenolic profile

SOIL:

Total Carbon, respiration, total minerals, pH, extractable minerals and available Nitrogen

Here is a summary of the management data to be collected:

CATTLE:
- Breed/species
- Age
- Sex
- Castrated y/n

PASTURE:
- Forage species present and relative mix
- Establishment date
- Stocking rates
- Recovery time
- Relative forage quality
- Movement of animals in and out of paddock

FEED (non-pasture):
- Feed mix (relative mix of grain, forage, etc)

SIGNIFICANCE:

While not thoroughly assessed, this expanded pool of nutrients must be considered in attempts to understand the effects of various types of meat consumption (as it relates to management practices) on human health, such as the impact of inflammation linked with cancer, heart disease, and metabolic syndrome—diseases that have all been associated with meat (Zheng et al., 2019; Zhong et al., 2020). This proposed project will allow us to, **for the first time**, establish a direct link between livestock production systems and the nutrient density of beef.

Additionally, for production to be sustainable, it also needs to be profitable. While the US grass-fed beef market has grown from $17 million in retail sales in 2012 to $480 million in 2019 (Nielsen, 2020), 75% of all grass-fed beef currently sold in the US is imported (van Vliet et al., 2021). There is, a growing consumer interest in high quality meat.

We expect our results will be directly usable to:

PRODUCERS by providing information on levels health-promoting nutrients, who can demonstrate the presence of these attributes when marketing their products.

EATERS by being empowered to make educated decisions based on the characteristics of their supply chain.

AGRONOMISTS by having metadata identifying best practices to achieve best results.

To apply:
BionutrientInstitute.org/beef

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FAQ's

What makes this study significant?

After five years of documenting very significant nutrient variations across 21 crops, the Bionutrient Institute is now focusing on beef as the first food that it will define nutrient density for. We will be studying hundreds of compounds to be able to have sufficient data to accomplish this objective.

Who should apply to be part of this study?

Growers producing beef and would like to understand the nutritional value of what they're selling and how management connects to it.

Organizations, companies, and researchers who want to understand the connection between soil, plant, animal and human health.

Eaters who want to understand the nutritional value of beef in their area.

What will you receive by participating in this study?

Partners will receive a report of their farm's soil and forage metrics; animal fecal microbiome; suite of 200 nutrients in beef. Also, access to the complete data set to see how your results compare to others, including a comparison of management practices.

Participants will be able to communicate the relative product value to customers, as well as to learn from others' results on management practices (anonymously) as it contributes to nutrient density.

Citizen scientists will receive the same nutritional analysis of the beef submitted. They will also have access to the nutritional data of other beef samples in the study.

Can others access my farm or personal data and information?

No.

I am a company or an organization, how do I participate?

Share this project with growers you work with and/or invite them to apply, and/or sponsor them. Support the management and coordination costs of this project. Share with your audience about this work.

How much does it cost?

For one partner's complete sampling: $2500

Why are we doing this?

1. To comprehensively define nutrient density in beef and its causal factors. This has not been done before.
2. To support differentiation in the market that will allow consumers to make purchasing decisions based upon actual nutrition value.
3. To support producers in understanding and realizing the potential of their operations.

What does participation look like?

If you're a grower:

1. Submit your application to join the project.
2. Fill out the management survey. (10-15 minutes)
3. Collect and send to our lab: meat, forage, stool and soil samples.
4. Receive results.
5. Learn and share.

If you're a citizen scientist/consumer:

1. Submit your application to join the project.
2. Purchase beef samples, complete sample survey and send in samples.
3. Receive results.
4. Learn and share.

When will I receive my results?

3-6 months, depending on which sample it is.
ie: Forage, meat, etc

I am not a farmer or rancher, but want to support this work...how do I do that?

We need "eaters" to submit what is available to them in their area. If you would like to support us in sending in samples from grocery store shelves, please apply to be a citizen scientist partner.

COMPOUNDS ANALYZED IN MEAT–FATTY ACIDS:

- FA 20:5 omega-3 (EPA)
- FA 18:2 omega-6 (LA)
- FA 20:3 omega-9
- FA 20:5 omega-6 (EPA)
- FA 22:5 omega-6
- FA 22:4 omega-6
- FA 18:3 omega-3 (ALA)
- FA 22:4 omega-3
- FA 16:0 (palmitic acid)
- FA 22:6 omega-3 (DHA)
- FA 22:4 omega-3
- FA 18:1 (oleic acid)
- FA 16:1 (palmitoleic acid)
- FA 17:1
- FA 18:0 (stearic acid)
- FA 20:4 omega-6 (AA)
- FA 20:3 omega-6
- FA 20:0
- FA 22:5 omega-3

PHENOLIC ACIDS	FLAVONOIDS	AMINO ACID DERIVATIVES	CARBOXYLIC ACIDS
Gallic acid	Myricetin	Glutamic acid	Phenylacetic acid & derivates
Squalene	Kaempferol	N-benzoylglutamic acid	Propionic acid & derivates
Vanillic acid	Malvidin	N-acetylglutamic acid	Malic acid
Tyrosol	Anthocyanidins	N-acetylneuraminic acid	Fumaric acid
Hydroxytyrosol	Epicatechin-O-glucuronide	Glutathione metabolism	Pyridoxic acid

ALKALOIDS	BENZOIC ACIDS	HYDROXYCINNAMIC ACIDS	POLYAMINES
Xanthosine	Pyrogallol	Coumaric Acid	Putrescine
Xanthine	Gallic Acid	Rosmarinic acid	Spermidine
Sulfurol	3-hydroxybenzoic acid	Caffeoylquinic acid	Spermine
Dipicolinic acid	3-methoxybenzoic acid	Ferulic acid and derivatives	
Indoles	Hydroxymandelic acid	Methoxycinnamic acid	

FAMILIES OF MICROBES - ANALYZED IN STOOL SAMPLES

- Spirochaetaceae
- Fibrobacteraceae
- Methanobacteriaceae
- Atopobiaceae
- Bifidobacteriaceae
- Succinivibrionaceae
- Prevotellaceae
- Veillonellaceae
- Selenomonadaceae
- Anaerovoracaceae
- Ruminococcaceae
- Oscillospiraceae
- Lachnospiraceae
- Hungateiclostridiaceae
- Christensenellaceae
- Acidaminococcaceae
- Acholeplasmataceae

The management of this project is supported by charitable contributions.

If you'd like to donate, please email:
dan@bionutrient.org