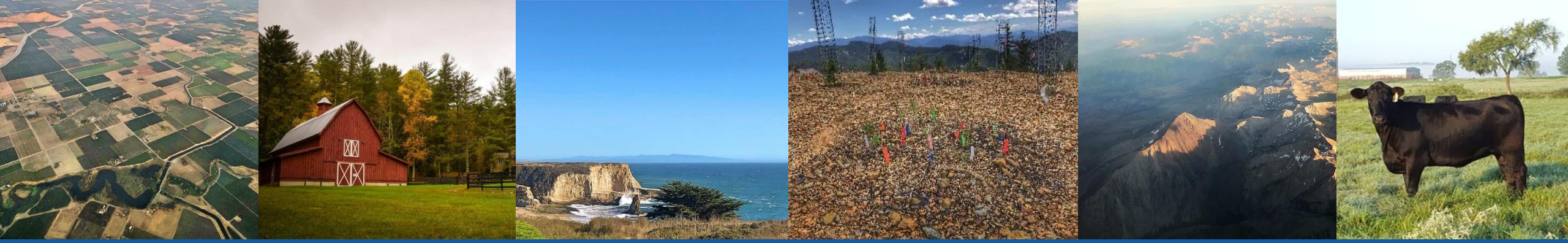


Analytical Methods and Validation

1. Abatement
2. Environment
3. Food
4. Livestock
5. Plants

Abatement: Early/ease of detection

Food: Rapid screening/standardized analysis

Livestock: Analytical needs; validation; cost; rapid methods

Plants: Improving and standardizing analytical methods for detecting PFAS in plants

1st priority problem topic:

The need for rapid quantitative methods for PFAS

Critical Aspects:

- Need for rapid instrumental analysis (<20 min)
- Applicability to different matrices (soil, water, food, plants, others)
- Need for screening methods

Challenges:

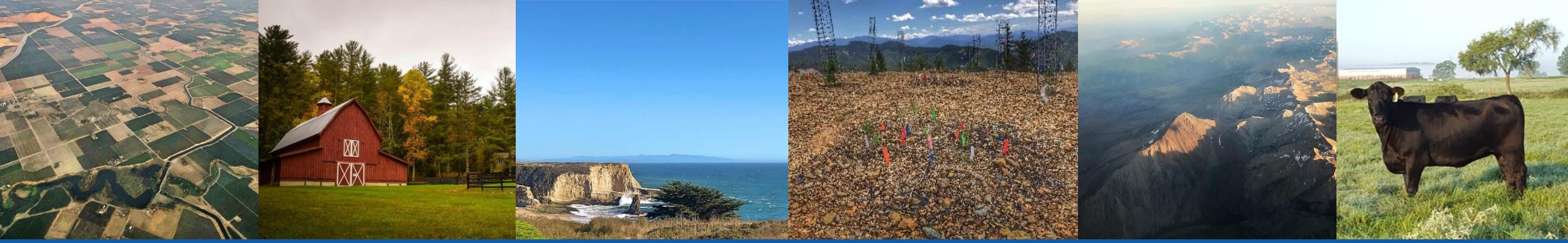
- Cost of labor, standards & instrumentation
- Lack of available methods (EPA 1633, FDA method)
- Lack of rapid screening methods
- Existing methods are time-consuming and long
- QA/QC, complex matrices, interferences, false positives, PFAS background contamination
- No standardized methods & training

Desired outcomes (Tools? Practices?) (up to 4) :

- Lower cost, faster, greener methods
- Standard training system for PFAS analysis (adequate training)
- Validated, standardized methods
- Analytical methods network (regional & national)

DATA Tools Developing a harmonized repository structure that is sustainable, and developing best practices for a minimum data set.

- Address actual use cases
- Understand who has what data-there are a finite amount of organizations who are collecting this data
- Importance of an interdisciplinary approach so communication is considered
- Acknowledgement that there not all data can be seen by everyone due to PII
- Data submission aspect as well as a data mining aspect
- There are existing frameworks out there that are jumping off points- Torstens data at UMO and the FDA database are perfect examples.
- Need to identify the few key pieces of information that connect all of our data sets



Threshold and Action Limits

1. Abatement
2. Environment
3. Food
4. Livestock
5. Socio-Economic

Abatement: What is the minimal threshold for action?

Currently unknown in most scenarios but will have to be regionally adapted based on commodity and systems.

Environment: Improved testing methods…

Some being developed by the FDA, and will roll out to state labs

Food: Regulatory standards/thresholds- only water

Livestock: Establishment of action limits for regulated matrices- toxicology data is missing.

Socio-Economic: National Agronomic and farming PFAS screening ranges- unknown

RENAME (1st priority problem topic):

Critical Aspects:

Hot spots in the environment, field heterogeneity particular crops or foods may be more of a risk.

Bio inherently different from other acute toxins

Toxicology- missing data

Testing is time consuming and expensive.

Challenges:

Systematic modeling of transfer rates from soils to end product.

Key collaborators- European food safety authority, CDC, FDA, EPA, FSIS, USDA, State Depts of Ag & CDC, others.

Developing risk scenarios for different farming operations.

Desired outcomes (Tools? Practices?) (up to 4) :

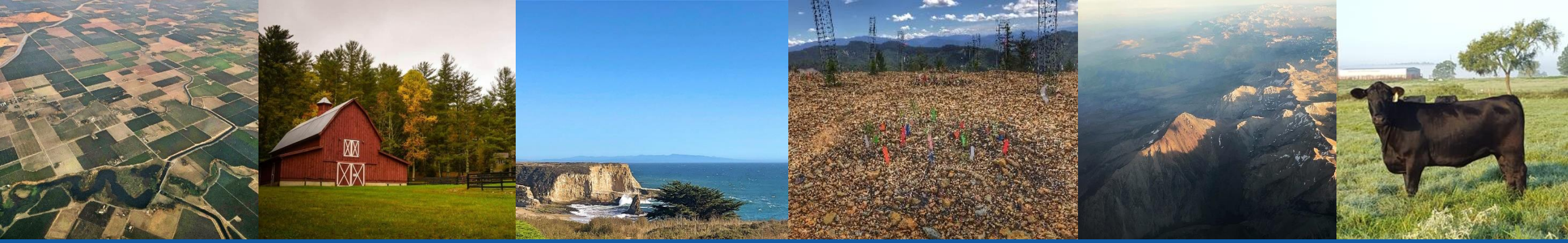
High resolution testing and detection.

Identification of hotspots in the field then options for the farmer for that field and the resulting use of crops

Develop conceptual and empirical transfer models focusing on high value crops and products in particular regions

RENAME (2nd priority problem topic – if time):

Critical Aspects: ultimately what is safe for humans



Alternatives, Abatement & Remediation

1. Abatement
2. Environment
3. Livestock
4. Materials

Environment: Evaluate current BMPs for applicability to PFAS remediation

Abatement: H_2O treatment for ag uses

Livestock: Remediation methods

Materials: Developing bio-based alternatives

RENAME (1st priority problem topic):

Reduce PFAs from agroecosystems while optimizing resource inputs.

Critical Aspects:

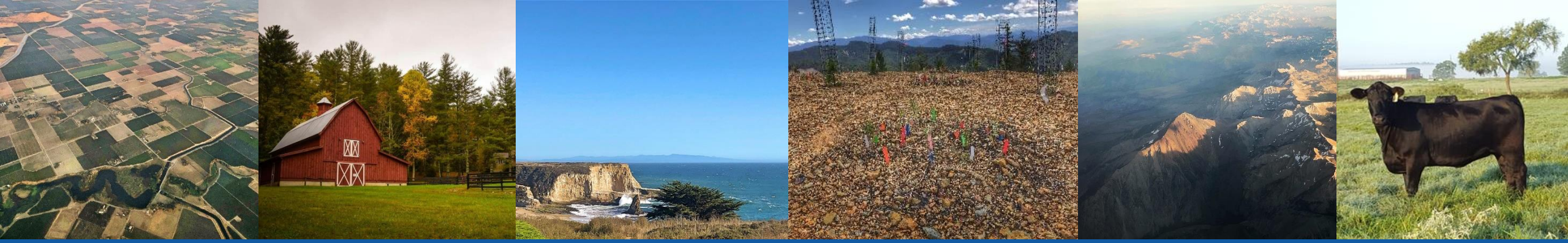
Short term – assess current BMP's. Sorption for removal. Threshold level detection. Limited use biobased products. Alternative low PFA food sources. Long term – link past BMPs to better future BMPs. Develop plants that exclude or accumulate PFAs. Destruction of PFAs once concentrated, scaling of treatment.

Challenges:

Alternatives

Immobilize

Destruction



Fate and Transport in Ag Systems

1. Environment
2. Food
3. Materials
4. Livestock
5. Plants

Environment: Develop fate and transport models

Food: Need uptake data for foods/exposure and risk assessment

Materials: Determine LD_{50}s, transfer coefficients

Livestock: PFAS kinetics in animals, tissues, species

Plants: Improve understanding of PFAS uptake, fate and transport in plants

Production cycle impacts:

Critical Aspects:

- Understanding plant component transfer
- Predictive tools for whole production chain
  - Water sources, species, climate, depth to ground, dust, soil
- Management tools (i.e., manure, animals, crop selection, others)

Challenges:

- Analyses
  - Sample collection, distinction of stuff (dust), uncertainty in guidelines, analytes of concern (sampling for tomorrow), consistency (detection levels, distribution), temporal aspects, access to land/animals
- Costs, difficulties (i.e., animals), analyses, trained specialists, time/costs
- SOPs – communication with producers
- Safety nets – what does it mean for the farmer
- Real risk levels
- Consistency/uncertainty of approach, quality controls
- Sensitivity

Desired outcomes(up to 4) :

SOPs
- Communication, engagement with producers
- Uniform technical practices, QC
- Proficiency groups

Predictive tools (issue, potential issue)

Whole production system fate/transfer tools

Risk reduction tools

Non-Production Impacts:

Critical Aspects:

Impacts to recreation (hunting, fishing)
Tribal, treaty rights
Wells, aquifer, streams
Dusts transport
Backyard gardens

Challenges:

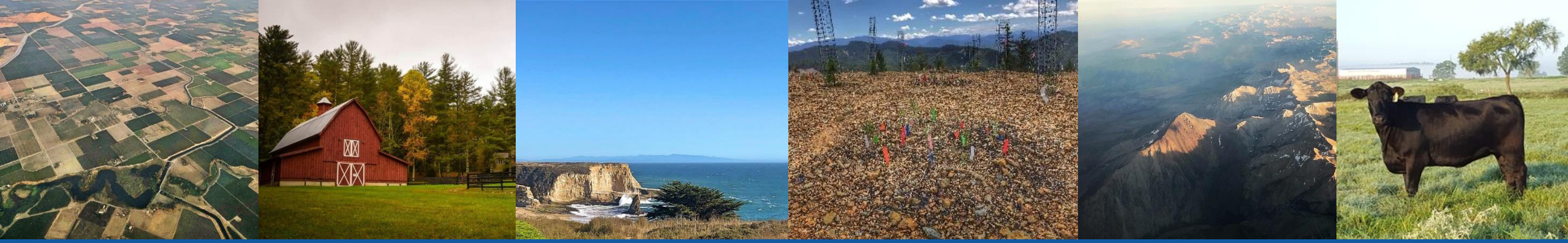
Non point-source tracking

Boundaries, radius of impacts

Solutions for moving targets?

Desired outcomes:

- Advisories (fish, game)
- Conceptual site model
- Communications
- Predictive tools?
- Safety nets



Communication and Education

1. Food
1. Materials
2. Socio-Economic

RENAME (1st priority problem topic): Research is needed to consolidate "lessons learned", open questions, and unknowns into targed communication tools. These will help us to address uncertainty and provide evidence that generates assurance of good paths forward. This is needed for diverse audiences, such as farmers, consumers, policy makers, researchers and etc.

Critical aspects and Tools needed:

- case studies
- Development of a playbook
- Clarity of transparency and reliance on communication of science based evidence and it is evolving
- Still communicate that while there are successes, there is a seriousness to the problem
- Difficulty in ensuring clarity of communications that PFAS presences are different in food vs water vs other exposure sources.
- Difficulty in assurance of trustability
- State differences in communications – how make consistent and understandable by all

Challenges

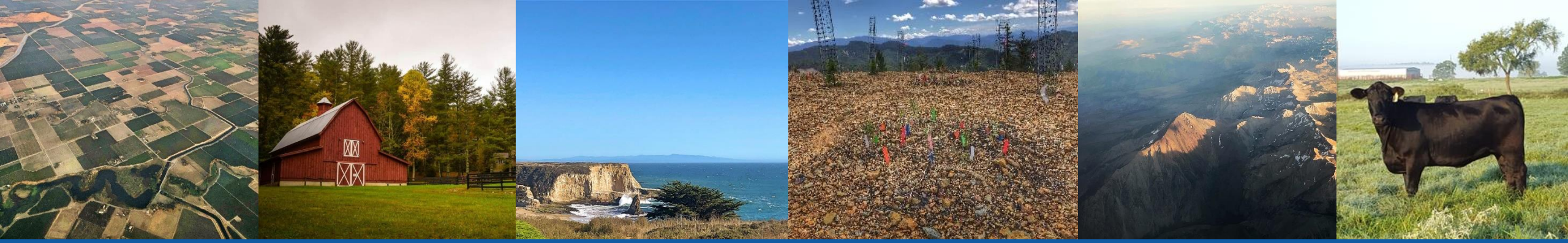
1. How to clearly communicate what metrics are?
2. How to clearly communicate how we got to the metrics?
3. How do we regionalize the information for best relevance?
4. Research is need on how we communicate that there might be other impacts of PFAS besides human health?
5. Research on how to clearly and simply communicate how PFAS got into our lives?
6. Educational materials for PFAS (chemistry, history, other school curricula?) that are age appropriate?
7. Research on how to not vilify the beneficial aspects of PFAS and by any association, connections to the agricultural community

Challenges

8. How do we develop communication tools where farmers and others feel safe in testing for PFAS.
9. Risk communication (how to frame vs other risks?); bar charts?
10. Who is more likely to be exposed, where and when?
11. (e.g., it's a "chemical"; "chemicals are bad")
12. Baseline of what people are thinking and what is your context?
13. Use lessons learned from FDA "closer to zero" – what are the risks of heavy metals in baby food? – in their case, "variety is the answer".
14. Research of helping people understand about what is safer: processed or fresh or local?
15. How do we clearly differentiate different risks, such as that Teflon is safe vs what is in contaminated water is not vs other exposures?

Challenges

16. How do we communicate that products have had these in them for a long time, but now we are studying it?
17. Research to develop a community media toolkit that is common (for many media sources) that is easy to understand and trusted. Adaptable for different user groups
18. Research is needed to get ahead and develop communication tools of what might be regulated in seafood. FDA had some lessons learned (consider mercury vs PFAS in seafood)
19. Who are the trusted messengers?
20. What are the misconceptions about PFAS and how to correct?
21. How do we communicate about food packaging itself and even things like composting food package materials? And the safety of gardens.
22. How to communicate different ways you are exposed to PFAS (drinking water, cosmetics, Teflon pans) and are there special considerations for farmers and farming communities?
23. What steps can I take?



The Problems of PFAS Scale, Scope and Source Tracking

1. Abatement
2. Environment
3. Livestock

Abatement: Source tracking in place of field-based detection systems

Environment: Research and develop methods to use localized source identification

Livestock: Understanding and identifying source contributions from different sources (e.g., biosolids)

RENAME (1st priority problem topic):

Biosolids Tracking Program

Justification:

We already know biosolids are a "major player in the spread of PFAS".

- it's a low hanging fruit

Agriculture is a critical user of municipal waste solids.

Biosolids can serve as a surrogate for the larger problem (the scope).

- they impact soil, animals (via forage), wildlife, crops, groundwater.

Biosolids will flag upstream point sources for further investigation (we can backtrack biosolids from field application to their creation).

There is an extensive network/infrastructure around biosolids (biosolid generation is mature technology).

Critical Aspects:

1. Understanding background levels (true background)
   - Matrix specific (e.g., soil vs water vs biosolids)
2. What is the threshold for which action must be taken, either upstream (e.g., municipality to track sources of contamination) or downstream (i.e., use or don't)
3. Standardization of testing at point of generation (municipal waste water treatment plants)
   - How is this implemented?
4. Centralized data repository
   - Would be outside of the immediate use by municipalities (and reported to state)
   - Repository can be later use can be used to drive spatial analyses (regional hot spots)
     - surveillance as deterrence

Challenges:

1. Development AND adoption of standardized testing
2. Difficulty in determining "ground zero" of PFAS sources (e.g., lack of granted access to sites, may be state dependent)
3. Communicating results to the public

Desired outcomes (Tools? Practices?) (up to 4) :

1. Defined background levels
   - regional and state
2. Provides data for analysis of potential exposures
   - e.g., correlate PFAS exposure to health outcomes (epidemiological analysis)
3. Identify geographical points of most immediate concern
   - For abatement

RENAME (2nd priority problem topic – if time):

Think of the fishies!

Justification:

Fish may serve as a good signal species in lieu of wastewater treatment.

Fish collection can be done without impacting private lands