GLOBAL RESEARCH ALLIANCE

ON AGRICULTURAL GREENHOUSE GASES

Network: Soil Carbon Sequestration

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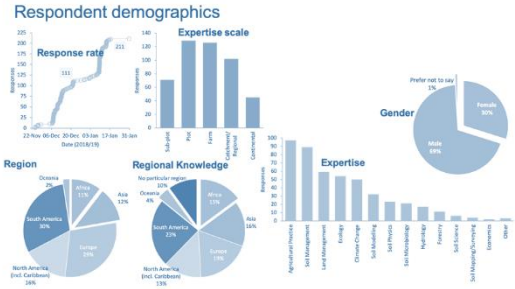
Presentation to IRG Annual Meeting

24-25 June 2021

Review Scientific & Technical Evidence



- 211 responses
- Responses from all continents
- Strong representation of Agricultural Practice, Soil and Land Management researchers
- Poor representation Social Science disciplines

14 Research Challenges to SOC in agriculture

Theme 1

Processes

1. Stabilisation of soil carbon
2. Soil C saturation
3. Role of Microorganisms in soil C dynamics
4. SOC and greenhouse gas emissions

Theme 2

Management & Monitoring

5. Deep soil stabilisation
6. Measuring and Monitoring
7. Vegetation management
8. Organic amendment management
9. Mixed agricultural practices

Theme 3

Barriers

10. Preventing soil organic loss
11. Economic
12. Socio-cultural barriers
13. Institutional/legal barriers
14. Technological readiness for SCS

[CIRCASA, 2019. The science base of a strategic research agenda]

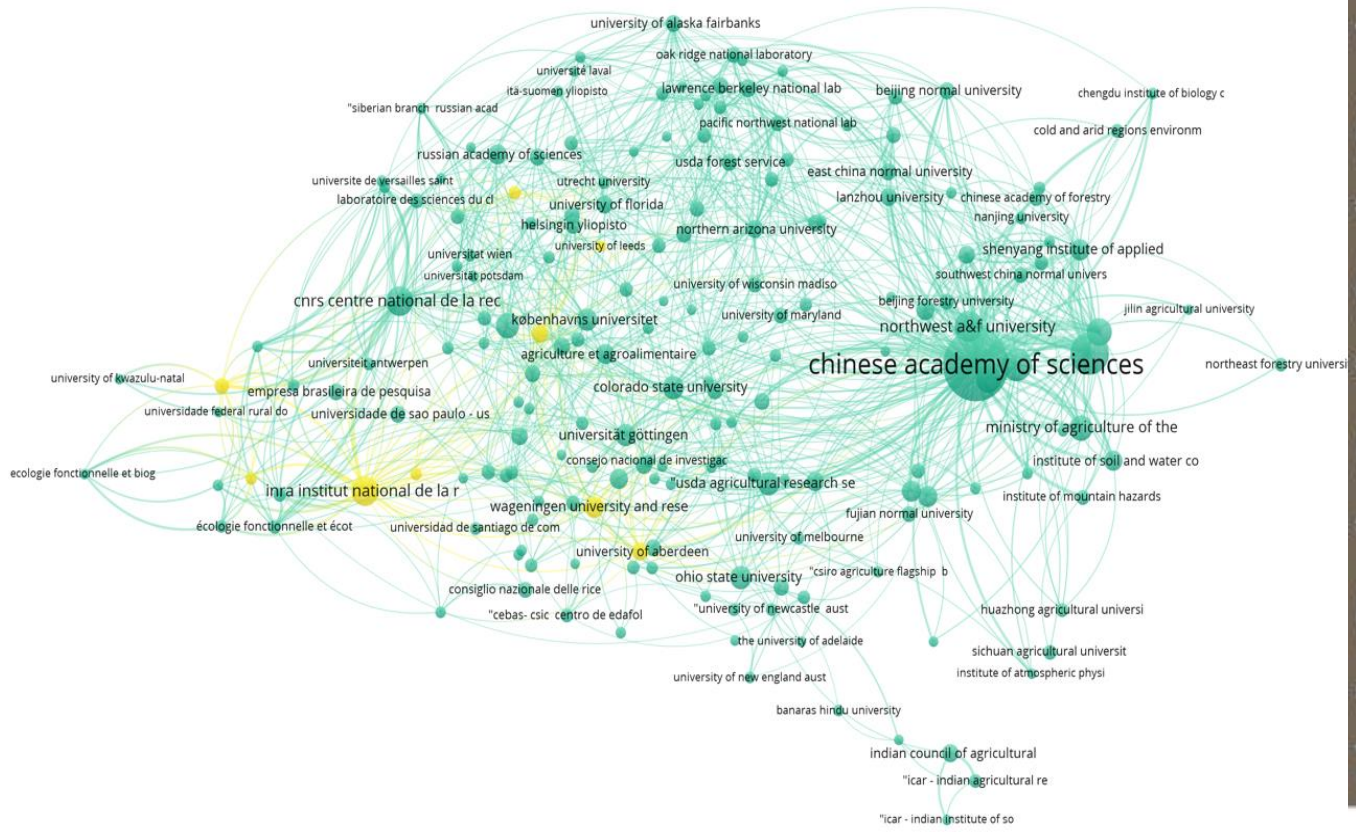
Review Scientific & Technical Evidence

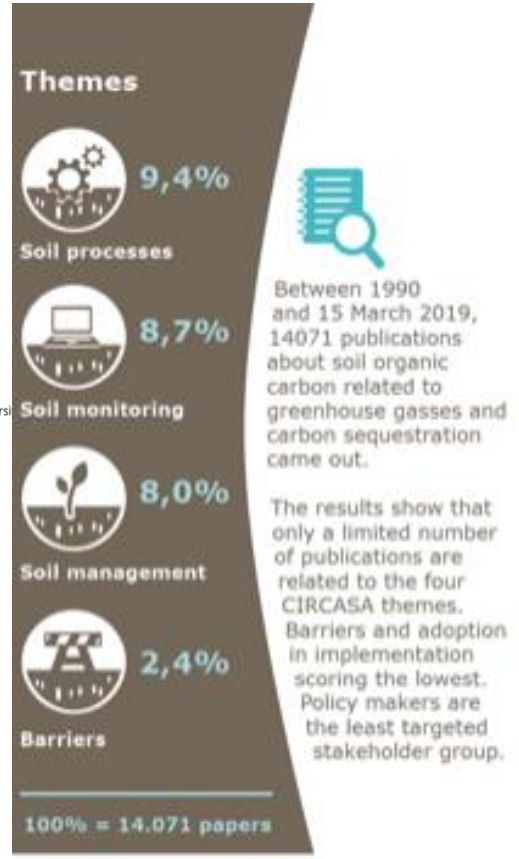
Stocktake:

To identify gaps in research based on the CIRCASA themes

To identify complementary networks

14,071 journal articles



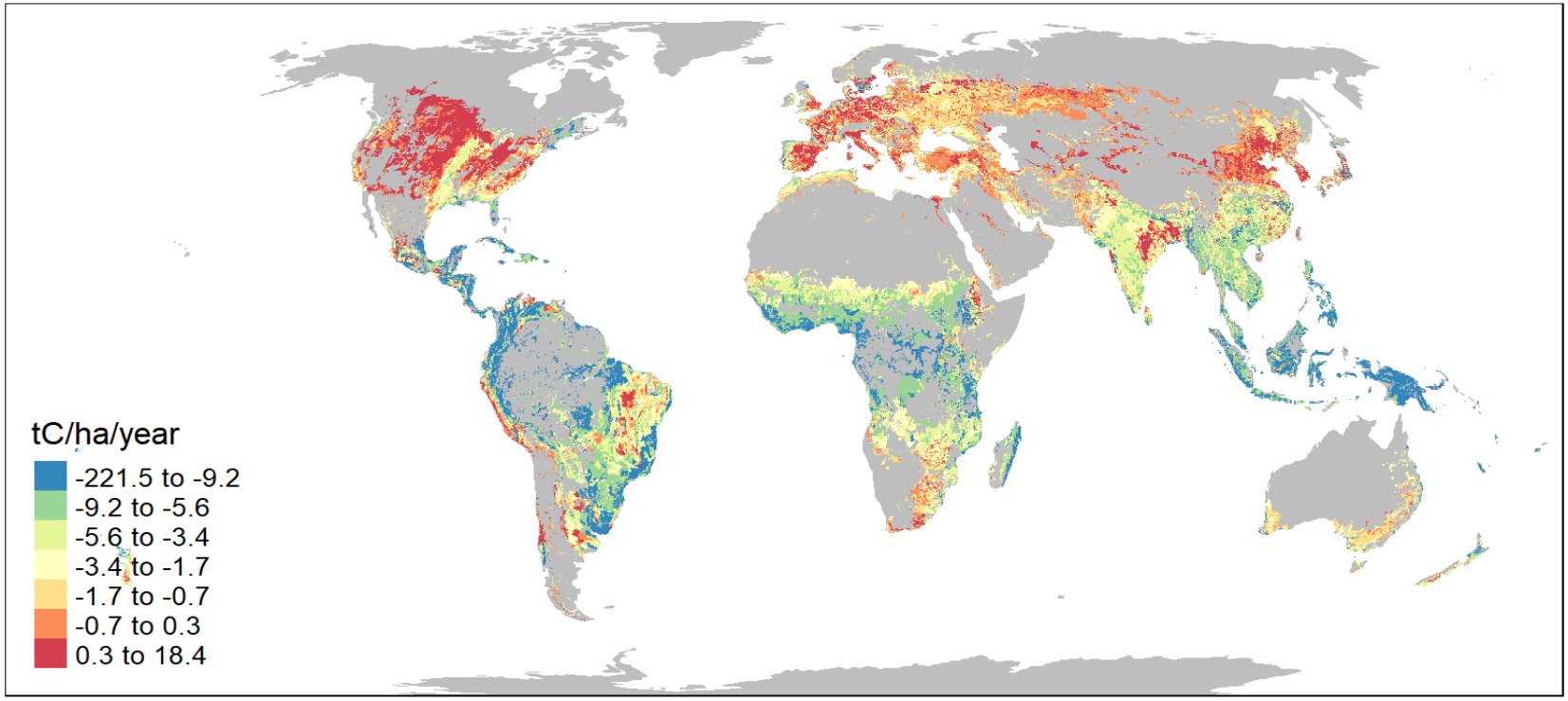


[CIRCASA 2019, "The Network map and dialogue"]

Review Scientific & Technical Evidence

Reaching the 4 per 1000 aspirational target in global croplands?

Simulated balance between crop residue inputs (Global EPIC) and soil organic carbon decomposition (RothC)

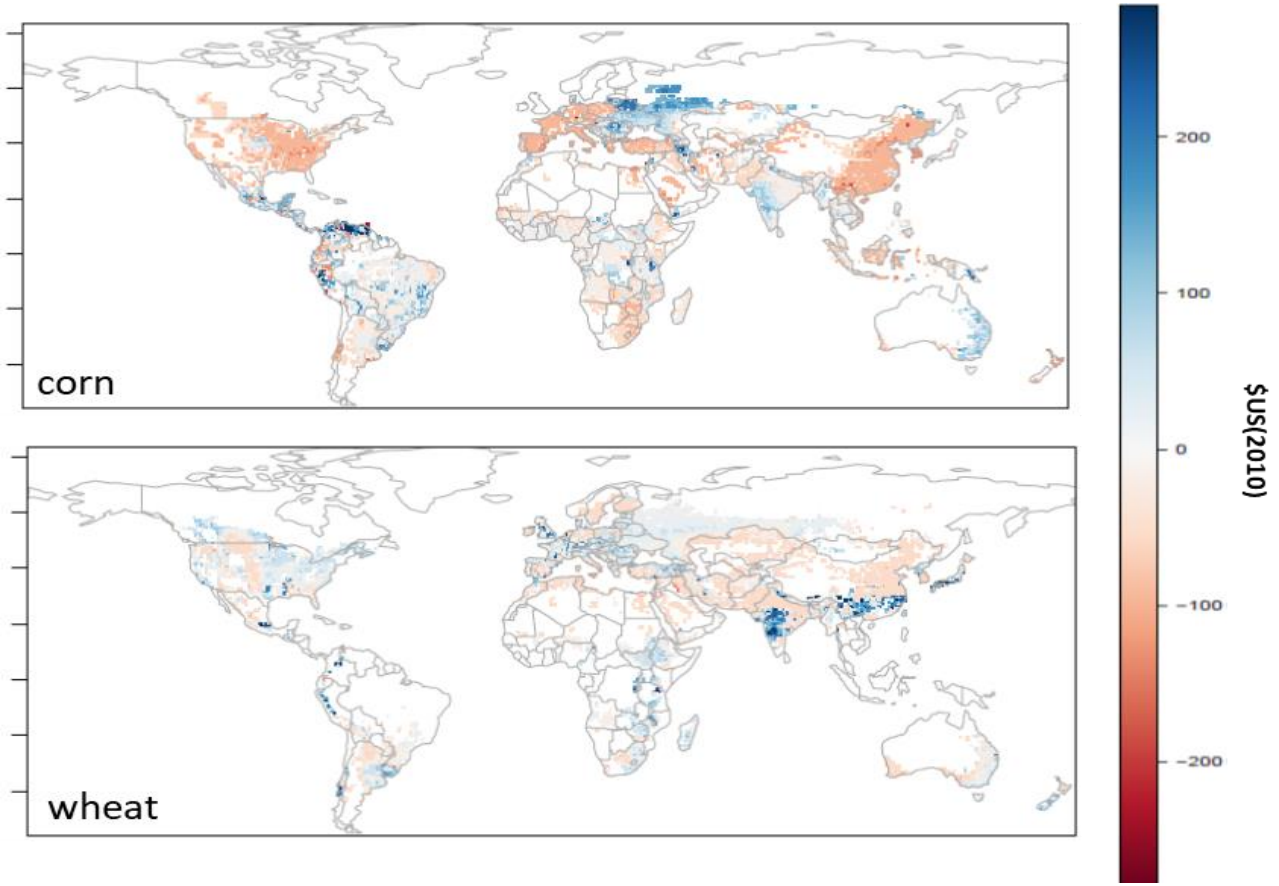


Note: soil decomposition may be overestimated in some hot and wet tropical environments

Review Scientific & Technical Evidence

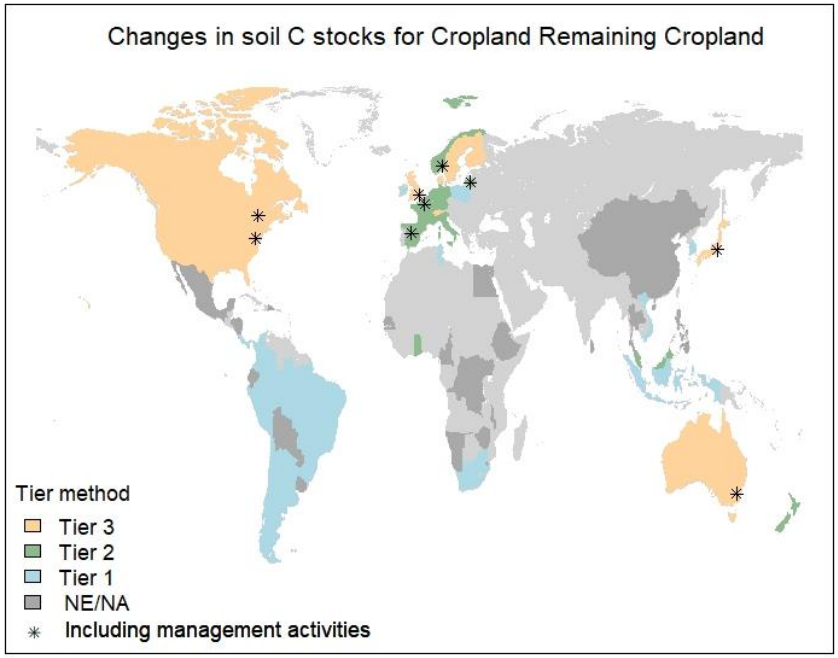
International Knowledge Synthesis activities

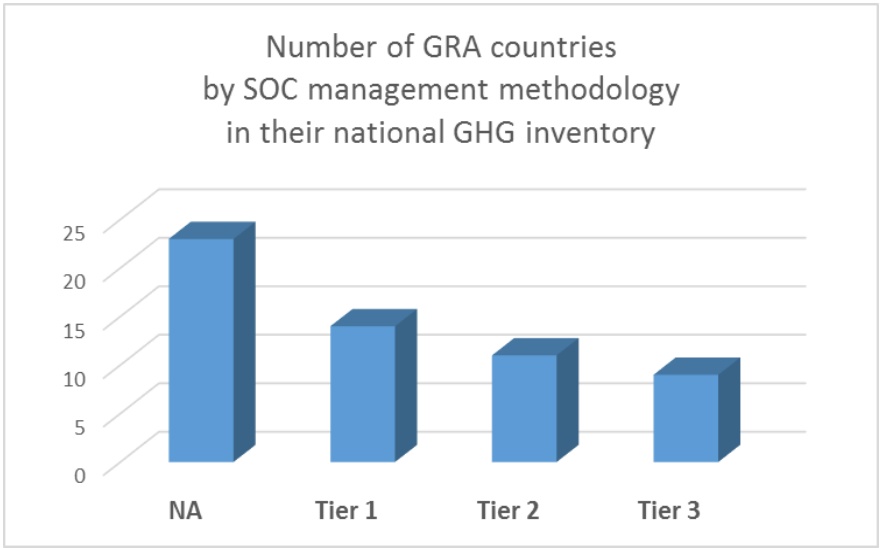
Costing the change from conventional tillage to no-till in global croplands (US$2010 per hectare)



Contribution to guidelines on **SOC Monitoring, Reporting and Verification**

In collaboration with CIRCASA scientists, the Soil Carbon Sequestration (SCS) Network of the Integrative Research Group of the Global Research Alliance scientists produced a review how do we measure, report and verify soil carbon change (Smith et al., 2020 *Global Change Biology* **26,** 219-241. doi: 10.1111/gcb.14815).





CIRCASA

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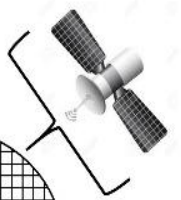
Vision for a global framework for Monitoring, Reporting and Verification of SOC change (Smith, Soussana et al. 2019, Global Change Biology)

7) Spatial soil re-sampling survey grid (M/V)

- Same sites – resampled each decade — t 0 yr
- Used for ground-truthing SOC change — t+10 yr
- Used for ground-truthing activity data — t+20 yr etc.



6) Remote sensing (M/R/V)

- Verify activity data
- Inputs to run models
- Soils and vegetation

5) Activity data (M/R)

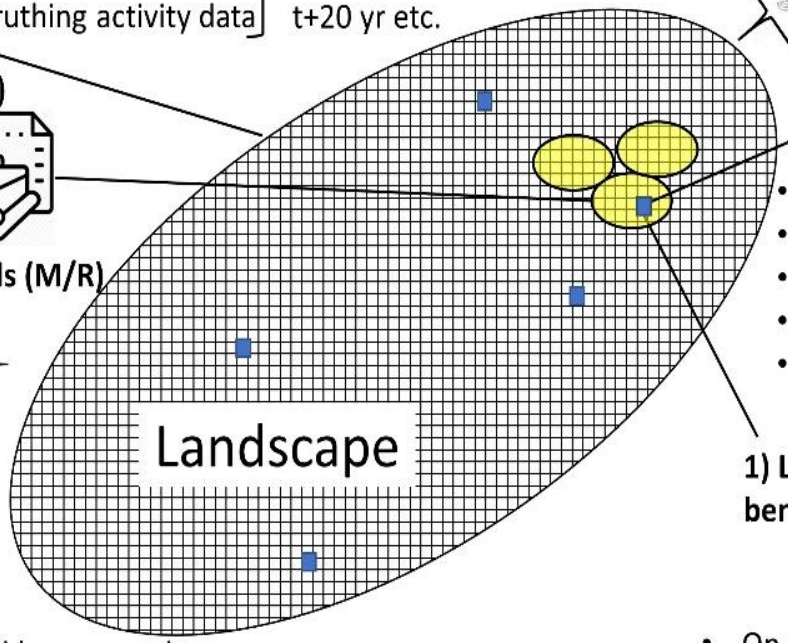
- Management data
- Field / farm level
- Self-reporting

2) Shorter-term experiments (M)

- At long-term sites
- Measure fluxes
- Investigate processes — t 0 (days), t+x (days), t+y (days) etc.
- Develop novel tools
- Calibrate models

4) Spatial data to drive models (M/R)

- Climate
- Soils
- Land cover etc.



3) SOC / GHG models (M/R)

- Developed using short- and long-term data
- Calibrated using short- and long-term data
- Evaluated against long-term data
- Applied to derive tier 2 EF
- Applied using spatial data as tier 3 methodology
- Verified using survey data and remote sensing

SOC change over time

1) Long-term experiments at benchmark sites (M)

- On different land uses
- Different treatments
- Long term SOC measurement (decades) or chronosequence — t 0 yr, t+10 yr, t+20 yr etc.

Key: ■ = long term experiment ● = farm

Stakeholder Consultation

Online Survey

7 languages (English, French, German, Danish, Portuguese, Spanish, Russian)

Knowledge needed by farmers / other stakeholders

Knowledge available but not accessible

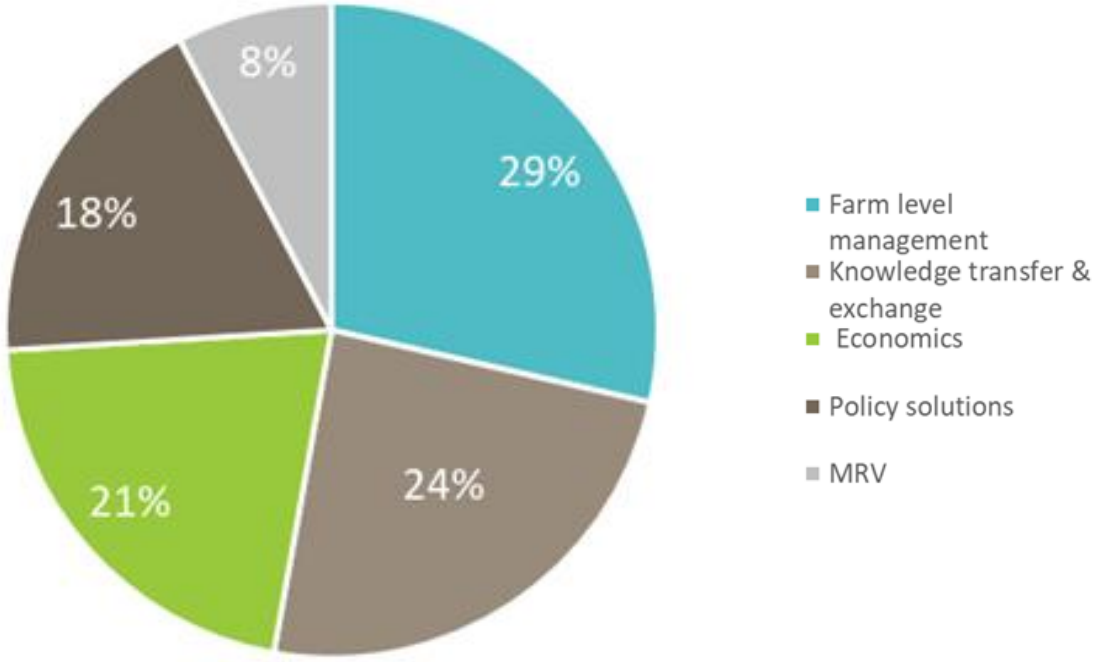
New research needed

1369 respondents

\+ 1807 Danish farmers

10 Regional Workshops

Knowledge Needs



Share of responses per theme (global survey)

Research Needs

Farmers / Farm Advisors

- **Costs and benefits of SOC management**
  - **Productivity / yields / water**
  - **Financial returns / net income**
  - **Risks / trade-offs, time and effort involved**
- **Crop choice and combinations, interactions among practices, role of microorganisms**

Other Stakeholders

- **Demonstrate societal and environmental benefits**
- **Develop policy mechanisms to better incentivize SOC management (targeting, tailoring)**
- **Improve reliability & standardisation of MRV at a reasonable cost (including farm level sampling, crowd sourcing)**
- **Agri-food system transformations (cost of food, external costs …)**

How we do research

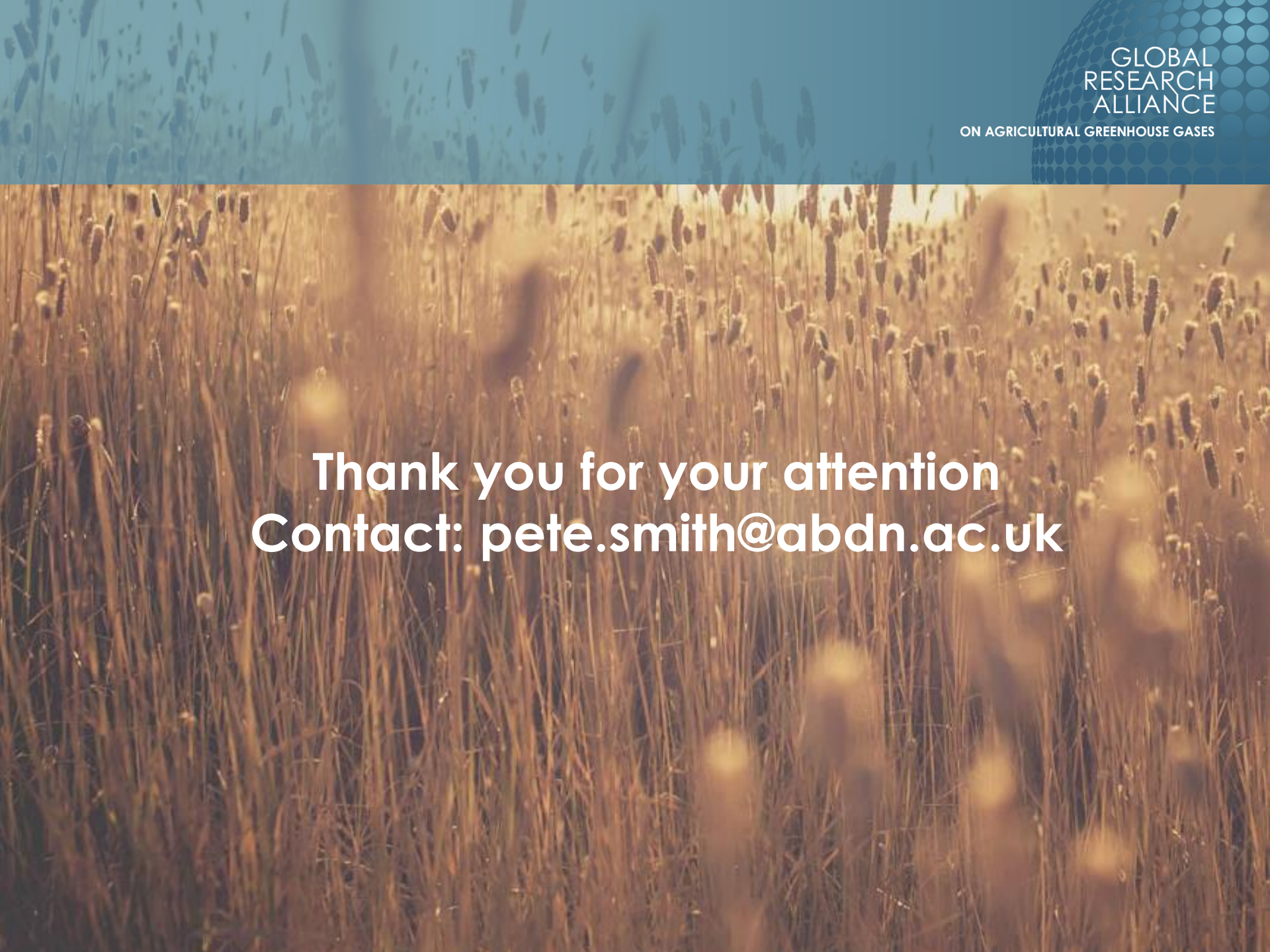
Better alignment with knowledge needs

Contextual, place-based knowledge

Tailored guidance

Co-creation

Enable access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