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Submissions under UNFCCC decision 4/CP.23
provided by Parties and observers as at 16 December 2019

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ABBREVIATIONS AND ACRONYMS

ABDN	University of Aberdeen
AC	Adaptation Committee
AFB	Adaptation Fund Board
AGN	African Group of Negotiators
CAES	College of Agricultural and Environmental Science
CAN	Climate Action Network International
CBs	Constituted bodies
CCAC	Climate and Clean Air Coalition
CCAFS	CGIAR Research Program on Climate Change, Agriculture and Food Security
CEA	French Alternative Energies and Atomic Energy Commission
CEIGRAM	Centro de Estudios e Investigación para la Gestión de Riesgos Agrarios y Mediambientales
CGE	Consultative Group of Experts on National Communications from Parties not included in Annex I to the Convention
CGIAR	Consultative Group of International Agriculture Research
CH_4	International Maize and Wheat Improvement Center
CIMMYT	International Maize and Wheat Improvement Center
CIRAD	Centre de coopération internationale en recherche agronomique pour le développement
CMCC	Euro-Mediterranean Center on Climate Change
COP23	23rd session of the Conference of the Parties
COP26	26th session of the Conference of the Parties
CSA	Climate-smart agriculture
CTCN	Climate Technology Centre & Network
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FIBL	Forschungsinstitut für biologischen Landbau
FWG-LCIPP	Facilitative Working Group of the Local Communities and Indigenous Peoples Platform
GASL	Global Agenda for Sustainable Livestock
GCF	Green Climate Fund

GEF	Global Environment Facility
GHG	Greenhouse gas
IBC&SB	Institute of Bioenergy Crops and Sugar Beet
IFA	International Fertilizer Industry Association
IFOAM	International Federation of Organic Agriculture Movements
IGO	Intergovernmental organization
IIASA	International Institute for Applied Systems Analysis
IITA	International Institute of Tropical Agriculture
INIA	Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria
INRA	Institut national dela recherche agronomique
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change
IRD	Institut de recherche pour le développement
ISRIC	International Soil Reference and Information Centre
KCI	Katowice Committee of Experts on the Impacts of the Implementation of Response Measures
KJWA	Koronivia Joint Work on Agriculture
LDCF	Least Developed Countries Fund
LEAP	Livestock Environmental Assessment and Performance Partnership
LEG	Least Developed Countries Expert Group
LULUCF	Land Use, Land Use Change and Forestry
MRV	Measuring, Reporting and Verification
NACSAA	North America Climate Smart Agriculture Alliance Business for Social Responsibility
NAE	Non-admitted entities
NDCs	Nationally Determined Contributions
NGO	Non-governmental organization
PCCB	Paris Committee on Capacity-Building
SB 48	48th session of the Subsidiary Bodies
SB 51	51st session of the Subsidiary Bodies
SBI	Subsidiary Body for Implementation
SBs	Subsidiary Bodies
SBSTA	Subsidiary Body for Scientific and Technological Advice
SCCF	Special Climate Change Fund
SCF	Standing Committee on Finance
SDGs	Sustainable Development Goals
TEC	Technology Executive Committee
UN	United Nations

UNFCCC	United Nations Framework Convention on Climate Change
WB	World Bank
WBCSD	World Business Council for Sustainable Development
WFO	World Farmers' Organisation
WIM Excom	Executive Committee of the Warsaw International Mechanism

CHEMICAL FORMULAE

CH_4	Methane
K	Potash
N	Nitrogen
N_2O	Nitrous Oxide
NH_3	Ammonia
P	Phosphate

INTRODUCTION

At the 23rd session of the Conference of Parties (COP 23) to the United Nations Framework Convention on Climate Change (UNFCCC) in November 2017 countries recognized the fundamental importance of agriculture in responding to climate change with a dedicated decision (4/CP.23): Koronivia Joint Work on Agriculture (KJWA) (UNFCCC, 2018a).

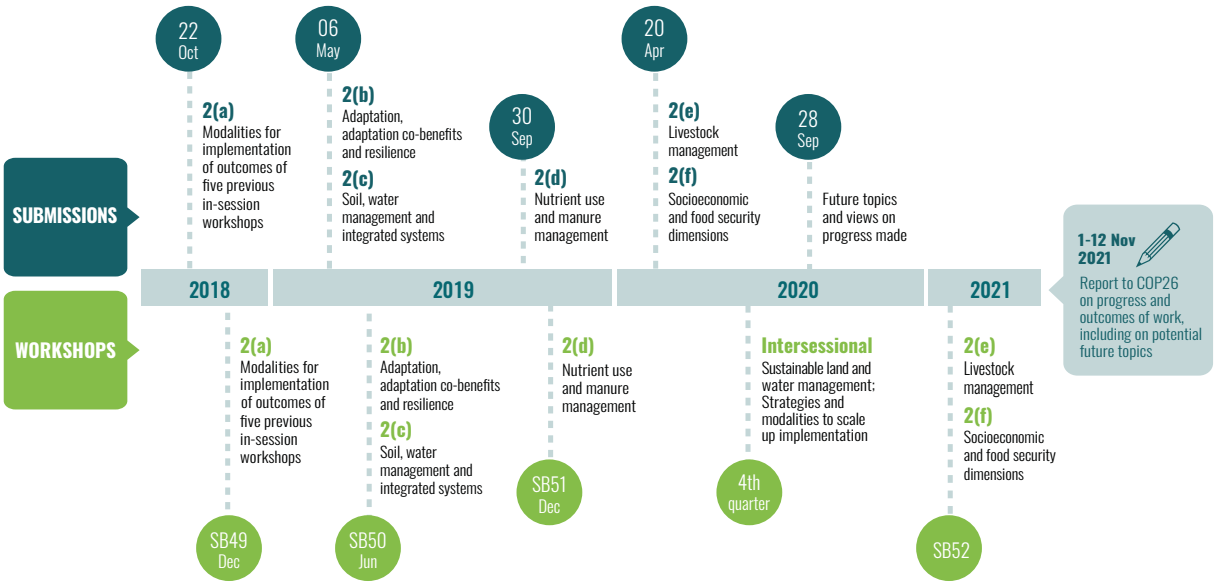
The KJWA was established to advance discussions on issues related to agriculture under the two Subsidiary Bodies (SBs) of the UNFCCC: the Subsidiary Body for Scientific and Technological Advice (SBSTA) and the Subsidiary Body for Implementation (SBI). Parties decided to continue their work on agriculture, originally initiated under SBSTA in 2011 (decision 2/CP.17, paragraphs 75-77), as a joint effort between both SBs and in collaboration with the constituted bodies (CBs) under the Convention (listed in **Figure 1**).

FIGURE 1.

CONSTITUTED BODIES UNDER THE CONVENTION

FIGURE 2.

KORONIVIA JOINT WORK ON AGRICULTURE ROAD MAP



KJWA foresees a three-year work plan (2018-2020),[1] that aims at advancing the exchange among Parties on issues related to agriculture, starting from, but not limited to, an initial list of topics:

- Modalities for implementation of the outcomes of the five in-session workshops on issues related to agriculture and other future topics that may arise from this work;
- Methods and approaches for assessing adaptation, adaptation co-benefits and resilience;
- Improved soil carbon, soil health and soil fertility under grassland and cropland as well as integrated systems, including water management;
- Improved nutrient use and manure management towards sustainable and resilient agricultural systems;
- Improved livestock management systems; and
- Socioeconomic and food security dimensions of climate change in the agricultural sector.

The decision recognizes the fundamental importance of agriculture in responding to climate change.

> The discussion under the KJWA should take into consideration the vulnerabilities of agriculture to climate change and approaches to address food security, taking note also of the importance of issues related to farmers, gender, youth, local communities and indigenous peoples.

The 48th session of the Subsidiary Bodies (SB 48) in May 2018 further defined a three-year road map for discussions under the KJWA, including a schedule of workshops, submissions and reports related to each topic above (UNFCCC, 2018b). However, many Parties have already declared in their submissions that the three-year period currently foreseen for the KJWA may not signify the end date of the process, but that the SBs may define further work after 2020, pending a further decision at the 26th session of the Conference of the Parties (COP 26) to the UNFCCC (FAO, 2018).

The workshops foresee participation of the CBs under the Convention presenting their past and planned activities on agriculture in general and specifically on the workshop topics. The operating entities of the Financial Mechanism of the Convention (Global Environment Facility

[1] As a result of disruptions caused by the COVID-19 pandemic, the road map has been extended to 2021.

[GEF] and Green Climate Fund [GCF], the Adaptation Fund, the Least Developed Countries Fund [LDCF]and the Special Climate Change Fund [SCCF]) are also invited to contribute to the KJWA workshops (UNFCCC, 2018c). This request for collaboration provides an opportunity for interlinkages and harmonized action under the different bodies, and recognizes that, in order to achieve greater results, it is necessary to combine scientific and technical negotiations with exchanges on how to facilitate and finance implementation.

Most Parties see the KJWA as an opportunity to increase exchange and collaboration among countries. They also see potential to promote the development and transfer of knowledge, innovations and technologies to-scale up implementation of best practices for sustainable production in agricultural systems. For many Parties the exchange could lead to concrete recommendations to the CBs and provide countries and stakeholders with tools to address the major challenges related to climate change, agriculture and food security that could be embedded in their national planning efforts (FAO, 2018).

As outlined in the KJWA road map, the 51st session of the Subsidiary Bodies (SB 51) (December 2019, Madrid, Spain) hosted the fourth in-session workshop that addressed the following topic: 'Improved nutrient use and manure management towards sustainable and resilient agricultural systems.' In this context, the Food and Agriculture Organization of the United Nations (FAO) is committed to supporting countries in the KJWA process. Recognizing that the decision 4/CP.23 does not mandate the UNFCCC secretariat to produce a synthesis of submissions made, several Parties informally suggested that FAO might provide a factual summary of submissions. FAO has been undertaking this exercise and has already provided the analysis of three past rounds of submissions by Parties and observers in preparation of the 48th, 49th and 50th sessions of the Subsidiary Bodies, namely:

- Koronivia Joint Work on Agriculture: Analysis of Submissions (FAO, 2018);
- Koronivia Joint Work on Agriculture: Analysis of Submissions on topic 2(a) (FAO, 2019a); and
- Koronivia Joint Work on Agriculture: Analysis of Submissions on topics 2(b) and 2(c) (FAO, 2019b).

Objective

This analysis provides a factual summary of the views submitted on KJWA topic 2(d) – 'Improved nutrient use and manure management towards sustainable and resilient agricultural systems' available in the Submission and Statement Portal of the UNFCCC as at 16 December 2019 (UNFCCC, 2019).

The analysis intends to make the wide range of views submitted more easily accessible to those interested, including to Parties and observers to the UNFCCC, but also experts working on climate change more generally, as well as interested members of the public.

Methodology

The analysis takes into consideration 11 submissions on topic 2(d) by Parties or groups of Parties and ten by observer organizations or groups of observers. Each submission was studied in full to ensure a comprehensive assessment of the views provided by Parties and observers. Original text was extracted into a database that permits cross-referencing on different aspects of individual submissions. The database includes the general view expressed by Parties and observers, the priorities and needs in relation to the topic 2(d), the desired participation to the workshop and expected outcomes. The draft of the complete analysis was circulated with Parties and observers for comments and feedback. The comments were addressed in the final version, as far as possible.

BOX 1. KEY TERMS

Agriculture or **the agricultural sectors**, when used by FAO, comprises the sub-sectors of crops, livestock, fisheries and aquaculture and forestry. The terms agriculture or the agricultural sector in the UNFCCC domain are defined in accordance with Intergovernmental Panel on Climate Change (IPCC) terminology and cover emissions from enteric fermentation, manure management, rice cultivation, prescribed burning of savannas and grassland, and from soils (i.e. agricultural emissions). Emissions and removals from grassland and cropland are covered under LULUCF (Land Use, Land Use Change and Forestry). In the IPCC 2006, the two sectors (i.e. agriculture and LULUCF) are treated together in the Agriculture, Forestry and Land Use sector.

Resilience is the capacity of interconnected social, economic and ecological systems to cope with a hazardous event, trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity and structure. Resilience is a positive attribute when it maintains capacity for adaptation, learning and/or transformation (IPCC, 2019).

Food security, although having a central role in the KJWA, is not defined in the decision. When used by FAO, the term draws on the World Food Summit definition (1996): "Food security exists when all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life." From this definition, four main dimensions of food security are identified: food availability, food access, utilization and stability.

In this analysis, the terms above are reported from the submissions without specifically referring to any specific meaning, thus not prejudging the interpretation applied by different Parties.

PARTY AND GROUP SUBMISSIONS

1. African Group of Negotiators (AGN)
2. Argentina
3. Brazil
4. European Union (EU)
5. Indonesia
6. Japan
7. Kenya
8. New Zealand
9. Senegal
10. Sri Lanka
11. The United States of America

OBSERVER SUBMISSIONS

United Nations System

1. Food and Agriculture Organization of the United Nations (FAO)

Admitted Intergovernmental Organizations

2. The Consultative Group of International Agriculture Research (CGIAR) System Organization, the World Business Council for Sustainable Development (WBCSD), the Institut national de la recherche agronomique (INRA) and the World Bank (WB) (mentioned in the text hereafter as CGIAR and others)

Non-Governmental Organizations

3. Brighter Green and members of the Food and Climate Alliance (mentioned in the text hereafter as Brighter Green and others)
4. Climate Action Network International (CAN)
5. CropLife International (CropLife)
6. International Fertilizer Industry Association (IFA)
7. The North America Climate Smart Agriculture Alliance, Business for Social Responsibility (NACSAA)
8. World Farmers' Organisation (WFO)

Non-Admitted Entities

9. University of Aberdeen (ABDN), College of Agricultural and Environmental Sciences (CAES) in Makerere University, French Alternative Energies and Atomic Energy Commission (CEA), Centro de Estudios e Investigación para la Gestión de Riesgos Agrarios y Mediambientales (CEIGRAM), International Maize and Wheat Improvement Center (CIMMYT), Centre de coopération internationale en recherche agronomique pour le développement (CIRAD), Global Agenda for Sustainable Livestock (GASL), Institute of Bioenergy Crops and Sugar Beet (IBC&SB), International Institute for Applied Systems Analysis (IIASA), Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria (INIA), Institut national dela recherche agronomique (INRA), Institut de recherche pour le développement (IRD), International Institute of Tropical Agriculture (IITA), International Soil Reference and Information Centre (ISRIC), Laboratoire des radioisotopes, Lomonosov Moscow State University, Scientific and Technical Committee of the 4p1000 initiative, University of Life Sciences in Lubin and Vietnam Academy of Agricultural Sciences (mentioned in the text hereafter as ABDN and others)
10. International Federation of Organic Agriculture Movements (IFOAM) Organics International, IFOAM-EU, Biovision and Forschungsinstitut für biologischen Landbau (FiBL) (mentioned in the text hereafter as IFOAM and others)

FIGURE 3.

BREAKDOWN OF SUBMISSIONS

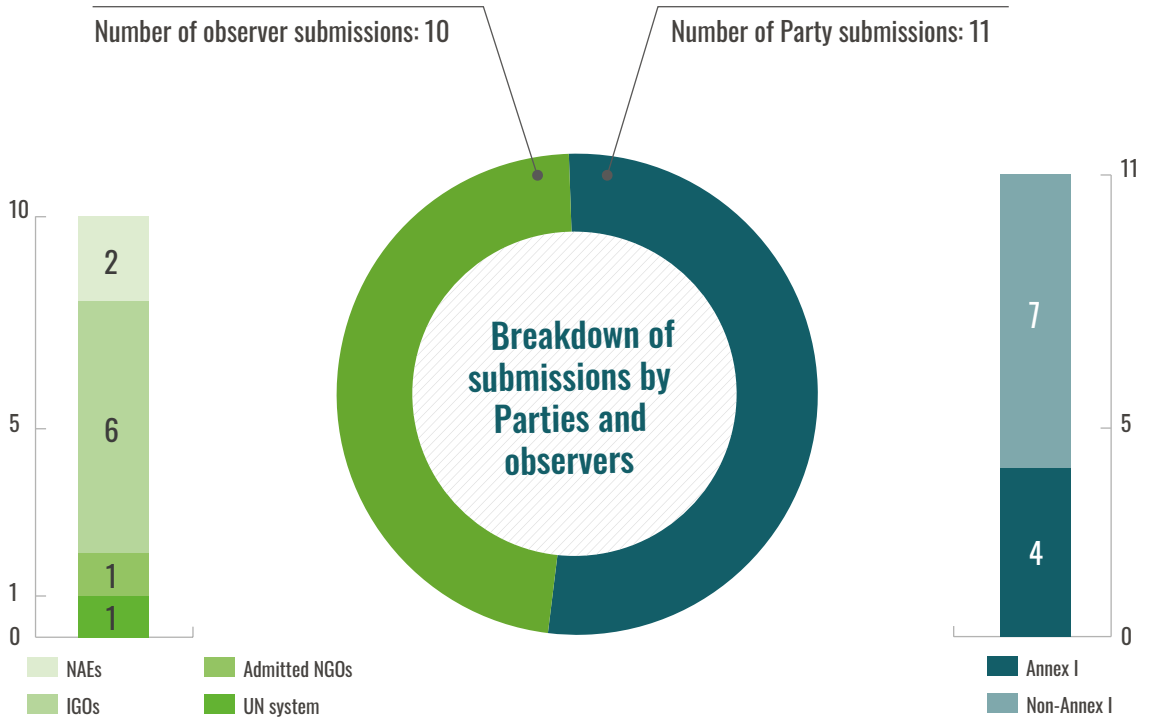
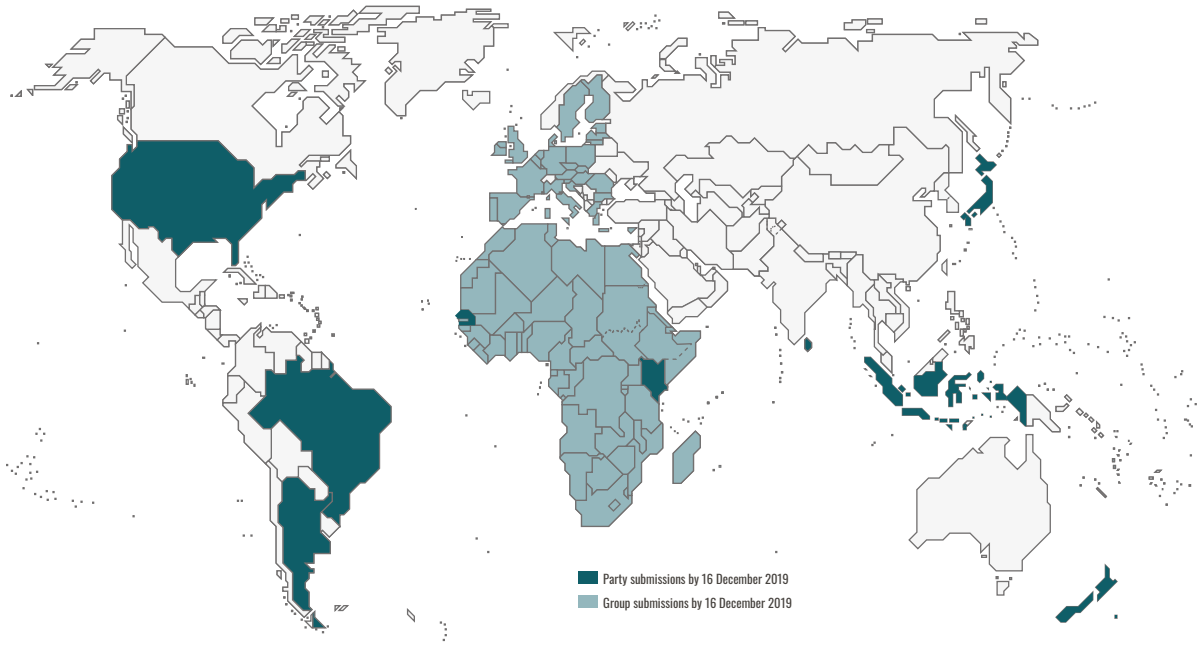


FIGURE 4.

PARTY AND GROUP SUBMISSIONS



Source: Adapted from United Nations World map, February 2019

The designations employed and the presentation of material in this information product do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations (FAO) concerning the legal or development status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dashes lines on maps represent approximate border lines for which there may not yet be full agreement.

CHAPTER

1

OVERVIEW OF THE SUBMISSIONS BY PARTIES

Although Party submissions on topic 2(d) vary considerably in structure, length and degree of detail, many submissions (Argentina, AGN, Brazil, EU, Japan, Kenya, Senegal, Sri Lanka and the United States of America) highlight the importance of increasing efforts to create resilient and sustainable agriculture systems.

In this regard, the KJWA has a pivotal role in promoting knowledge exchange at the national, regional and global levels with the aim of scaling up the implementation of best practices. These exchanges need to include science, innovation and technology, and successful policies that, according to national circumstances, increase resilience and sustainable production in agricultural systems.

Valuable and concrete results are expected by these Party submissions at the end of the KJWA road map in 2020, in line also with enhanced National Determined Contributions (NDCs) under the Paris Agreement.

Parties highlighted the strong link between nutrient use and manure management and climate change and agriculture.

In particular, some submissions (Argentina, EU, Japan, New Zealand and Senegal) recall the fact that optimized nutrient use and improved manure management are reported by the 2019 IPCC Special Report on Climate Change and Land (IPCC, 2019) as practices that contribute to mitigation of climate change. In fact, it is well -known that nutrient use generates nitrous oxide (N_2O) emissions and can modify soil carbon stocks and influence the nutrient composition of soils, while manure management is associated with methane (CH_4), N_2O as well as ammonia (NH_3) emissions. Therefore, by optimizing nutrient use and compost management it is possible also to reduce CH_4 and N_2O and NH_3 emissions and enhance soil carbon stock.

According to two submissions (EU and Japan), the themes under the topic 2(d) show several interlinkages with other topics under the KJWA, in particular with topic 2(b) – 'Methods and approaches for assessing adaptation, adaptation co-benefits and resilience', topic 2(c) –' Improved soil carbon, soil health and soil fertility under grassland and cropland as well as integrated systems', topic 2(e) – 'Improved livestock management systems' and topic 2(f) – 'Socioeconomic and food security dimensions of climate change in the agricultural sector'. Moreover, one of these submissions (EU) also emphasizes the important link between topic 2(d), quality of water and air, and the Sustainable Development Goals (SDGs). Furthermore, the submission highlights the following SDG indicators:

- 2.3. - by 2030, double the agricultural productivity and the incomes of small-scale food producers, particularly women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment;
- 14.1. - by 2025, prevent and significantly reduce marine pollution of all kinds, particularly from land-based activities, including marine debris and nutrient pollution; and
- 15.3. - by 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world.

This submission (EU) also underlines that topic 2(d) is closely linked with the protection and restoration of biodiversity, as, among others, appropriate nutrient management is also included in the agenda of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES).

Most of the Party submissions (Argentina, AGN, Brazil, EU, Japan, Kenya, New Zealand, Senegal and the United States of America) highlight the importance of sharing experiences, opportunities and challenges in improving nutrient use and manure management.

This would help to identify and exchange views on sustainable practices, policies and technologies related to the topic. Furthermore, it would help to develop a common understanding and country-specific strategies to achieve climate efficient manure management and fertilizer use avoiding nutrient surpluses and deprivation, as well as to identify knowledge gaps around these themes. Therefore, these submissions present national programmes and initiatives, policy actions, research, and lessons learned for other countries to move towards sustainable and resilient agricultural systems, considering also the important links with soil health, water quality, agricultural productivity and economic prosperity. For example, two submissions (Argentina and EU) underline that the KJWA could be an opportunity to strengthen the network with regional and global initiatives, such as the Livestock Environmental Assessment and Performance Partnership (LEAP), GASL, Global Research Alliance on Agricultural Greenhouse Gases, and others.

One submission (Japan) expresses some observations on the main findings from the previous workshops related to topic 2(b) and 2(c). Some submissions (EU, Japan and New Zealand) see farmers and farm advisers as important actors in improving nutrient use and manure management, as they are at the forefront of climate change for the agricultural sector and the ones that take actions on the ground for global food production. At the same time, national governments also play a key role and, therefore, there is a need to develop appropriate policies to regulate and monitor nutrient circulation and manure management.

1.1 Improved nutrient use

Elements such as nitrogen (N), phosphate (P) and potash (K) are essential plant nutrients to produce crops used for food, feed, fibers and fuel. A deficit of these elements can compromise agricultural

productivity, while an overapplication can harm the environment. In this regard, some submissions (Argentina, EU, Indonesia and Sri Lanka) highlight that nutrient use is very specific across countries and depends on local conditions (e.g. soil types, pH, plant species, climate). They also indicate that **imbalanced application of nutrients**, with high concentration applied in some areas and severe underuse in other areas, can occur **both at global and regional level**. An over-use of some nutrients, especially of N, can occur together with an underuse of some other nutrients. Moreover, the production of chemical fertilizers needs a large amount of fossil energy and their use generates greenhouse gas (GHG) emissions. Therefore, an **optimized nutrient management system** is crucial to reduce this disparity, maintaining or even increasing yields, enhancing agricultural resilience to climate change and reducing negative environmental impacts.

More efficient and balanced fertilization and nutrient use are indicated as paramount for sustainable food production in many submissions (Argentina, EU, Indonesia, Kenya, New Zealand, Sri Lanka and the United States of America).

These submissions recommend the application of **precision nutrient management practices** including selection of the right fertilizer, applying it in the right amount, at the right time and place to match plant needs. This can be achieved by using soil testing kits to calibrate local specific nutrient application, especially, N, P and K. The approach of optimal nutrient supply, tailored for plants and crops, is crucial both for large scale and smallholder farming to maximize productivity and financial co-benefits, and to minimize GHG emissions, N leaching and nutrient losses to water, and environmental pollution.

Three submissions (Brazil, New Zealand and Sri Lanka) outline that a key element in encouraging an optimal use of resources including nutrient application is understanding the relationship between economic and environmental sustainability. Despite the fact that commercial chemical fertilizers are the major source of nutrients currently applied at global level, many submissions (Brazil, EU, Indonesia, Kenya, New Zealand, Senegal, Sri Lanka and the United States of America) promote **organic fertilizers**. Animal manure, crop residues and other organic waste materials can contribute to providing useful nutrients for crops. Organic fertilizers can be used in their initial form or after processing (biological digestion, compost or chemical transformation) into granular, crushed or fluid organic-mineral fertilizers. These submissions emphasise that an efficient use of animal and plant-derived nutrients can reduce costs for farmers, while enhancing farm profitability and minimizing environmental impacts. In fact, the use of renewably-sourced fertilizers reduces the reliance on non-renewable synthetic fertilizers, and the vulnerability to price volatility. In addition, **sustainable farming methods can reduce the demand for synthetic fertilizers** and promote agricultural sustainability. In this regard, six submissions (Brazil, EU, Japan, Senegal, Sri Lanka and the United States of America) suggest possible sustainable agricultural practices and soil conservation techniques that can reduce the need for synthetic nutrient use. In particular, they refer to the following:

- **No-till farming** and protecting soil by **leaving crop residues** can increase the capacity of nutrient and water retention, reduce soil erosion, and improve soil fertility and resilience;
- **Crop rotation** can improve soil organic material, reduce pests, regulate soil moisture and reduce soil erosion, enhancing plant nutrient uptake while reducing the need for synthetic fertilizers;
- Ecological intensification of production systems, with the introduction of **cover crops** or through techniques such as **liming** (ensures that the nutrients in the soil are made available to the crop), **plastering and corrective fertilization** can lead to an immediate reduction in fertilizer consumption while maintaining productivity;
- Integrated systems that prioritize organic fertilizers, such as **agroecology**, agroforestry and **organic farming**, improve soil characteristics and enhance plant nutrient uptake;
- Integration of **innovative technologies and local knowledge** to identify and apply sustainable farming methods;

- Integrating crop varieties with high biological nitrification inhibitor function in cropping/pasture systems can biologically slow down the nitrification process in the soil, leading to enhanced N use efficiency and reduced N_2O emissions; and
- Using **bacteria** for biological nitrogen fixation and integrating **nitrogen fixing plants** into agricultural crops or in crop rotation, can reduce the need for mineral and organic fertilizers, due to the ability of leguminous plants to fix atmospheric N in soils.

The use of **biochar** is suggested as a useful practice by one Party (Brazil). This practice can enhance nutrient retention and provide some nutrients (K and P), increase soil porosity, aeration and drainage capacity while maintaining moisture and nutrients, thus avoiding excessive input losses.

In conclusion, almost all submissions mention that farming methods using organic fertilizer products and sustainable agricultural practices that can reduce the need for nutrient use are to be encouraged where possible.

1.2 Improved manure management

Efficient manure management is a key element closely linked to nutrient use and management, and to agricultural GHG emissions as well as to soil carbon sequestration, both at farm and landscape levels.

In this regard, three submissions (Brazil, New Zealand and Sri Lanka) highlight that the intensification of animal production, pasture and grazing systems can lead to an over-production of animal effluents, exceeding the capacity of agricultural land to absorb their nutrients. This can have various negative externalities, associated with animal welfare issues and environmental impacts, including GHG emissions. Therefore, some submissions (Argentina, EU, New Zealand, Sri Lanka and the United States of America) mention the use of adequate **storage and treatments** of effluent and manure, such as digesters, ponds, and tanks, and the use of **off-paddock structures** in grazing pastures as effective systems that can have the following positive co-benefits:

- Reduction of GHG emissions and preservation of water quality;
- Reduction of excreta deposited directly onto pasture, while minimizing N_2O emissions and N leaching; and
- Reduction of damage to soil structure from animal trampling while improving production of pasture.

The use of stored manure as fertilizer is mentioned by these submissions as a good practice with important implications for farm productivity and for the environment. The use of manure as a soil amendment can improve productivity by reducing or eliminating the need for synthetic fertilizer, minimize N leaching, and reducing CH_4 emissions if applied according to the agronomic needs of crops and at appropriate times of the year. According to these submissions, animal manure applications also help to increase soil organic matter and soil health, while one submission (the United States of America) underlines that the over-application of manure nutrients (N and P) to cropland can increase the risk surface water contamination.

Furthermore, four submissions (Brazil, EU, Kenya and Senegal) suggest that synergies between animal and crop production systems and integrated systems should be enhanced. For example, a **circular economy** approach can turn the nutrient surplus problems, generated by intensive livestock systems, into a possible solution, reallocating manure to agricultural soils where nutrients are lacking. Circular economy together with lower livestock density or reintroduction of livestock in some areas would benefit the optimal use of nutrients.

Some submissions (Argentina, Brazil, EU, Japan, Kenya, New Zealand and Senegal) suggest developing specific measures and approaches for improved manure management, including the following:

- Regulate the properties of manure and the consequent GHG emissions through dietary changes and feed additives;
- Use manure in renewably-sourced fertilizers, and to obtain the right nutrient balance by mixing manure with other sources containing nutrients (e.g. food waste, agri-food industry waste, green waste) to meet crop requirements;
- Bring livestock to more sustainable levels, in order to reduce nutrient surpluses, energy consumption, GHGs (CH_4) and freeing former feed growing areas for food production;
- Produce local feed to avoid the import of additional feed;
- Foster legal frameworks with appropriate regulations on manure management that help to minimize pollution and ensure GHG emission reductions;
- Apply appropriate practices and technologies for efficient manure collection, storage and utilization (spreading, treatment and transfer) in order to minimize its influence on climate change, including:

  - Manure treatments that have potential to reduce the emissions from handling of manure, such as technologies for acidification of manure in the stable, and cooling or separation of manure;
  - Treatment practices for composted and digested residues that aim to conserve and stabilize nutrients in manure and that can be stored in a form which can be easily used by farmers. This may help in managing nutrient excess in the surroundings of large animal production facilities; and
  - The use of manure for energy production (heating and electricity) through the production of biogas (the product of anaerobic digestion) and/or syngas (the product of gasification) reduces CH_4 emissions. This can contribute to the national energy mix, especially in areas with large animal production facilities. In particular, bioenergy is the only non-intermittent renewable energy resource and can provide supplementary income for farmers.

1.3 Needs and priorities to improve nutrient use and manure management

Many Party submissions (AGN, Argentina, Brazil, EU, Indonesia, Kenya, New Zealand, Senegal, Sri Lanka and the United States of America) expanded the discussion on the needs and priorities they see as paramount to improve nutrient use and manure management towards sustainable and resilient agricultural systems. In particular, they refer to the following:

- The importance of having a **better understanding and knowledge of soil and crop characteristics**, considering local conditions such as climate aspects, before any practices on nutrient management are undertaken. This would help to achieve focused, effective and efficient nutrient management;
- The need to evaluate and consider the efficiency and **environmental, sanitary and technological risks of synthetic and organic fertilizers**. This should include analysing the presence of microorganisms, emerging contaminants, and potentially persistent polymers, to prevent any toxification of soils, water bodies, animals, consumers and of the environment;
- The need to **enhance quantity, quality and accessibility of manure to be used as fertilizer** in order to reduce nutrient losses and GHG emissions while restoring degraded land and ensuring productivity;
- The importance of **data collection** on the status of nutrients in soils, use of nitrogen fertilizers by farmers, irrigation practices as well as on feed and effluent management practices in livestock, in order to:

  - Map the status of nutrients in soils and enhance soil nutrient monitoring systems; and
  - Benchmarking information to model accurate N loss and conversion efficiencies at farm level;

- Develop and implement **new methods and technologies**, including:
  - Chemical strategies, such as the use of lime and other amendments, as well as physical and biological strategies, that improve the availability of nutrients in the soil, considering local climatic and soil conditions;
  - Access to innovation and technology for farmers, professional consultants, technicians, researchers and government agencies to foster better manure management;
  - Tools that predict crop responses to N and help farmers to make decisions on the rate and spatial use of nutrients, and the location/context-specific environment;
  - Models that forecast nutrient flows through the animal, pasture, crop and soil, and provide estimated nutrient losses, nutrient leaching and GHG emissions;
  - Risk maps of nutrient loss and bacterial contaminants at farm level that can support the evaluation of the costs for different mitigation strategies; and
  - Methods for the assessment of the effluent systems and manure management, with the aim of reducing nutrients imbalance and GHG emissions;
- The importance of enhancing robust **scientific research** on:
  - Nutrient management strategies and their effectiveness in reducing farming costs, environmental impacts and conserving natural resources;
  - Alternative sources of nutrients, including agricultural use of organic, industrial and urban residues as nutrient sources, correctives and soil conditioners;
  - Farming practices that can reduce or avoid the use of synthetic fertilizers;
  - The utilization of manure, including management systems, rate and methods of application to minimize nutrient loss, as well as possible negative environmental impacts of its over-use;
  - Mitigation options for livestock and crop management, including a quantitative assessment of their effectiveness in order to provide useful information to decision-makers and farm managers;
- The importance of developing training and guidance to increase the accuracy in quantifying and reflecting changes in manure and fertilizer management and to facilitate **improvement in national GHG inventories**;
- The need to **exchange information** on the co-benefits of the efficient use of nutrients, alternative nutrient sources and their management techniques, and farming practices that can reduce or avoid the use of synthetic fertilizers. This exchange would **increase farmers' awareness and knowledge** of environmental and economic impacts;
- The importance of understanding and overcoming possible **barriers** to the adoption of new methods and technologies for sustainable and resilient agricultural systems, mainly related to logistics, financial, and social perception of opportunities or willingness to change; and
- The need to **increase investments in smart -agricultural technologies** to produce more with less inputs, minimize nutrient losses and improve nutrient use efficiency.

Three submissions (AGN, Kenya and Senegal) highlight the importance of **financial resources** and in this regard request:

- The Standing Committee on Finance (SCF) to consider making recommendations to the Conference of Parties on the long-term climate financing of agriculture; and
- CBs and the operating entities of the Financial Mechanism under the Convention to review their programs and strategies, and to work jointly to better integrate agriculture in their current and future work, with full participation of Parties.

1.4 Views on the workshop on topic 2(d)

Four Party submissions (Argentina, EU, Japan and Kenya) make specific reference to the in-session workshop of SB 51 on topic 2(d) introducing some key issues to be addressed, expected participation and format. According to these submissions, the workshop should help Parties to:

- Identify, showcase and exchange views on sustainable practices, policies and technologies to reduce GHG emissions and prevent nutrient depletion, while ensuring food security and adapting to impacts of climate change;
- Develop a common understanding for strategies to optimize nutrient use and manure management, while maintaining and increasing yields;
- Enhance discussion of possibilities for national regulation such as monitoring and controlling, regulative laws, taxes and subsidies;
- Facilitate access to technology for soil nutrient mapping, development and monitoring of soil information systems for decision-making; and
- Facilitate capacity building to improve knowledge of smallholder farmers on improved soil nutrient use and manure management.

One submission (Japan) underlines the importance of including the following speakers and panellists:

- Experts from bodies within and outside the UNFCCC with expertise and experience in implementation related to 2(d) to give presentations, and to share their research and implementation experiences. These experts should represent FAO, the World Bank (WB), 4per1000 Initiative, Global Research Alliance on Agricultural GHGs, CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), Climate and Clean Air Coalition (CCAC), IPCC and possibly others; and
- Farmers that are at the forefront of climate change and the caregivers of global food security and nutrition. The effectiveness of farmers' voices were mentioned in many comments made at the workshop on topic 2(c).

CHAPTER

2

OVERVIEW OF THE SUBMISSIONS BY OBSERVERS

This chapter analyses the views on topic 2(d) expressed by ten observer organizations representing one United Nations (UN) system' member (FAO), one Intergovernmental Organization (IGO) (CGIAR and others), two Non-Admitted Entities (NAEs) (ABDN and others and IFOAM and others) and six Non-Governmental Organizations (NGOs) (Brighter Green and others, CAN, CropLife, IFA, NACSAA and WFO).

Despite the differences among the submissions in structure, length, degree of detail and focus on different priority issues, the ten observer submissions present some common elements.

Overall, submissions recognize the fundamental importance of a proper nutrient use and manure management under crop and livestock production systems.

All submissions underline that appropriate management of nutrients in agricultural systems, particularly N and carbon, can play a key role in improving crop response to the adverse impacts of climate change to meet the increasing food demand for a growing global population.

Two submissions (NGOs: CAN and WFO) highlight that it is essential to have access to knowledge and technology for farmers, especially smallholders, women and youth, who are at the centre of agricultural systems. Knowledge and technology would enable more people to secure their livelihoods and access to healthy food. These groups should be at the forefront of accessing opportunities such as training, knowledge and technology use for appropriate nutrient use and manure management under crop and livestock production systems. In this regard, some submissions (one UN system: FAO; one NAE: ABDN and others; and three NGOs: IFA, NACSAA and Brighter Green and others) recommend the application of measures and enabling policies that can enhance adaptation in agriculture, improve resilience and deliver ecosystem services for farmers, including the following:

- Facilitate farmers' access to decision-making processes, with the aim of including agricultural stakeholders in a participatory approach (one NAE: ABDN and others; and two NGOs: NACSAA and WFO); and
- Enhance knowledge sharing, research and training among farmers, with the aim of increasing their capacity to understand and manage climate actions in agriculture (one UN system: FAO; one NAE: ABDN and others; and four NGOs: IFA, NACSAA, Brighter Green and others and WFO).

Topic 2(d) is considered as a priority by many submissions in order to achieve the adaptation and mitigation goals of the Paris Agreement, protect biodiversity and enhance the livelihoods of the people who work in agriculture worldwide. In fact, according to nine observer submissions (one UN system: FAO; one IGO: CGIAR and others; two NAEs: ABDN and others and IFOAM and others; and five NGOs: CAN, CropLife, IFA, NACSAA and WFO) the use of nutrients (organic, manure and synthetic fertilizers) strongly influence soil carbon sequestration and GHG emissions.

Many observer submissions discuss the importance of sharing experiences, opportunities and challenges related to improving nutrient use and manure management. Five observer submissions (one UN system: FAO; one NAE: ABDN and others; and three NGOs: CropLife, IFA and NACSAA) mention specific actions, programmes and initiatives, including developed approaches, tools, methodologies, technologies, know-how, to be referred to as the best practices and lessons learned. The most common management practices and approaches highlighted by these observers include the following examples:

- Promoting indications for the use and management of fertilizers (one UN system: FAO);
- Setting reference criteria for assessing soil carbon sequestration in agricultural land (one NAE: ABDN and others);
- Implementing information platforms for environmental performance and the sustainability of livestock supply chains (one UN system: FAO);
- Developing models to identify efficiency gaps in livestock management (one UN system: FAO);
- Promoting nutrient use efficiency as a key component of sustainable agricultural intensification (one NAE: ABDN and others; and three NGOs: CropLife, IFA and NACSAA); and
- Using inoculants to increase yields and capture carbon for reducing carbon emissions (one NGO: CropLife).

According to three submissions (one UN system: FAO; one NAEs: ABDN and others; and one NGO: CropLife) the themes under the topic 2(d) show interlinkages with topic 2(c) – 'Improved soil carbon, soil health and soil fertility under grassland and cropland as well as integrated systems, including water management'; while one of the three submissions (one UN system: FAO) considers elements under topic 2(d) also strongly related to topic 2(e) – 'Improved livestock management systems'.

2.1 Improved nutrient use

All observer submissions reinforce the discussion on topic 2(d) emphasising the importance of improving nutrient use and manure management efficiency in order to obtain sustainable and resilient agricultural systems. In particular, they refer to the following priorities:

- Balance global fertilizer application, while enhancing soil fertility and sequestration of soil organic carbon (one UN system: FAO; one IGO: CGIAR and others; one NAE: IFOAM and others; and two NGOs: NACSAA and WFO);
- Apply fertilizers according to the principles of climate-smart agriculture (CSA) to enhance the adaptive capacity of agriculture to changing climate conditions (one NGOs: NACSAA) and provide important co-benefits. These co-benefits include maintaining the quality of soils (reducing erosion, maintaining soil fertility and enhancing soil carbon), air (reducing NH_3 and nitric oxide emissions), water (reducing nitrification and eutrophication), improving

biodiversity and related ecosystem services (one UN system: FAO; one IGO: CGIAR and others; two NAEs: ABDN and others and IFOAM and others; and two NGOs: Brighter Green and others and CAN);

- Promote the implementation of nutrient use practices, techniques, and methods in line with holistic and agro-ecological approaches such as organic agriculture, agroforestry and permaculture (one UN system: FAO; one IGO: CGIAR and others; two NAEs: ABDN and others and IFOAM and others; and four NGOs: CAN, CropLife, Brighter Green and others and WFO);
- Enhance livestock and crop systems with the aim of avoiding burning of residues and optimizing recycling of both residues and manure (circular bio-economy) while reducing emissions and improving productivity of agro-food systems (one UN system: FAO; one IGO: CGIAR and others; two NAEs: ABDN and others and IFOAM and others; and one NGO: CAN).

Seven observer submissions (one UN system: FAO; one IGO: CGIAR and others; one NAE: IFOAM and others; and four NGOs: CropLife, IFA, NACSAA and WFO) also highlighted that applying sustainable farming methods can enhance the efficiency of nutrient use and even reduce the demand for synthetic fertilizers.

In this regard, sustainable agricultural practices and soil conservation techniques are suggested by these submissions, including the following:

- Increase the use of organic fertilizers (such as compost, manure and green manure) in order to minimize use of synthetic and chemical fertilizers and pesticides;
- Incorporate techniques such as cover cropping, in particular with leguminous crops, and forage rotations in the farming system, while improving soil organic material and fixing atmospheric N in soils;
- Use of no-till farming and mulching while protecting soils, increasing nutrient and water retention capacity, reducing soil erosion, and improving soil fertility; and
- Apply precision farming to understand the right amount of nutrients needed for crops and provide them at the right time and at the right place.

One submission (one NGO: NACSAA) identifies that the use of biochar can enhance the efficiency of soil's retention of nutrients with potential benefits for soil fertility.

Many submissions highlight the potential of sustainable practices to be applied at different scales (from small-scale farms to the landscape or global level) as they can contribute to high-yield and low-emission development (one UN system: FAO; one IGO: CGIAR and others; one NAE: IFOAM and others; and two NGOs: CAN and NACSAA).

According to these submissions, the application of sustainable farming methods for more efficient nutrient use, will also help to increase productivity and financial co-benefits, minimize GHG emissions, N leaching and nutrient losses to water, thus reducing environmental pollution.

Some submissions (three NGOs: CropLife, IFA and NACSAA) express their view on the usefulness of applying chemical fertilizers according to best management practices such as Right Nutrient Source, at the Right Rate, at the Right Time, in the Right Place (4R), the Nutrient Stewardship principle and the Integrated Plant Nutrient Management practices.

These practices recommend applying mineral fertilizers combined with organic fertilizers and conservation practices such as crop rotation, reduced tillage, mulching and cover cropping. These observers, mainly agribusiness representatives, see the application of chemical fertilizers in combination with sustainable agricultural practices, as a possible climate solution for achieving global food security, while increasing yield productivity, enhancing soil organic carbon and reducing GHG emissions per unit of agricultural products.

However, many observer submissions are critical on the use of chemical fertilizers considering the risks of increasing absolute (total) GHG emissions of the agriculture sector and the threats posed to biodiversity. Most of the observer submissions agree on reducing chemical inputs as a general aim to improve soil health and fertility.

2.2 Improved manure management

Some observer submissions (one UN system: FAO; one IGO: CGIAR and others; two NAEs: ABDN and others and IFOAM and others; and three NGOs: CAN, NACSAA and WFO) highlight the necessity of including environmental impact assessment, such as acidification, eutrophication and biodiversity loss, in manure management. In this regard, six submissions (one UN system: FAO; two NAEs: ABDN and others and IFOAM and others; and three NGOs: CAN, NACSAA and WFO) suggest specific actions to be undertaken to properly manage manure and maximize co-benefits. In particular, they refer to the following:

- Deposit the manure in soils in order to provide organic matter, increase soil fertility and quality, and preserve the ecological integrity of soils through soil water retention, carbon sequestration and plant health;
- Utilize the nutrient budget approach to evaluate how manure can be beneficial or harmful for soils and the environment;
- Use free-grazing livestock to transfer nutrients from rangelands to croplands, and concentrate nutrients in croplands;
- Utilize proper sustainable manure strategies that should include microbiological assessments of water quality in various sampling points along livestock production areas;
- Reduce imported feed and focus on competing feed, such as grass, byproducts, residues and waste, while reducing concentrate feed use and production; and
- Adjust the nutritional content of feed to save resources and also improve animal health and productivity.

Regarding the last point, three observers (one UN system: FAO; one NAE: ABDN and others; and one NGO: NACSAA) point out that the supply of micronutrients in feed is essential as it directly contributes to high-quality animal diets which ultimately lead to improved animal health.

Five observers (two NAEs: ABDN and others and IFOAM and others; and three NGOs: CAN, NACSAA and WFO) focus attention on the improvement of manure storage and the critical actions to take. These may include adoption of new technologies for better storage and processing, and application of alternative techniques, such as covering manure heaps and manure incorporation in soil.

Three submissions (one IGO: CGIAR and others; and two NGOs: CAN and NACSAA) promote the generation of clean and renewable energy from manure management, e.g. from anaerobic bio-digesters from livestock manure.

Two observers (one NAE: IFOAM and others; and one NGO: Brighter Green and others) emphasize the need for an essential transformation in global food systems, reducing agricultural land for feed crops, fertilizer inputs and pesticides, and protecting and restoring ecosystems and biodiversity.

2.3 Needs and priorities to improve nutrient use and manure management

Many observer submissions report diverse key areas for which actions are needed in order to improve nutrient use and manure management towards sustainable and resilient agricultural systems. These include:

- Develop coherent policy frameworks to address nutrient use and manure management (one UN system: FAO; one IGO: CGIAR and others; and one NGO: NACSAA);
- Align the social, economic, environmental and context-specific priorities and solutions with national policies and priorities (one NAE: IFOAM and others; one NAE: ABDN and others, and three NGOs: IFA, NACSAA and Brighter Green and others);
- Provide countries with technical assistance to identify agricultural techniques and timings

to maximize nutrient uptake and manure management (one UN system: FAO; one IGO: CGIAR and others; one NAE: ABDN and others; and one NGO: NACSAA);

- Support research, and develop analysis and tools that respond to the needs of countries seeking to undertake transformative changes in agricultural sectors (one UN system: FAO; one IGO: CGIAR and others; one NAE: ABDN and others; and three NGOs: IFA, NACSAA and WFO);
- Promote site and crop specific plant nutrient use to achieve sustainable and resilient agricultural systems, as different agricultural systems require different nutrient solutions (one UN system: FAO; one IGO: CGIAR and others; one NAE: IFOAM and others; and three NGOs: IFA, NACSAA and WFO);
- Facilitate knowledge and experience sharing among farmers on the sustainable use of organic fertilizers (one UN system: FAO; two NAEs: ABDN and others and IFOAM and others; and one IGO: CGIAR and others);
- Minimize reliance on synthetic fertilizers, chemicals, and pesticides (one UN system: FAO; one IGO: CGIAR and others; two NAEs: ABDN and others and IFOAM and others; and two NGOs: Brighter Green and others and CAN);
- Optimize the use of nutrients through technological innovation (i.e. information technology, remote sensing) (one UN system: FAO; one IGO: CGIAR and others; and four NGOs: CropLife; IFA, NACSAA and WFO);
- Optimize and rationalize the use of inorganic and organic fertilizers focused on reducing emissions and enhancing co-benefits such as protection of water, soil, air, biodiversity and energy production (one IGO: CGIAR and others; and two NGOs: Brighter Green and others and WFO);
- Improve fertilizer production technologies to reduce additional emissions (one IGO: CGIAR and others; and one NGO: IFA); and
- Enhance optimal nutrient use efficiency and manure management through standardized Measuring, Reporting, and Verification (MRV) approaches in order to measure and disseminate the mitigation and resilience effects of good practices (one UN system: FAO; one IGO: CGIAR and others; and one NAE: ABDN and others).

Regarding the last point, three submissions (one IGO: CGIAR and others; one NAE: ABDN and others; and one NGO: IFA) underline that assessed and improved efficiency of nutrient use and manure management could be considered in the review of the NDCs.

In this regard, these observer submissions see the KJWA as an opportunity to provide countries with the necessary technical assistance during country updates on NDCs in order to assess the efficiency of nutrient use and manure management and enhance their efforts for climate change adaptation and mitigation.

One submission (one IGO: CGIAR and others) refers to the importance of enhancing the quality of data on nutrient and manure use, relevant farm conditions and management practices, especially for smallholders.

The submission suggests the usefulness of a global open access data repository with soil and nutrient information for all countries.

Financial support is highlighted as essential by four submissions (one UN system: FAO; one IGO: CGIAR and others; one NAE: ABDN and others; and one NGO: CropLife).

These submissions underline the importance of ensuring adequate investments to incentivize nutrient and manure management planning. Two observer submissions (one IGO: CGIAR and others; and one NAE: ABDN and others) propose a dedicated contribution of specific funds (such as GCF or incentives and payments for ecosystem services) as fundamental to implement appropriate methods and approaches for resilient agricultural systems.

Moreover, according to one submission (one IGO: CGIAR and others) the public financial support should also aim to strengthen investments in development of research and skills in particular on agriculture extensions and its benefits.

2.4 Views on the workshop on topic 2(d)

Six out of ten observer submissions (one UN system: FAO; two NAEs: ABDN and others and IFOAM and others; and three NGOs: Brighter Green and others, CropLife and NACSAA) make specific reference to the in-session workshop of SB 51 on topic 2(d) proposing key issues to be considered and discussed in the workshop. These include:

- Establishment of sustainable and climate -resilient agricultural systems by holistic and agro-ecological practices;
- Planning tools that include practical global standards for manure and nutrient management;
- Improved N use efficiency in crops;
- MRV mechanisms (e.g. technologies, protocols, minimum data proxies) for fertilizer application at farm level;
- Incentivizing natural and local solutions to manage pests and disease outbreaks as reliance on synthetic fertilizers, chemicals, and pesticides can strip soils of organic matter; and
- Interlinkages between soil carbon sequestration and manure and nutrient management.

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ANNEX

Main initiatives, projects and publications undertaken by United Nations observers or in which they are actively involved recalled in the observer submissions

LINK TO THE KJWA DECISION ELEMENT 2(D) / Observer: UN System		
OBSERVER who mentioned the Programme/Project/Report	ACTIVITY/INITIATIVE/PROJECT/PUBLICATION	WEB LINK
FAO	International Code of Conduct for the Use and Management of Fertilizers	www.fao.org/3/ca5253en/CA5253EN.pdf
FAO	Livestock Environmental Assessment and Performance (LEAP) Partnership	www.fao.org/partnerships/leap/en/
FAO	Nutrient flows and associated environmental impacts in livestock supply chains: Guidelines for assessment	www.fao.org/3/CA1328EN/ca1328en.pdf
FAO	Global Livestock Environmental Assessment Model	www.fao.org/gleam/en/
FAO	Save and Grow. A policymaker's guide to the sustainable intensification of smallholder crop production	www.fao.org/3/a-i2215e.pdf
FAO	Agroecology Knowledge Hub	www.fao.org/agroecology/home/en/
FAO	Green Manure/ Cover Crops and Crop Rotation in Conservation Agriculture on Small Farms	www.fao.org/fileadmin/user_upload/agp/icm12.pdf
FAO	Nitrogen inputs to agricultural soils from livestock manure. New Statistics	www.fao.org/3/I8153EN/i8153en.pdf
FAO	The Global Soils Doctors Programme	www.fao.org/global-soil-partnership/pillars-action/2-awareness-raising/soil-doctor/en/
FAO	Manual on Integrated Soil Management and Conservation Practices	www.fao.org/3/x4799e/x4799e.pdf
FAO	More People, More Food, Worse Water? A Global Review of Water Pollution from Agriculture	www.fao.org/3/ca0146en/CA0146EN.pdf

The historic Koronivia Joint Work on Agriculture decision was adopted at the 2017 UN International Climate Conference, COP23.

The decision recognizes the fundamental importance of agriculture in responding to climate change, and calls for joint work between the two Subsidiary Bodies of the United Nations Framework Convention on Climate Change.

The Koronivia decision represents the first conclusions adopted on the agenda item on "issues relating to agriculture" since its inception in 2011. Importantly, it broadens the conversation on agriculture from its former scientific and technical focus to also consider implementation. The six elements specifically mentioned in the decision cover many of the most promising areas for action, including soil, livestock, nutrient and water management as well as the assessment of adaptation, socio-economic and food security dimensions.

Parties and observers were invited to submit their views on topic 2(d) – 'Improved nutrient use and manure management towards sustainable and resilient agricultural systems' by 20 September 2019. This working paper summarizes 11 submissions made by Parties and Party groups and ten submissions from observers that were published on the UNFCCC submission portal as at 16 December 2019.

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