Cornell Law School

Allison M. Chatrchyan
Sr. Research Associate and Adjunct Professor
International Environmental Law
Myron Taylor Hall
Ithaca, New York 14853-4901
607.254.8808 | amc256@cornell.edu

Submission from Cornell University to the United Nations Framework Convention on Climate Change (UNFCCC) on views related to the Sharm el-Sheikh joint work on implementation of climate action on agriculture and food security

1. Background

The mission of Cornell University is to discover, preserve, and disseminate knowledge to educate the next generation of global citizens. Cornellians apply world-class expertise to solve real-world problems. Cornell is also a leading institution for agricultural, climate change, legal, and policy research. As an observer organization to the United Nations Framework Convention on Climate Change (UNFCCC), we have participated in the UNFCCC and Koronivia Joint Work on Agriculture (KJWA) negotiations. Below, we present **research on critical issues** that should be considered to scale up the implementation of best practices in an inclusive and participatory way and have compiled a list of **workshop topic recommendations** in response to the Sharm el-Sheikh Joint Work on Implementation of Climate Action on Agriculture and Food Security FCCC/CP/2022/L.4, paragraph 15(b).

2. Context

Agricultural production provides critical food, feed, fiber, fuel, and environmental services that globally sustain both rural and urban economies. These systems are already experiencing significant climate impacts, which will only increase in frequency and severity over time.[i] Agricultural production is also a key source of greenhouse gas (GHG) emissions, accelerating climate change that disproportionately impacts low-income households, indigenous peoples, women, and youth in developing countries. It is critically important to accurately quantify GHG emissions and adaptation benefits through long-term, integrated research.

The Importance of Smallholders and Small Farms: Roughly 30% of global food is cultivated by smallholder or family farms, which account for 84% of all farms worldwide.[ii] Developing countries particularly rely on small-scale farming for economic and agricultural support, as up to 98% of farms in developing countries are deemed "small" by area.[iii] Small-scale farms are imperative to supporting local biodiversity and reducing agricultural emissions. However, increased climate variability leaves these farms particularly vulnerable to extreme weather events due to their limited access to resources such as irrigation systems, climate-resistant crops, and financial insurance.[iv] Extension support and peer-to-peer knowledge networks are critically

important to the dissemination of Climate-Smart Agriculture (CSA) best practices to smallholder farms.

Water Conservation, Efficiency, and Management: The high cost of agricultural water usage is in part due to inefficient water extraction. Cornell researchers have identified a perverse incentive for farmers to over-extract water for agricultural uses, affecting water availability and amplifying costs for other farmers.[v] To combat this issue, researchers have investigated strategies for coordinating water usage among farmers and designing groundwater management policies regarding usage and distribution. One study demonstrated a direct link between such strategies and massive cost abatement for farmers, including savings of more than $800,000 USD per 100 acres of strawberry crops.[vi]

Water use coordination challenges arise when farmers are not bound by legislation and governmental enforcement to conserve water.[vii] For maximum efficiency, regulations should be as uniform as possible after accounting for different usage needs by different agricultural systems.[viii] Financial subsidies covering irrigation water should be phased out in favor of encouraging efficient irrigation technologies and incentivizing water conservation and soil management.[ix]

Transboundary Water Management: Recent research has also demonstrated the need for transboundary climate and water policy coordination to protect water resources for agriculture. A 2022 study by Giuliani et al. considered more than 7,000 potential futures by combining different climates, socio-economic projections, and mitigation policies.[x] The study demonstrated that fragmented policies were capable of producing irrigation demands twice as high as those generated by coordinated global water consumption schemes.[xi] However, the study also noted that fragmented policies proved favorable for "extensive agricultural projects in Africa where the price associated to the land-use change emission [was] low."[xii]

Soil-Health Management: The consequences of desertification are extremely severe, contributing to large-scale biodiversity eradication, socio-economic instability, and - over the course of human history - the collapse of multiple large empires.[xiii] Today's rate of desertification is unprecedented.[xiv] An estimated 55% of the world's desertified land is attributable to soil degradation.[xv] Optimizing soil management practices can significantly reduce desertification by enhancing soil health and crop fertility, retaining moisture, suppressing disease, preventing land erosion, and sequestering GHG emissions.[xvi] Nature-based solutions have been found to increase carbon storage, avoid GHG emissions and increase resiliency of agricultural systems.[xvii]

Cornell researchers have characterized the benefits of microbiome analysis on predictive soil health and fertility[xviii], noting correlations between certain bacterial populations and ecological traits pertinent to enhancing natural carbon sinks.[xix] Additional research has identified several key biological indicators of progress of health soil, including earthworm populations, which may likewise be used as correlative metrics for soil crop productivity and ecosystem health.[xx]

3. Workshops

Given the severity of the challenges facing agricultural systems, Cornell University proposes these critically important topics for in-session/hybrid workshops under the Sharm el-Sheikh Joint Work on Implementation of Climate Action on Agriculture and Food Security. In addition to representatives from Parties and constituted bodies, we strongly encourage that researchers be invited to share their latest findings regarding:

- ***Ecological and Nature-Based Solutions:*** A workshop presenting research-based knowledge on utilizing agroecological, agroforestry, landscape-based, and nature-based solutions found to increase carbon storage, avoid GHG emissions and increase resiliency of agricultural systems.[xxi]
- ***Quantification:*** A workshop to share research and experiences on quantifying, monitoring, reporting and verification of GHG mitigation and adaptation benefits in relation to improved soil health, nutrients and livestock management and other practices.
- ***Smallholder and Small-Scale Farms:*** A workshop focused the specific needs of smallholder and small-scale family farms, with a focus on addressing the disparate impacts of climate change and challenges for adoption of new practices that these farms face. The Cornell Small Farms Program provides resources including training, publications, data, and information on funding sources for climate resiliency.[xxii]
- ***Extension and Peer-to-Peer Networks:*** A workshop focused on building the capacity of Extension and peer-to-peer networks to support farmers adoption of Climate-Smart Agriculture (CSA) and risk management practices. The Cornell Climate Smart Farming Program provides free online decision support tools and has trained Extension specialists in climate change mitigation and adaptation.[xxiii]
- ***Promoting Efficient Water Conservation and Management:*** A specific workshop presenting research and best practices for efficient irrigation technologies and systems and incentivizing local water conservation and efficiency.
- ***Water Policies and Transboundary Cooperation:*** A thematic workshop presenting strategies for coherent policies on water usage, with a specific focus on cost abatement for farmers, and strategies for transboundary water management. The Cornell Law School is a resource for international climate and legal governance pertaining to climate change and water resources.
- ***Improving Soil Health:*** A workshop on soil health frameworks, policies, outreach programs, and practices, including comprehensive soil assessment, using chemical, physical, and biological indicators, and microbiome research. Cornell's Soil Health Program and Cornell Soil Health Laboratory are exemplary resources.

- ***One Health:*** A workshop focusing on understanding the impact of climate on the one health agenda. Cornell's One Health Initiative can serve as a source of research-based information.

Cornell University stands ready and is committed to supporting the Sharm el-Sheikh joint work program over the next four years with its expertise and knowledge. We thank you for the opportunity to provide our views, and we remain available for any additional questions at amc256@cornell.edu.

Sincerely,

Ms. Maral M. Asik, Mr. Kevin P. Cho, Ms. Erin B. Elliott, Mr. Jackson E. Kalinski, and Ms. Johanna M. Martinez, with Dr. Allison M. Chatrchyan

International Environmental Law Course (LAW 7358)
The Cornell Law School

References

[i] See U.N. Food and Agric. Org, *Climate Change and Food Security: Risks and Responses*, FAO.ORG (last visited Mar. 25, 2023), https://www.fao.org/3/i5188e/I5188E.pdf.

[ii] Sarah K. Lowder et al., *Farms, Family Farms, Farmland Distribution and Farm Labour: What do we Know Today?*, AGECON (2019), https://ageconsearch.umn.edu/record/301283/; Vincent Ricciardi et al., *How Much of the World's Food do Smallholders Produce?*, SCIENCEDIRECT (June 2018), https://www.sciencedirect.com/science/article/pii/S2211912417301293.

[iii] This maximum value of 97% specifically pertains to the People's Republic of China. Yiyun Wu et al., *Policy Distortions, Farm Size, and the Overuse of Agricultural Chemicals in China*, PNAS (June 18, 2018), https://www.pnas.org/doi/10.1073/pnas.1806645115.

[iv] *See* S. Ryan Isakson, *Derivatives for Development? Small-Farmer Vulnerability and the Financialization of Climate Risk Management*, 15 J. Agrarian Change 569 (June 5, 2015), https://onlinelibrary.wiley.com/doi/abs/10.1111/joac.12124; Evans School Policy Analysis & Research Group, *Climate Change Impacts Small-Scale Producers*, EVANS SCHOOL OF PUBLIC POLICY & GOVERNANCE (last visited Mar. 19, 2023), https://epar.evans.uw.edu/blog/climate-change-impacts-small-scale-producers.

[v] Louis Sears et al., *Spatial Groundwater Management: A Dynamic Game Framework and Application to California*, 5 Water Economics & Policy, no. 1, Dec. 2018, at 3, 17, https://clinlawell.dyson.cornell.edu/WEP_CA_spatial_groundwater_paper.pdf.

[vi] *Id.* Cost abatement resulting from cooperative water consumption varies widely between different crop types. *Id.* at 27.

[vii] *See generally id.*

[viii] *Id.*

[ix] *See* David Pimentel et al., *Water Resources: Agriculture, the Environment, and Society*, 47 BIOSCIENCE 97, 104 (Feb. 1997), https://doi.org/10.2307/1313020.

[x] Matteo Giuliani et al., *Unintended Consequences of Climate Change Mitigation for African River Basins*, 12 NATURE CLIMATE CHANGE 187, 189 (Jan. 31, 2022), https://doi.org/10.1038/s41558-021-01262-9.

[xi] *Id.*

[xii] *Id.* at 190.

[xiii] United Nations, *Desertification and its Effects*, UNITED NATIONS (last visited Mar. 25, 2023), https://www.un.org/en/observances/desertification-day/background.

[xiv] *Id.*

[xv] NASA Earth Observatory, *Temporary Drought or Permanent Desert?*, NASA (Jan. 3, 2007), https://earthobservatory.nasa.gov/features/Desertification/desertification2.php.

[xvi] U.S. DEP'T OF AGRIC., SOIL HEALTH (last visited Mar. 20, 2023), https://www.fs.usda.gov/nac/topics/soil-health.php.

[xvii] Joseph E. Fargione et al., *Natural Climate Solutions for the United States*, SCIENCEADVANCES (Nov. 14, 2018), https://www.science.org/doi/10.1126/sciadv.aat1869.

[xviii] *See* Cornell University Agricultural Experiment Station, *Evaluating Soil Microbes as an Indicator of Soil Health*, CORNELL CALS (last visited Mar. 16, 2023), https://cals.cornell.edu/agricultural-experiment-station/research-impacts/evaluating-soil-microbes-indicator-soil-health (explaining how soil microbiomes are valuable indicators of soil health).

[xix] *Id.*

[xx] Suzanne Boothby, *The Hidden Costs of Conventional Agriculture*, NATURAL GROCERS (last visited Mar. 20, 2023), https://www.naturalgrocers.com/health-hotline-article/hidden-costs-conventional-agriculture#:~:text=Conventional%20agriculture.,-17&text=Soil%20degradation%20leads%20to%20erosion,farming%20and%20threatening%20food%20production.&text=Degraded%20soil%20also%20releases%20carbon,major%20contributor%20to%20climate%20change.

[xxi] Joseph E. Fargione et al., *Natural Climate Solutions for the United States*, SCIENCEADVANCES (Nov. 14, 2018), https://www.science.org/doi/10.1126/sciadv.aat1869.

[xxii] Cornell Small Farms Program, CORNELL CALS (last visited Mar. 19, 2023), https://smallfarms.cornell.edu.

[xxiii] Cornell Climate Smart Farming Program, CORNELL CALS (last visited Mar. 20, 2023), http://climatesmartfarming.org/.