Cornell CALS College of Agriculture and Life Sciences

Draft Scoping Plan Comments
NYSERDA
17 Columbia Circle
Albany, NY 12203-6399

Submitted by Julie C. Suarez, Associate Dean for Land Grant Affairs, on behalf of Cornell CALS and selected faculty with pertinent expertise in the identified areas of the draft scoping plan. All literature and references cited are available upon request – jcs433@cornell.edu.

Cornell's College of Agriculture and Life Sciences (CALS) considers it a privilege to be New York State's Land Grant partner for over 150 years. Various Cornell faculty and staff have participated in different parts of the CAC, as well as other Advisory Committees for the CLCPA, and these comments are simply meant to amplify and highlight a few specific areas for further exploration in the draft scoping plan.

New York is an agriculturally vibrant state with a large and diverse array of fruit, vegetable, dairy and livestock production. Partnering with stakeholders statewide, our faculty are committed to translating research findings into evidence-based support for the wide range of farm sizes and types in our state and bringing findings from the field back to campus labs and classrooms. This two-way knowledge exchange is critical to enriching New York farmers, communities and industries with proven methods and technologies.

Agriculture has meaningful potential to help stabilize the climate while feeding it by accelerating development, testing and implementation of our most promising climate-smart farming innovations. By accessing the expertise and innovation at Cornell CALS, as New York's Land-Grant, and our partner SUNY institutions with relevant expertise, NY agriculture is poised to lead next-generation climate solutions here and abroad. But we cannot afford any further delay: the time to act is now while there remains an opportunity to protect our food supply from climate extremes. A few examples highlight the urgency of our challenge:

———A recent Cornell analysis found that agricultural productivity over the past 60 years was 21 percent lower than it would have been without climate change — the equivalent of seven years of lost productivity growth. This is a disturbing trend, especially when factoring in the growth of our global population which could reach 10 billion by 2050. This trend is only expected to worsen, with rising global temperatures projected to significantly reduce crop yields in coming decades.

The western United States has battled increasing droughts and water shortages in recent decades — a trend that is also forecast to worsen in the coming decades. A recent paper suggests that future megadroughts —extended dry periods lasting two decades or more— will last longer, occur more frequently, and create more damage than today's conditions. Climate change is expected to accelerate these effects, pushing Earth nearer to an irreversible tipping point.

At an average of 49.5 degrees Fahrenheit, 2021 was the third-warmest year on record for the Northeast United States, according to the Northeast Regional Climate Center. Since this record-keeping began in 1895, the three warmest years for the Northeast have occurred within the past 25 years. With

Office of the Dean
126 State Street Suite 200
Albany, NY 12207
518 434-4157
JCS433@cornell.edu
cals.cornell.edu

increasing greenhouse gas concentrations in the atmosphere, these warming trends are expected to continue, along with more powerful weather extremes.

For years the research community has debated whether the most important place to start is by mitigating greenhouse gas emissions or by removing carbon from the atmosphere. The reality is that we need to do both simultaneously: radically reduce emissions and deploy innovative carbon capture methods. Along with these steps to mitigate the cause of climate change, we need to pursue adaptation strategies to keep our farmers in business by helping them to adjust to the stressors of a changing climate. It is going to take every tool in our arsenal to stop the dangerous warming of our planet and to safeguard our food systems. We are past the point of either/or thinking: We need solutions that create real-time, local adaptation to weather extremes while slashing emissions and capturing greenhouse gases at scale.

The CLCPA scoping plan does not set up an either/or framework of thinking. According to DEC's GHG inventory, agriculture reflects only 6% of the state's emissions – yet our shared land area has a meaningful potential to reduce CO2 emissions through "carbon farming" and forest carbon storage. The Agriculture and Forestry Committee recommendations clearly represent a consensus amongst the group on the importance of soil health, and the ability of our scientific community to assist in providing the necessary science-based strategies to quantify and measure net greenhouse gas impacts and extreme weather resiliency from healthy soil initiatives. The focus of the committee recommendations on precision nitrogen usage, ensuring that nitrogen is judiciously utilized for necessary plant growth and with increasing focus on developing a more circular economy to find strategies to reduce when unnecessary synthetic fertilizer usage, are important components to implement. The CLCPA scoping plan, particularly draft scenario four, also reflects a need for deep reductions in methane emissions. DEC's GHG inventory identifies that the agricultural sector contributes 19% of the state's current methane emissions. This should be regarded as a challenge to help farm families solve, through new technologies and incentives to use those technologies surrounding enteric fermentation reduction and improved or alternative manure management strategies that address both nitrous oxide and methane.

The College respectfully requests that the state of NY actively continue and increase its support for the necessary R&D to quantify individual and aggregated on-farm emissions from the dairy and livestock sector. Recent investments made by the state of NY will help in this endeavor, and the College will be deploying a test bed facility designed to actively measure methane on our research dairy within the next few years. Providing scientific justification to farmers on the usage of feed additives that reduce methane, as well as nitrogen, without imperiling the health of the animal, milk production, or subsequent soil systems that receive the manure will be critical to achieving the draft scoping plan goals while ensuring that New Yorkers continue to enjoy New York produced foods, including dairy. If we act as expeditiously as possible to assist farmers with the science and the tools needed to reduce methane, as a short-lived climate pollutant, we will be able to make a valuable contribution to the rate of reducing overall warming.

Significantly, the Agricultural and Forestry recommendations call for "sustainable intensification" of New York's food producing sector, or the increased efficiency of utilizing an acre of farmland to boost food production while having a concomitant impact of reducing GHG per acre. As an example of sustainable intensification, I will point to a recent World Resources Institute estimate that increased

efficiencies in U.S. agriculture from 1977-2007 led to a 16% reduction in greenhouse gas emissions per pound of beef produced in the United States. Data indicate that livestock and crop production have increased by about 30% from 1997 to 2017 while increasing their greenhouse gas emissions by only 7%. It is critical to celebrate these advancements and recognize the need to do even more in the U.S. and NY agri-food system.

NY as a leader in that engages nature-based climate solutions. Incredible potential exists to develop nature-based solutions and truly utilize our farms and forests to provide quality products while sequestering carbon, and mitigating harmful long-lived climate pollutants like nitrous oxide and short-lived methane. Similarly, incredible potential exists in the movement to shift towards a more sustainable, bio-based economy that replaces fossil fuel products with ones derived from agriculture and forestry, as well as synthetic biology. **It will be critically important for NYSERDA, AGM, and DEC to think thoughtfully about financially supporting the research enterprises, as well as synergize with existing entrepreneurial support programs located at ESDC funded Centers of Excellence, Innovation Hot Spots, Innovation Competitions, etc., to ensure that the science innovation exists to develop, test, and implement towards a bio-based economy.** Significant opportunities exist in utilizing our wood products, as well as synthetic biology approaches to repurposing food waste, and creating new replacements for fossil fuel derived plastics that fit within our existing economy and can be commercialized as we drive towards 2050. With less than 2% of the annual United Starts Department of Agriculture budget funding R&D, and far less climate focused funding available with the failure of the Build Back Better federal climate legislation, it's clear that states like New York, with ambitious CLCPA goals, will have to devote additional resources to providing science-based solutions that will drive us towards our CLCPA mandates for a more sustainable economy. Additionally, as we seek new tools to recover from decades of utilizing fossil-fuel derived products, it's clear that bio-based solutions for bioremediation will be cost effective to explore for future generations and to help clean our environment.

CALS respectfully suggests that the state consider establishing a metrics-based framework for measuring, verifying and reporting on GHG mitigation strategies for the agriculture and forestry sector. Thinking of further refinements of the opportunities that exist to mitigate emissions and to offset emissions in different commodity sectors may be important, and providing to farmers science-based tools, appropriate to the Northeast, may be helpful in accessing public or private financial incentives to assist with cost of adoption. CALS history in extension-based programs has shown that benchmarking tools are widely utilized by farmers, particularly those with an emphasis on demonstrating economically efficient practices by showcasing and sharing information on best practices with other farmers. Furthermore, it will be critically important for the state to continue the Agricultural Environmental Management and Climate Resilient Farms financial incentive programs. Ensuring adequate cost-share exists for implementation of GHG mitigation actions, which will not provide an immediate economic boost to the farm, will be vital to the success of the CLCPA's Agriculture and Forestry goals. Recognizing there is a challenge in that incentives typically are spent to establish larger scale, immediate reductions or improvements, a state decision to adopt an incentive framework that also ensures smaller scale farmers, urban farms, and farmers of color the ability to participate will be important for a more equitable food system overall.

Office of the Dean
126 State Street Suite 200
Albany, NY 12207
518 434-4157
JCS433@cornell.edu
cals.cornell.edu

In general, CALS agrees with and wholeheartedly endorses the suggestions embedded within the Agriculture and Forestry chapter. We'd suggest that the state consider the challenge of **climate adaptation** in future iterations of the scoping plan and/or devote some time to consider this issue more carefully with additional consultation from farmer and forester stakeholders. Since the year 1958, NOAA has reported a 55% increase in extreme precipitation events. The NRCC forecasts a 75% increase in extreme precipitation events over the next decade. Farmers will need to become water managers, in addition to their farming responsibilities, in the years to come. CALS is pleased with a recent investment in this year's state budget which will enable our institution to create a Climate Resilient Farm – on our vegetable research farm in Freeville, NY. We plan on constructing temporary wetlands, improving drainage, installing bioremediation strips as well as agroforestry buffers to both plan out what works, and what doesn't work, and demonstrate that to farmers through our field days and extension networks. Land management, as well as improved soil health, will become an increasing challenge for New York's farm community in a warming climate with more weather extremes. New plant varieties will need to be developed and bred that can withstand additional pressures of increased heat degree days, along with periods of prolonged dryness and prolonged wetness, sometimes in the same season. Climate mitigation, rather than climate adaptation, was the focus and rightly so of the Committee recommendations, but it's clear that climate adaptation will become an increasing challenge for farmers at the same time when our society will rely on NY and NE agriculture for an additional boost in food production given national and global arable land availability challenges. **It will also be critical for the state to financially support the land-grant research endeavor necessary to ensure that farmers have well-developed, climate smart approaches and new tools that fit within the economics of the farm.**

CALS respectfully is offering a few technical suggestions on the below parts of the scoping plan:

Food Waste

A new section should be added on reducing food waste throughout the entire food system. This topic is mentioned only in a very limited way in the waste section. Reducing food waste is a huge opportunity to increase land use, food utility, end-use efficiency and save money while reducing GHG emissions substantially.

In the United States, 31% of food is estimated to be lost at the retail or consumer level based on analysis of 2010 data (Buzby et al. 2014). Food is also lost on farms and throughout food supply chains, both pre and post-consumer. Importantly, reducing food waste reduces all of the emissions occurring where the food was produced. Furthermore, reducing food waste reduces the amount of land required for agriculture, freeing up land for other uses including further GHG mitigation opportunities (Wightman & Woodbury 2020). Thus, reducing food waste would greatly reduce GHG emissions from the agricultural sector per unit product used. The United States Department of Agriculture (USDA) and EPA set a goal to reduce food loss and waste by half by the year 2030. The New York State Department of Environmental Conservation (DEC) also promotes reduction in food waste (NYSDEC 2010). If food waste could be reduced from 30 to 40% down to 10 or 20%, there would be very large reductions in GHG emissions from food production while increasing the capacity for these same lands to feed a growing population.

Much more attention is needed in the Scoping plan to address opportunities to reduce food waste throughout the food supply system. Opportunities should be analyzed at multiple locations in the food

Office of the Dean
126 State Street Suite 200
Albany, NY 12207
518 434-4157
JCS433@cornell.edu
cals.cornell.edu

system including on-farm, storage, transportation, packaging, retail and wholesale, restaurants and food service, consumer use, etc. Likewise, there are opportunities to upcycle food waste for human consumption, animal feed, or as valuable soil amendments. There are also social justice issues linked to food waste. For example, Cornell researchers found that reducing "food deserts" in US cities by having more local grocery stores could reduce food waste (Belavina 2020). Reducing food waste can also provide community benefits by reducing trash production, pests, odors, truck trips through neighborhoods, etc. Additionally, increases in efficiency that reduce food waste saves money for producers, processors, retailers, consumers, transporters, and municipal waste managers.

Cornell CALS, both separately and in conjunction with private industry along with the state funded RIT led Pollution Prevention Institute, have worked extensively on assisting manufacturers with re-purposing and finding new products for specific food waste stream ingredients. The post-consumer waste problem; however, remains hard and is an area where much more significant inquiry is needed, particularly paring in research in food science and healthy product innovation in more sustainable packaging materials. Food waste is frequently upcycled through New York farms, new food products (whey as beer or sports drink), animal feed, composted as high-quality soil amendment to support the food system or converted to fuel. But again – there is significant work that needs to be done in this area to reduce food waste at the source, at the consumer level, and enable for better source separation to reduce methane emissions in landfills.

Carbon sequestration from freshwater wetlands, ponds

While carbon sequestration in coastal systems may not be a necessarily worthwhile area of investment, Cornell CALS is conducting several research inquiries into the ability of our constructed farm ponds, wetlands, and naturally occurring ponds to sequester carbon, while paying careful attention to measuring methane and particularly, in determining whether any methods or environmental conditions either exacerbate or reduce methane emissions from constructed ponds. It's clear that when the state calculates its compliance with CLCPA goals, having an accurate measure combining carbon sequestration with concomitant methane emissions from inland waters will add completeness to the model of carbon sequestration possibilities.

Inland waters, especially ponds and wetlands, can have significant potential. For instance, unpublished work occurring the Cornell CALS experimental ponds (representative of farm / residential ponds) show they store ~70 g C m-2 yr-1 (on average). And very preliminary work in natural ponds indicates burial rates of >150 g m-2 year-1. Published review papers show wetlands (marshes, forested wetlands, shrub/scrub) store between 14 – 130 g C m-2 year-1 (Villa et al. 2018); averaging ~90 g C m-2 yr-1 in temperate systems. North temperate lakes bury less carbon, but it's still significant, with estimates ~15 g C m-2 yr-1 (Heathcote et al. 2015). This storage, particularly in permanently inundated waters (e.g., ponds, lakes, many emergent wetlands) is "permanent" meaning it will stay buried as long as the waterbody is not drained. If we can reduce methane emissions from aquatic waterbodies and enhance carbon storage (especially in artificial ponds), this contribution of our inland waters and paying attention to new techniques to restore and manage inland waters for climate goals, could be an exciting addition to our state's nature-based plans to increase carbon storage. For instance, Department of Agriculture and Markets climate resiliency funds are incenting farm pond creation to assist farmers with climate adaptation for both water management and drought conditions for overall farm productivity and resiliency. There may be simple ways to design these ponds to be carbon friendly with lower methane emissions and a high carbon sequestration burial rate. Similarly, we know that eutrophication increases

methane emissions in natural ponds and lakes—so watershed management has the potential to reduce methane emissions. Cornell CALS will continue to work on this important area, and appreciates NYS Department of Environmental Conservation's support of this emerging research for inland water bodies, including constructed ponds and wetlands. This critical work will continue, we hope, to inform CLCPA scoping plan decisions in the years to come.

Forest Management

The CLCPA draft scoping plan provides excellent recommendations and strategies surrounding afforestation of former agricultural lands and carbon storage in our working forests. However, a significant gap is the lack of a concrete strategy to increase management of deer. Deer browsing and the consequent interfering vegetation that typify understory conditions throughout much of New York's woodlands pose an increasing threat to healthy, productive and self-regenerating forests. Failure to effectively address the issues of deer browsing and interfering vegetation will result in a steady decline in the health, productivity, and value of New York's forests over time, including a significant reduction in their ability to capture and store carbon. Proper silvilculture combined with innovative strategies like "slash walls" (www.slashwall.info) are critically needed to maintain healthy forests and the many resources they provide. Additionally, there needs to be a concerted effort to build out bio-economies that utilize management cuts to maximize health and growth of our very important forest resources that will also improve their ability to provide high quality materials for future generations and maximize high quality carbon storage (in the stock and in the long-lived wood products that can be harvested). This issue is mentioned briefly in the Scoping Plan, but should be clarified as a major issue and also a major opportunity to improve forest health and carbon sequestration.

Additionally, there are between 2-4 million acres of underutilized land in the state that could be activated for various products (solar, new food systems, grazing systems, or new forests). As NYS was orginally forested, a reasonable opportunity exists to promote afforestation and agroforestry as a growing part of New York's farm economy particularly in areas with more marginal soil types as they protect water and soil systems, improve air quality, provide diverse products and provide a long-lived form of carbon sequestration.

While the CLCPA is not designed to necessarily recognize the importance of processing networks, in order to meet agroforestry goals, ensuring that adequate agricultural processing and marketing opportunities exists to incent this emerging market will be important (for instance, nut processing, mushroom drying packing processor aggregators, and of course, small scale but expanded livestock processing).

Land Use Compatibility

While the private owners of the state's farm and forest land will make their own economic and environmental decisions, one of the challenges of the scoping plan is the myriad of pressures placed on the state's land usages. Working agricultural lands will need to intensify their food production to meet increased need for food from areas of our country that still have access to water --- while at the same point --- providing space for renewable energy installations, like large scale solar, and afforestation. **Research will be needed into efficient, economically compatible ways to construct dual usage (such as silvopasture or agrivoltaics) on our highly valuable and finite land base of competing**

needs and uses. While sheep are important and have been proven to work, it's also clear that we will need to develop new agriculturally based compatible use strategies to ensure a farmer has income from a renewable energy installation while also being able to utilize the land. Some of the crops that may have more potential would include berries, particularly if/when the technology exists to begin efficient and economical mechanical harvesting, and potentially other herbs, flowers, and vegetables that prefer shadier spots. We can envision a future whereby plant breeders will begin to breed varietals that will be completely compatible with large scale solar arrays – but that future is not yet here. It's important to consider dual use strategies that are compatible with existing and imagined future agricultural opportunities, as well as consider siting strategies carefully to protect and enhance soil health under solar arrays, considering additionality of incenting biodiversity in large scale arrays as well as soil carbon sequestration. Sustainably intensifying land for food production that is also utilizing an agrivoltaic strategy will be important for the future.

Energy

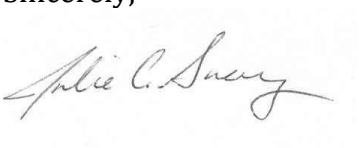
Due to the accounting framework where energy use is counted by the energy sector and not the agricultural sector, climate change will require new expenditure for new energy systems (drought requiring pumping and irrigation systems, high temperature impacting animal health and productivity requiring cooling fans, etc). It must be recommended that this may increase cost as well as emissions on farms but will be the cost of farming under a changing climate.

Prioritization

Finally, given the climate issue is fundamentally a fossil fuel issue and the land is the basis for all types of essential human forms of energy (food, feed, fiber, fuel), CALS recommends the state look at 2050 needs and work back to decide on priority programs so infrastructure built out today is building that 2050 vision. It is clear there is a lot of work to be done between now and 2050. CALS encourages that analyses be done as soon as possible that makes Real Permanent and Verifiable mitigation quantitatively comparable across sectors and within sectors so a batch-wise implementation strategy can be achieved to build out the greatest mitigation at the lowest cost to reduce the rate of change of climate.

In closing, thank you for the opportunity to offer selected comments on behalf of the College and particularly, faculty members with specific expertise.

Sincerely,



Julie C. Suarez, Associate Dean for Land-Grant Affairs

Office of the Dean
126 State Street Suite 200
Albany, NY 12207
518 434-4157
JCS433@cornell.edu
cals.cornell.edu