Research Article
Volume 14:01, 2024

Journal of Environmental & Analytical Toxicology

ISSN: 2161-0525 Open Access

Development of a Strategic Plan to Reduce GHG Emission in Sri Lankan Agriculture

Punchi Bandage Dharmasena[1]* and Chandima Gunasena[2]

[1]*Department of Agriculture, Rajarata University of Sri Lanka, Mihintale, Sri Lanka*
[2]*Department of Agriculture, University of Peradeniya, Peradeniya, Sri Lanka*

Abstract

Sri Lanka was among the 171 countries that signed the Paris Agreement in 2016 at the High- Level Signature Ceremony of the Paris Agreement held at the United Nations Headquarters in New York. Subsequently the country submitted the updated Nationally Determined Contribution (NDC) to the United Nations Framework Convention on Climate Change (UNFCC) in 2021. The Ministry of Environment, Sri Lanka prepared Carbon Net Zero 2050 Roadmap and Strategic Plan in 2023. The authors are responsible for the agriculture sector.

Agricultural lands contribute to the greenhouse effect primarily through the emission and consumption of Greenhouse Gases (GHGs) such as methane, nitrous oxide, and carbon dioxide. Synthetic fertilizers and organic materials after harvesting, and animal manure deposited during grazing are the most common sources that contribute to N_2O emission. Emission of CH_4 from agriculture is mainly from paddy fields and enteric fermentation of the livestock. Carbon dioxide is emitted from agricultural fields due to use of machinery, application of urea, dolomite and gypsum and tillage operations. However, when comparing the total GHG emissions from CH_4, N_2O and CO_2 from agricultural fields in Sri Lanka, it can be seen that the emission of CO_2 is negligible compared to other GHGs.

In the study three scenarios were adopted to predict GHG emission from agriculture up to 2050 – Baseline scenario, NDC 2030 scenario extended to 2050 and Improved mitigation scenario. The study included literature review, stakeholder discussions and analysis to determine strategies to minimize GHG emissions from the agriculture sector.

The study results showed that the NDC 2030 extended scenario and improved mitigation scenario can reduce GHG emissions by 30% and 60% respectively up to 2050 compared to the baseline situation. However, in achieving these targets the paper discusses issues and constraints and policy gaps, which would hinder the success of the efforts.

Keywords: Climate change • GHG emission • NDC 2030 • Carbon net zero 2050

Background and the Objective of the Study

Carbon net zero refers to the balance between the amount of C produced and the amount removed from the atmosphere, or activities that releases net-zero carbon emissions into the atmosphere. If a country is to reach carbon-net zero, it must primarily reduce its emissions of greenhouse gasses into the atmosphere and increase its carbon dioxide-absorbing ecosystems.

Even though Sri Lanka is considered a low-carbon emitting country compared too many other countries in the world, this trend of increasing CO_2 emission is a cause for concern. The Third National Communication of Climate Change in Sri Lanka (TNC) [1], states that the carbon sequestration is higher than the GHG emission in the country up to 2004, and it is reversed from 2005 onwards. The data given in the TNC Report show that this change has taken place both due to the increase in emissions as well as the decrease in net sequestration of Carbon over the years during the period 2000 to 2010.

***Address for Correspondence:** Punchi Bandage Dharmasena, Department of Agriculture, Rajarata University of Sri Lanka, Mihintale, Sri Lanka; E-mail: dharmasenapb@gmail.com*

Received: 03 December, 2023, Manuscript No. JEAT-23-121928; **Editor Assigned:** 05 December, 2023, PreQC No. P-121928; **Reviewed:** 18 December, 2023, QC No. Q-121928; **Revised:** 12 January, 2024, Manuscript No. R-121928; **Published:** 19 January, 2024, DOI: 10.37421/2161-0525.2024.14.746

In line with the above thinking, Sri Lanka has, in the updated Nationally Determined Contributions (NDCs) of the Ministry of Environment [2], committed to increasing the forest cover to 32% by 2030 and reducing greenhouse emissions by 14.5% for the period of 2021–2030 from Power (electricity generation), Transport, Industry, Waste, Agriculture and Forestry sectors. These targets are determined by considering the achievement of 70% renewable energy in electricity generation by 2030 to achieve Carbon Neutrality in electricity generation by 2050 and assuming there will be no capacity addition of coal power plants in the country. According to the above document, Sri Lanka expects to achieve its Carbon Neutrality by 2050.

The Glasgow Climate Pact called on all countries to revisit and strengthen the 2030 targets in their NDCs by the end of 2022, to align with the Paris Agreement temperature goal. If the overall Carbon neutrality (Net Zero) has to be achieved by 2050 for Sri Lanka, the targets given in the updated NDCs in 2021 have to be further updated, and the strategies and roadmap have to be prepared for achieving these. It has been observed that the agriculture sector contributes 25% of the total GHG emission in Sri Lanka.

Thus, the objective of the reporting study is to develop a strategic plan to reduce GHG emission in the agriculture sector of Sri Lanka, aiming to achieve carbon net zero situation by 2050 with all other sectors.

Introduction

Agricultural lands contribute to the greenhouse effect primarily through the emission and consumption of Greenhouse Gases (GHGs) such as methane, nitrous oxide, and carbon dioxide. In addition to that, green cover helps to reduce the greenhouse effect where, reflectivity or the Land Surface Albedo (LSA) which is the ratio of the upwelling radiant energy relative to the down welling irradiance incident upon a surface of the land reduces by the green

cover. In ecological systems, albedo can affect physical and physiological processes of ecosystems, such as energy balance and evapotranspiration by regulating the microclimate conditions of plant canopies and their absorption of solar radiation [3].

Agricultural land covers approximately 2.6 million hectares or roughly 42% of Sri Lanka's total land area. The great majority of the land used for food production is owned by about

1.65 million Small holder farmers, with average landholdings totalling less than 2 hectares, smallholder farmers are in charge of almost 80% of Sri Lanka's total annual crop production. The agricultural area in Sri Lanka has increased gradually in the past decade. With the end of the internal conflict, previously inaccessible territories have been converted into productive cropland. According to the statistics of Food and Agriculture Organization of United Nations, from 2003 to 2013, rice-harvested areas increased by 30.4% (911,440 to 1,188,230 hectares), while maize-harvested areas more than doubled (27,060 to 67,720 hectares). During the same timeframe, pastureland has not increased significantly, and shifting cultivation (chena) declined, due in part to limited land availability. Home gardens, which contribute to household level food security in rural Sri Lanka, cover a substantial 14.8% of the total land area of the country. These changing patterns of land use, coupled with the strict enforcement of anti-deforestation laws, have resulted in a decreasing rate of deforestation over the past decade. Agriculture accounts for 25.1% (4.71 million tonnes CO_2e) of the country's total Greenhouse Gas (GHG) emissions. Out of this, GHG emissions from cropland (mostly rice cultivation and cultivation of organic soils) account for 69.5% of total emissions, while the livestock sector (especially enteric fermentation) accounts for 30.5%. It could be observed that with the trend of reducing GHG emissions, Sri Lanka can reduce to 61% of the present level. To reduce the GHG emissions from the agriculture sector, appropriate management practices must be introduced to minimize CO_2, CH_4 and NO_2 emissions. Further, Land Surface Albedo in agricultural lands could be minimized to lower the Surface Albedo and increase the green cover and increase the carbon sequestration and suitable alternative measures must be introduced to minimize CO_2 emissions from agricultural fields. The main emphasis in agricultural sector should be given to GHG emission reduction from rice fields, livestock, and cultivated area of organic soils in the order of importance. In order to develop necessary mitigation measures carbon dioxide and methane emissions must be quantified for paddy cultivated areas. Nitrous Oxide (N_2O) is liable for 6% of worldwide anthropogenic GHG emissions; 90% of those emissions are associated with agriculture. Increased N fertilizer usage and animal production are the most significant sources of the projected increase in N_2O. Agricultural soils are the key anthropogenic sources of N_2O and contribute around 60% of human-derived N_2O emissions [4]. Urea is the major source of supply of nitrogen to crop production in Sri Lanka and urea is imported to Sri Lanka for agricultural use. Around 64% of the imported urea, with a nitrogen content of 46%, is used in paddy cultivation. The recovery of applied nitrogen to wetland paddy is around 20-40%. The agronomic efficiency of nitrogen (additional grain yield per kg N applied compared to without-N) is as low as 10 kg per kg of Nitrogen. Nitrogen utilization in the tea sector in 2018 includes 100.4 million kg of urea and 27.7 million kg of ammonium sulphate, totaling about 51.88 million kg of nitrogen. The total losses have been estimated at 40% of the applied nitrogen. The position of Sri Lanka in the agriculture sector, measured based on the Sustainable Nitrogen Management Index (SNMI) in the Environmental Performance Index (EPI) by Pimonenko T, et al. [5] is ranked low as 124 among the 180 countries indicating the significant improvement needed by the country in the future in achieving the Sustainable Development Goals (SDGs). Livestock populations with ruminants emit methane due to the anaerobic digestive process in the fore-stomachs (fermentation). Milk production from the dairy cow sector in Sri Lanka emits about 2.3 million tons of CO_2e. The emission profile of milk is dominated by methane (93.2%), while nitrous oxide (N_2O) and CO_2 contribute 1.6% and 5.2% of the entire emissions, respectively. Approximately 88% of the emissions from the management of stored manure arise from methane produced by the rumination of cows and 5% of CO_2 emissions related to feed production, transport, and processing contribute a further 5% to total emissions. Ruminants could produce 250 to 500 liters of methane per day counting on various animal and feed-related factors. That would cause about 12% loss of the dietary energy within the ration as methane. In Sri Lanka, cattle and buffaloes are the most abundant livestock groups, while sheep, goats, and swine remain as minors.

Past emission trends (2008-2019)

The current emission of main GHGs in the agriculture sector as observed in 2019 is shown in Table 1, with a comparison to the same in 2008.

Though Sri Lanka's N_2O emissions fluctuated substantially in recent years, they tended to increase through the 2000 - 2019 period ending at 2,450 thousand tonnes of CO_2eq in 2019. The increase was about 10%. Synthetic fertilizers and organic materials after harvesting, and animal manure deposited during grazing are the most common sources that contribute to N_2O emission. N_2O emissions from cropping systems are strongly correlated to increased N fertilization. With the doubling of nitrogen use in South Asia since 1990, there is an excellent potential for enhanced N_2O emissions from the Asian region. The overuse of synthetic N fertilizer generates significant environmental threats. Nitrogen fertilizer, which is not taken by the crop, is either lost as Nitrogen gases, including the greenhouse nitrous oxide gas (N_2O).

Emission of CH_4 from agriculture is mainly from paddy fields and enteric fermentation of the livestock. Increasing methane emissions are a major contributor to the rising concentration of greenhouse gases in Earth's atmosphere, and are thought to contribute up to one-third of near-term global heating.

According to the GHG emission assessment conducted by the Sri Lankan Ministry of Environment [6], 52% of the country's agricultural GHG emissions resulted from rice field CH_4 emissions, 27% from livestock enteric CH_4 emissions, and 16% from soil management. Sri Lanka has committed to reducing national GHG emissions by 14.5% from 2020 to 2030 and achieving net-zero emissions by 2050. Agricultural GHG mitigation is one of the most cost-effective and socially adaptive strategies to achieve these national targets.

Carbon dioxide is emitted from agricultural fields due to use of machinery, application of urea, dolomite and gypsum and tillage operations. However, when comparing the total GHG emissions from CH_4, N_2O and CO_2 from agricultural fields in Sri Lanka, it can be seen that the emission of CO_2 is negligible compared to other GHGs.

Approach and Methodology

Emission prediction models for the agriculture sector are limited as many prediction models in agriculture sector are focused to predict yield and production of various crops. Therefore, in this study three types of scenarios were developed to predict GHG emission from agriculture up to 2050.

Baseline scenario: The reference curve has been fixed considering GDP and population change as baseline scenario (Figure 1). Two exceptional lowering of emissions was observed in the year 2014 and 2016 and according to DOA it was due to the impacts of an El Nino condition prevailed in Sri Lanka.

NDC 2030 scenario extended to 2050: The GHG reduction curve established on the assumption that the mitigation strategies mentioned in 2030 report are adopted continuously up to 2050. It is observed that, when the NDC unconditional targets are extrapolated to 2050 using the model, the actions were capable to reduce GHG emissions by 30% from the year 2025 (5958 CO_2e in '000 tonnes to 4200 CO_2e in '000 tonnes) to the year 2050.

Improved mitigation scenario: This scenario was recommended by the

Table 1. Current emission of N_2O, CH_4 and CO_2 from agricultural lands (2019) compared to that in 2008.

GHG	Unit '000	2008	2019
Nitrous Oxide (N_2O)	Mt CO_2eq	2230	2450
Methane (CH_4)	Mt CO_2eq	4500	4180
Carbon Dioxide (CO_2)	Mt CO_2	350	180

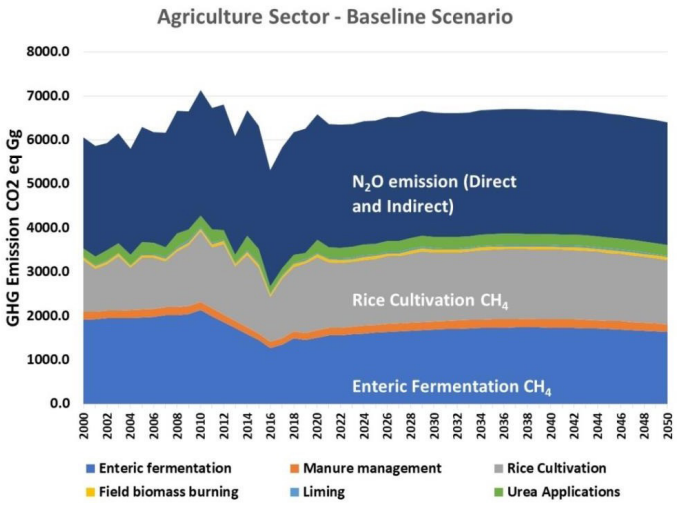

Figure 1. Baseline scenario developed by using GDP and population change.

authors of the study including 4 strategies to improve the reduction of GHGs as given below.

- Reduction of methane and nitrous oxide generation in paddy fields by removal of straw from paddy fields and using them for manufacturing paper and boards used in construction industry, production of biofuels and in the packaging industry
- Reduction of methane generation from cattle by feed quality improvements, night feeding and supply of water and animal comfort improvement
- Manure management and soil tillage reduction
- Reduction of nitrous oxide emissions from agricultural lands by reduction of artificial fertilizer applications

The authors for the agriculture sector studied the current status of GHG emissions and the related policy background for Sri Lanka and proposed feasible strategies and actions to minimize emissions and increase sequestration/ capture carbon in the period 2025 to 2050, through review of literature, discussions and consultations, and using their expert knowledge in the field. The updated NDC Report provided background information for the study, to understand the past trends and predictions up to 2030. However, the authors reviewed the proposed actions in the NDC report, and selected to carry forward only those that they could reasonably justify as feasible, and proposed some other strategies and actions too, to achieve Carbon Net Zero by 2050. The calculation of emissions in terms of tonnes of CO2 equivalent were carried out using the IPCC Guidelines (IPCC, 2006) and projections of emissions were carried out using accepted long term forecasting techniques for population and economic growth.

CH_4 reduction on fiver year basis was calculated according to the baseline scenario developed for the study. CH_4 and N_2O emissions were calculated and then converted into CO_2 equivalents using equations provided in the model. Global Warming Potential (GWP) value for CH_4 is 28 compared to 1 for CO_2. For N_2O the GWP value is 268 [7].

Results and Discussion

As shown in the Figure 2, improved mitigation scenario is capable of reducing GHG emissions by 61% compared to the baseline scenario. This clearly shows the limitations in the agriculture sector to reduce GHG emissions, where basically land and field level extension services are limiting. GHG emissions from postharvest management practices are also considered in the NDC Sri Lanka 2030 (extended) and therefore, C net zero 2050 model was also able to address emissions coming from the postharvest management practices. Further to that, it is proposed to introduce new technologies, like solar and other renewable energy sources to minimize GHG emissions from the agriculture sector.

Targets for reduction of emissions

In order to reduce the greenhouse effect from the agriculture sector, appropriate management practices must be introduced to minimize CO_2, CH_4 and NO_2 emissions. Further to that Land Surface Albino in agricultural lands should be minimized to lower the surface reflectivity and suitable alternative measures must be introduced to minimize CO_2 emissions from agricultural fields. The main emphasis in agricultural sector should be given to GHG emission reduction from Paddy fields, livestock and cultivated area of organic soils in the order of importance. Considering the feasible actions for reduction of GHG emissions, the targets for reduction of emissions from the agriculture sector have been set as given in Table 2.

Feasible strategies and mitigation actions for achieving targets

The government should ensure alignment between policies and actions, including public policy and advocacy. The national leadership should ensure this commitment is not undermined by conflicting targets. The national leadership should demonstrate commitment to net zero and the principles provided by:

- Providing strategic direction, oversight, support and sufficient resources to set and achieve targets,
- Incorporating net zero targets into core governance documented information (e.g. national policies, action plans, regulations etc.,),
- Disclosing stakeholder need information and records on climate-related issues, if appropriate to the country and net zero emission targets,
- Publicly committing to achieve targets as soon as possible through communication by the highest level of national leadership,

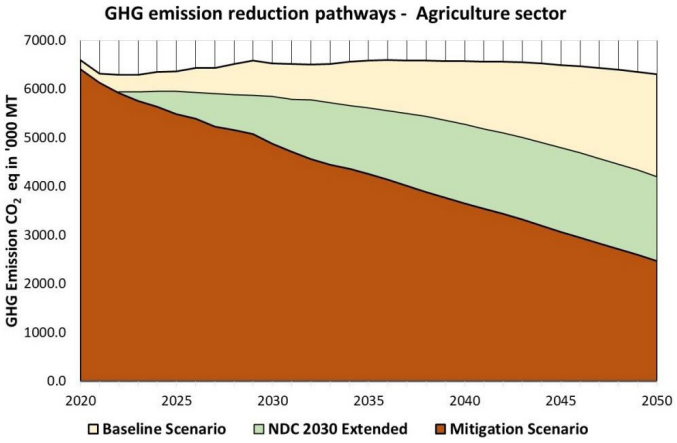

Figure 2. Improved mitigation scenario for the agriculture sector.

Table 2. Targets for reduction of emissions from the agriculture and livestock activities.

Strategy	CO_2e Emissions 2050 ('000 MT CO_2e Per Year)		% Reduction
	Baseline	Target of Reduction	
Paddy fields (due to methane emissions)	1830	685	62%
Reduce N_2O by reducing urea imports	244	94	61%
Direct/Indirect N_2O reduction	2788	1124	60%
Methane – Livestock management (neat cattle local, imported, Goats and Sheep)	1251	493	61%
Total	6113	2396	61%

- Clearly defining national leadership and sub level responsibilities,
- Appointing competent members of the national leadership to take responsibility for net zero actions,
- Ensuring competent persons are appointed to relevant roles and determining the frequency of updates to national leadership on climate-related issues and progress towards targets,
- Designing and implementing incentives for delivering net zero targets with national sustainability benefits,
- Ensuring consideration of actions needed to transition to net zero is prioritized at national level,
- Publicly and regularly communicating transition plans, progress and further action needed.

Once the above principles of good governance are in place, the sector wise strategies and mitigation actions will be effectively implementable.

Issues and constraints and policy gaps on achieving net zero status of Sri Lanka

The project plans to establish a Road Map and a Strategic Plan with the acceptance of all concerned stakeholders on its effective and meaningful implementation while developing set of policy guidelines anchored on the strategic plan collaborating all levels of the administrative entities of the Government of Sri Lanka. Further to that, country is planning to achieve the balance between the amount of carbon produced and the amount removed from the atmosphere or activity that releases net-zero carbon emissions into the atmosphere by primarily reducing its emissions of greenhouse gasses into the atmosphere and increase its carbon dioxide-absorbing ecosystems. Climate Analysis Indicators Tool published by the World Bank (WRI CAIT), Sri Lanka's GHG profile in 2011 was dominated by the energy sector (40%), followed by the waste (28%), land use change and forestry (LUCF) (15%), agriculture (14%) sectors and transport sector (20%).

Policy issues

If the targets set by the National Agriculture Policy by 2030, it means that resources productivity and economic profitability would increase by 100% and it is comparable to section 2 of the NDC 2030, where it stresses the importance of identifying crops/ varieties with high productivity, adopting good agricultural practices (GAP), increasing the land use productivity, improving fertilizer use-efficiency, improving water use efficiency and promoting precision agriculture. Further, the policy goals set target to increase technology adoption and high quality and high yielding seed and planting material production by 50%. Also it envisages increasing the eco - friendly inputs application in crop production up to 100% of the requirement indicating the possibility of achieving chemical free farming by the year 2030.

However, the institutions responsible for such achievements in agriculture mentioned at the First Stakeholder Workshop held on 23rd October 2022, that there are still policy gaps in following NDC 2030 activities (Table 3).

At the Second Stakeholder Workshop held on 18th November the Ministry of Agriculture reiterated that although they have resources (finances, manpower, technical knowledge) those are not adequate to review the present policy by 2025. They also have constraints such as lack of coordination among institutions, complexity, and lack of awareness within institutions. They need the support of International Organizations (FAO, UNDP, JICA, and WFP etc.), NGOs, and other organizations such as RRI, CRI, TRI, CCB, DOA, DAD, DEA etc.

Ministry of Livestock Development has also expressed the same concern on resources availability and they also need support of other institutions such as NLDB, Research Institutes, MILCO, Provincial DAPH, Irrigation Dept., Mahaweli, Universities etc.

Ministry of Irrigation and Ministry of Land are responsible for the review of the policy on Irrigation, Land Use and make recommendations to minimize GHG emissions. These Ministries can review the policies by 2025 but they are constrained with resources such as finances, manpower, technical knowledge etc. Supporting agencies are CEA, UDA, Ministry of Environment and they need further support from NBRO and Universities.

Availability of financial resources

Some institutions had to curtail their programmes due to restrictions of annual budgetary allocations. Without any external support some programmes would not be possible to implement. However, certain projects support institutes to continue their programmes. This resources constraint has been brought up by the institutes at the first stakeholder workshop of the Carbon net zero projects as follows (Table 4).

Institutional constraints

Main institutes working on NDC undergo several constraints that hinder the success of achievements especially policy gaps, staff, infrastructure and proper technologies. However, the institutes that responded seem to be having not many institutional constraints. As stated by institutions at the 1st Stakeholder Workshop, following institutional constraints for achieving NDC 2030 are faced by them (Table 5).

Technology/knowledge

Proper technology, available knowledge base and effective dissemination

Table 3. Policy gaps for NDC activities.

Institution	Activity	Policy Gaps for Sub Activities
Department of Animal Production and Health	Improve adoption of renewable energy in agriculture	Application of solar power and wind energy
		Promote grid electricity use
	Adopt renewable energy for livestock applications	
Coconut Cultivation Board	Increase crop productivity	Increase land use productivity
		Improve fertilizer use-efficiency
		Improve water use efficiency

Table 4. Financial constraints for sub-activities.

Institution	Activity	Financial Constraints for sub Activities
Department of Agrarian Development	Improve adoption of renewable energy in agriculture	Promote grid electricity use
Department of Animal Production and Health	Improve adoption of renewable energy in agriculture	Application of solar power and wind energy Promote grid electricity use
Coconut Cultivation Board	Increase crop productivity	Adopt GAP Increase land use productivity Improve fertilizer use-efficiency

Table 5. Institutional constraints for sub activities

Institution	Activity	Institutional Constraints for sub Activities
Department of Agrarian Development	Reduce post-harvest losses and value addition	Cultivation management Post-harvest management Excess production management
	Improve adoption of renewable energy in agriculture	Promote grid electricity use
Department of Animal Production and Health	Improve adoption of renewable energy in agriculture	Application of solar power and wind energy Promote grid electricity use
Coconut Cultivation Board	Increase crop productivity	Increase land use productivity Improve fertilizer use-efficiency Improve water use efficiency

process are constraints of some institutes in the agricultural sector in achieving NDC goals. It stresses the importance of capacity building for these institutions. This was brought up at the 1st Stakeholder Workshop (Table 6).

Productivity of agricultural crops can be increased through Good Agricultural Practices, increasing land use productivity of paddy lands, increasing soil fertility of crop lands, increasing water use efficiency in crop production, integrated farming systems, intercropping and agro-forestry systems approach. However, Agencies such as MoA, MPI, DoA, DEA, EDB are in the opinion that they do not have adequate resources such as finances, manpower, technical knowledge for successful implementation.

Another strategy is to promote crop diversification. Again responsible agencies such as DOA, DEA, Private Sector Organizations and EDB express their concern on inadequacy of resources such as finances, manpower, and technical knowledge for implementing the Carbon Net Zero approach.

As policymakers look toward including strengthened agriculture actions in an enhanced NDC, it is important that they first lay the foundation through enhanced policies, finance, and governance. Doing so will help ensure that proposed mitigation actions are tailored to the country's unique set of circumstances and needs and are aligned with a broader set of food security, equity, and sustainable development imperatives, thus maximizing the chances of successful implementation. This includes the following:

- Scoping the national context – As spatial variability across the country on geography, economy and social aspect, any Carbon net zero should avoid a blueprint approach and carefully consider key characteristics of a country's agriculture sector. This considers national production and consumption trends of crops and livestock, as well as the types and sizes of producers.
- **Involvement of stakeholders:** Involving stakeholders even at the beginning to strengthen the legitimacy, quality, and durability of the Carbon net zero targets of 2050. Stakeholders include not only relevant government ministries but also farmers, so that diverse perspectives, needs, and priorities are incorporated. Small-scale agriculture producers, especially women and women's organizations, should be explicitly included, which requires targeted and sustained attention from policymakers. Likewise, it is important to engage stakeholders that will be responsible for the implementation of agricultural climate action.
- **Establishing policy coherence:** Sri Lanka can consider progress made toward implementing existing goals and policies, and their coherence with other relevant plans, including other climate policies.
- **Strengthening measurement, reporting, and verification:** In the agriculture sector planning for mitigation, adaptation, and support is foundational for designing C net zero targets. Updated information base provides accessible, understandable, relevant, and timely information and data to inform the design of new climate targets and policies. It deepens the understanding about actions to address climate change to discern what works, what does not, and why. Such effort can also be a useful communication tool for motivating climate change action, both within government and among external stakeholders.

Table 6. Technology/knowledge requirement for sub activities.

Institution	Activity	Technology/Knowledge Requirement for Sub Activities
Department of Agrarian Development	Improve adoption of renewable energy in agriculture	Promote grid electricity use
Department of Animal Production and Health	Improve adoption of renewable energy in agriculture	Application of solar power and wind energy Promote grid electricity use
Coconut Cultivation Board	Increase crop productivity	Increase land use productivity Improve fertilizer use-efficiency Improve water use efficiency

- **Identifying opportunities for support:** Sri Lanka requires support to fully implement agricultural contributions to achieve C zero targets. This includes access to international climate finance, as well as local support such as improved extension services for farmers, including more widespread use of digital services such as early warnings and seasonal forecasts, and redirecting agricultural support to improve agricultural resilience and reduce emissions. The net zero enhancement process offers an opportunity to identify needs and attract support.
- **Ensuring equitable, inclusive governance:** It is important to anticipate whether and how proposed activities benefit or harm lives and livelihoods when advancing agricultural climate action. Careful design of incentive structures and finance flows can help facilitate equitable benefit sharing, while safeguard measures and rights-based approaches can help minimize harms.

Conclusion

The study results showed that the NDC 2030 extended scenario and improved mitigation scenario can reduce GHG emissions by 30% and 60% respectively up to 2050 compared to the baseline situation. However, in achieving these targets the paper discusses issues and constraints and policy gaps, which would hinder the success of the efforts.

Acknowledgement

None.

Conflict of Interest

None.

References

1. Third national communication of climate change in Sri Lanka (TNC), 2022, Ministry of Environment, Sri Lanka. ISBN: 978-624- 5817-25-2.
2. Ministry of Environment, 2021, Updated Nationally Determined Contributions (NDCs) under the Paris Agreement on Climate Change in Sri Lanka.
3. Tian, Li, Yangjian Zhang and Juntao Zhu. "Decreased surface albedo driven by denser vegetation on the Tibetan Plateau." *Environ Res Let* 10 (2014): 104001.
4. Marambe, B. "Sri Lanka status report on sustainable nitrogen management." (2021).
5. Pimonenko, Tetyana, Oleksii Lyulyov, Olena Chygryn and Maksim Palienko. "Environmental performance index: Relation between social and economic welfare of the countries." *Environ Econ* 3 (2018): 1.
6. The Second national communication on climate change.
7. Myhre, Gunnar, Drew Shindell and Julia Pongratz. "Anthropogenic and natural radiative forcing." (2014): 659-740.

How to cite this article: Dharmasena, Punchi Bandage and Chandima Gunasena. "Development of a Strategic Plan to Reduce GHG Emission in Sri Lankan Agriculture." *J Environ Anal Toxicol* 14 (2024): 746.