



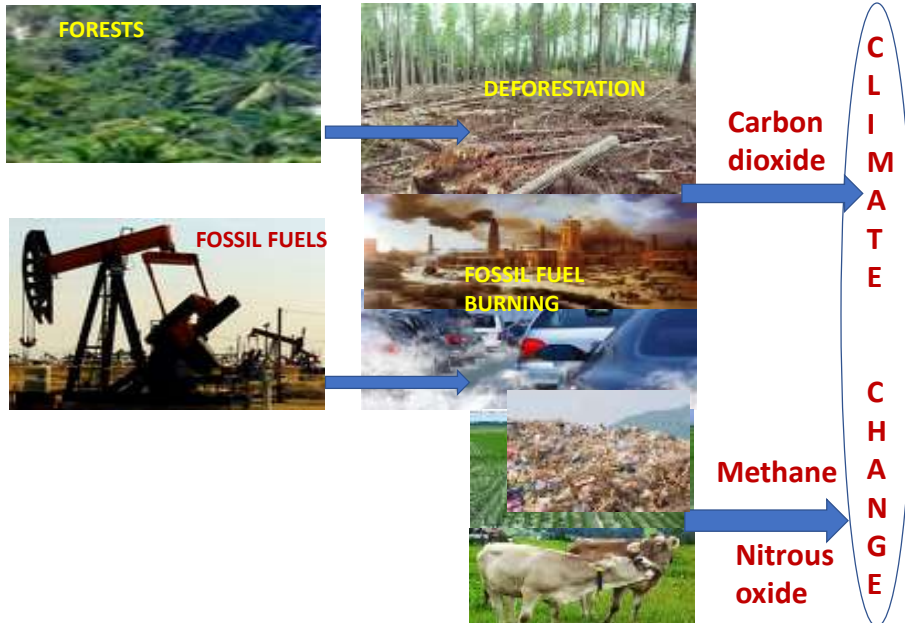
Opportunities available for the tea industry through climate change mitigation efforts

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Background

- Climate change means 'a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods' (UNFCCC, 1992)
- **Natural levels of greenhouse gases** in the atmosphere are important for life on earth
- Since industrial revolution we have increased the GHG emissions, mainly carbon dioxide (CO₂), causing **enhanced greenhouse effect**
- **Enhanced greenhouse effect** by us have led to **global warming (climate change)**

Enhanced greenhouse effect (global warming/ climate change) based on our activities since Industrial Revolution...

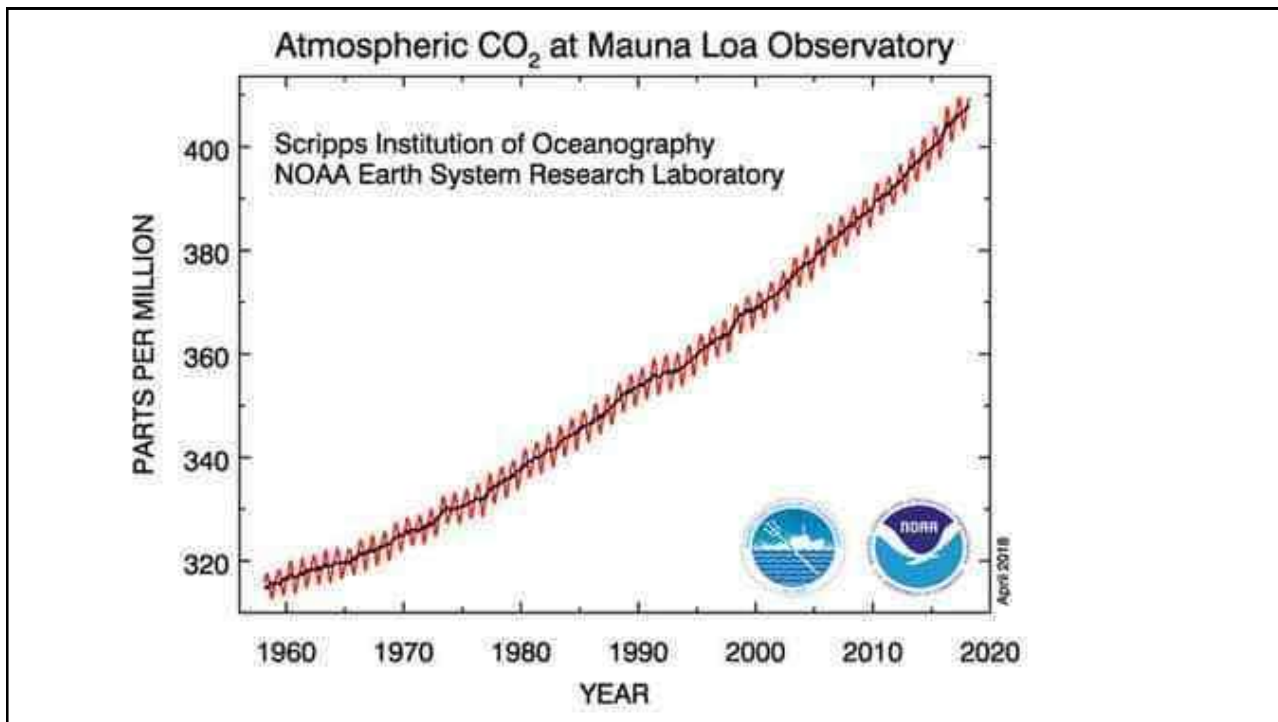


Carbon dioxide Concentration **x 2**

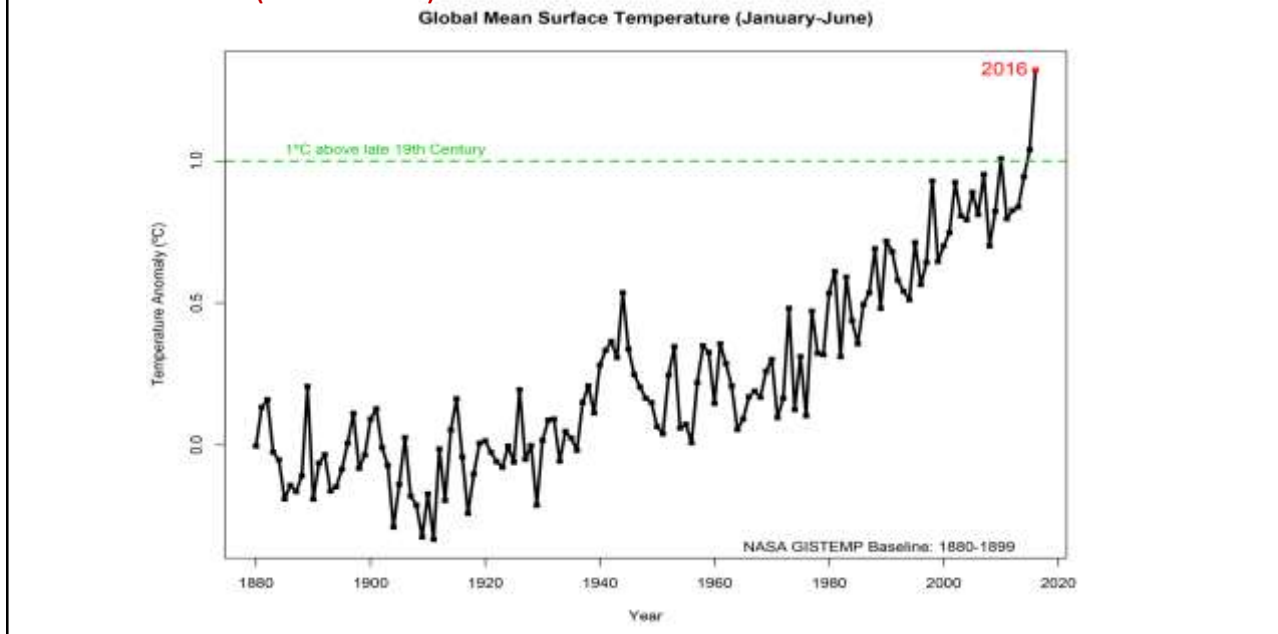


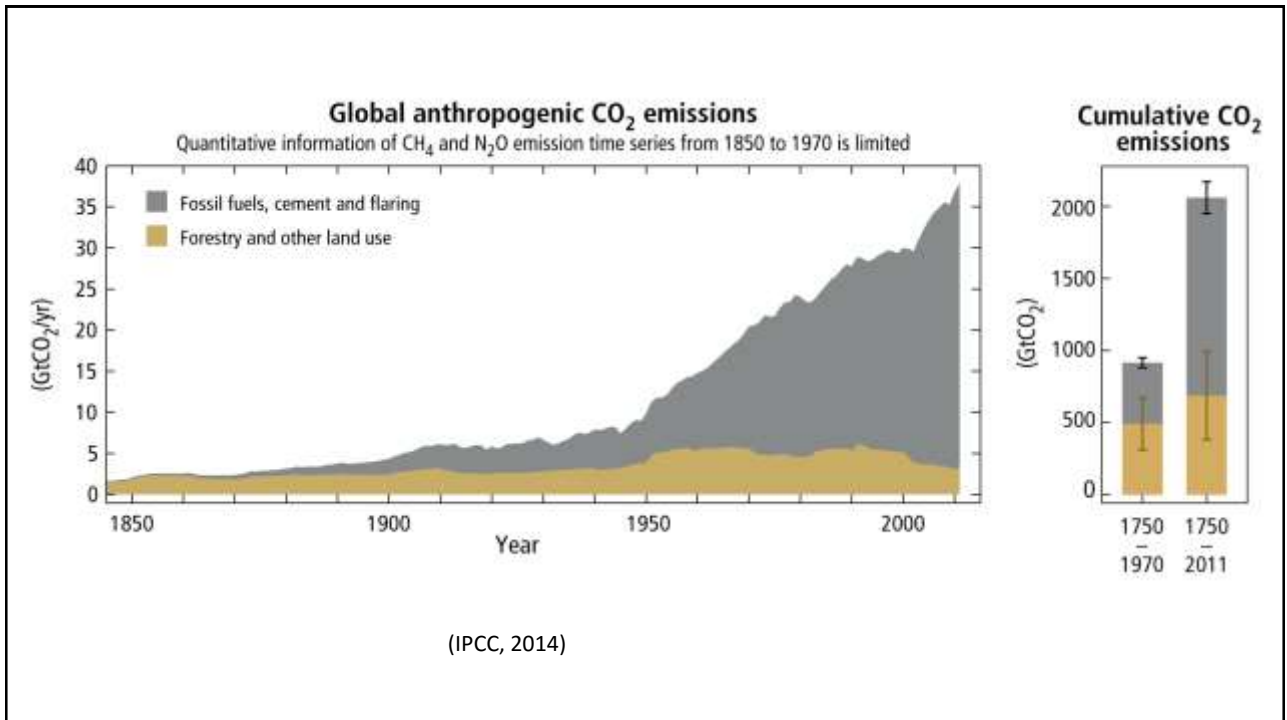
Global average temperature **+ 5 °C**

(Svante Arrhenius, 1896)



2016 was the warmest year since 1880 and current decade (since 2010) has been the warmest decade so far...

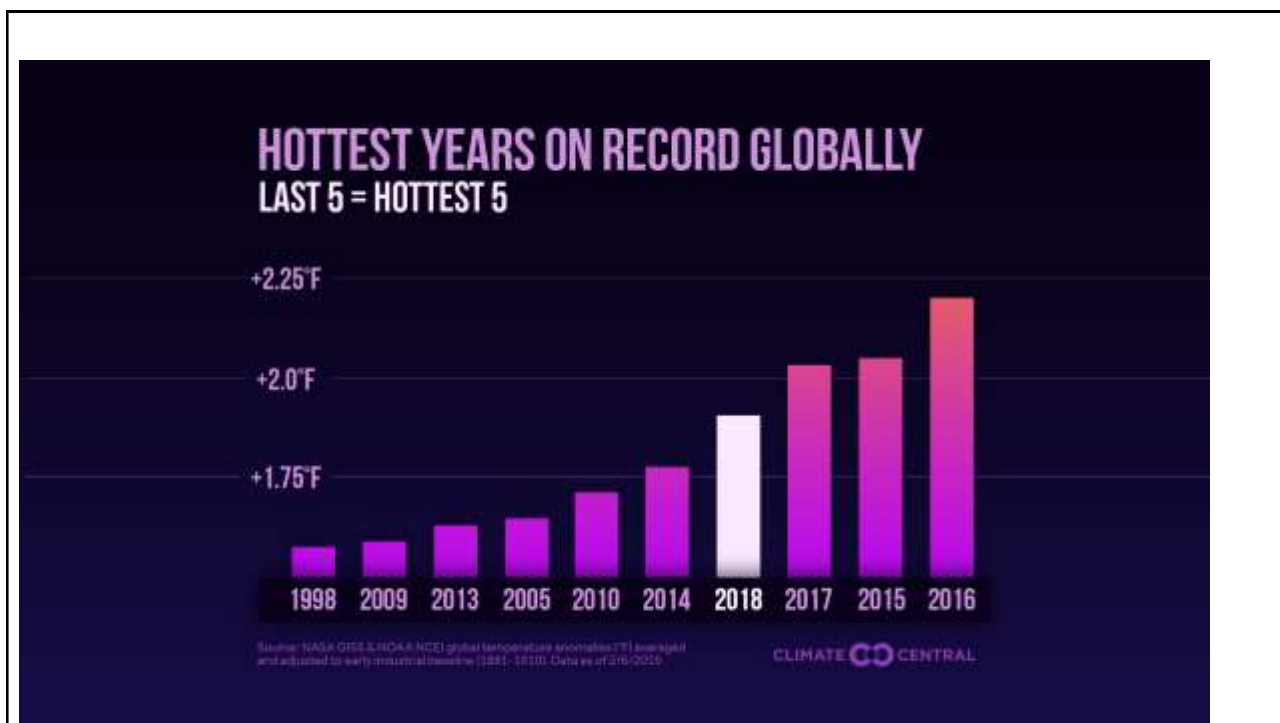
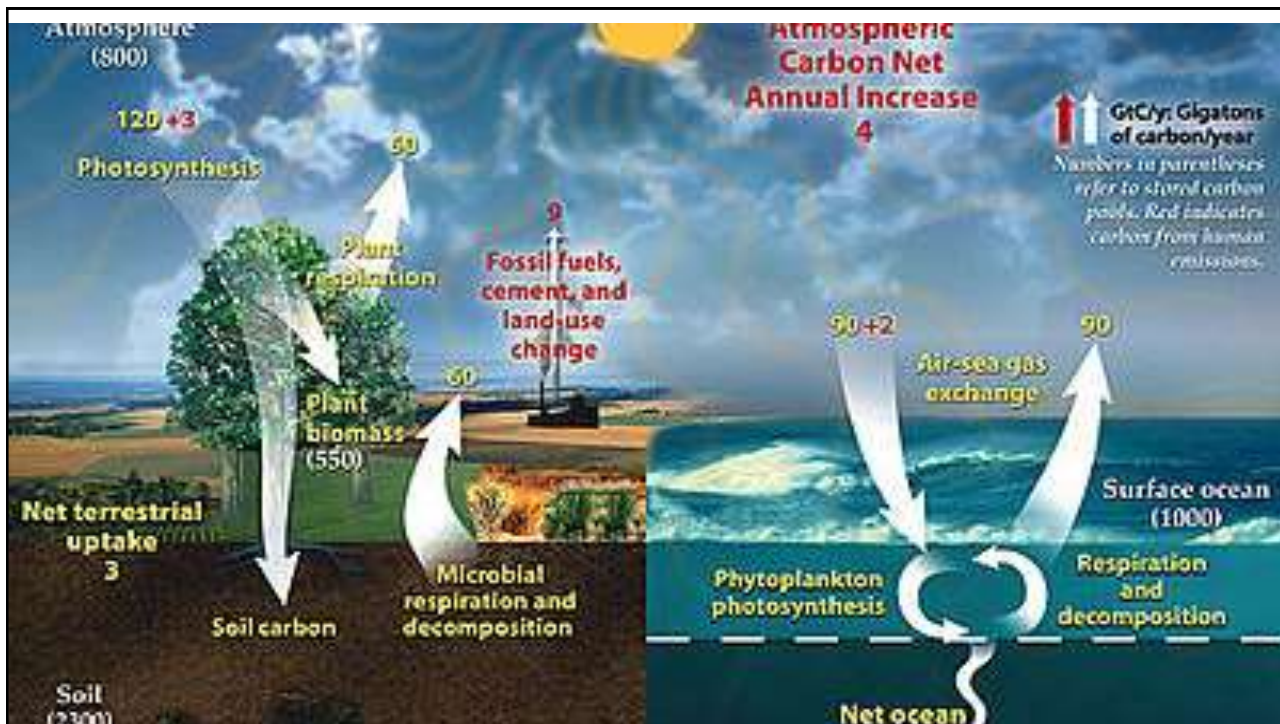




Objective of the United Nations Framework Convention on Climate Change (1992)

“ to **stabilize greenhouse gas concentrations in the atmosphere** at a level that would **prevent dangerous anthropogenic interference** with the **climate system**.

(UNFCCC, 1992)





Climate change induced disasters are costly..

- Sri Lanka has been ranked as **No 02** among the 10 most affected countries under the **global climate risk index**
- In Sri Lanka, annual losses (housing, roads, relief) due to disasters is Rs. 50 billion. - *World Bank*
- According to the sources of National Disaster Relief Services Center (NDRSC), over **RS. 9 billion** had been allocated by the government on **flood and drought relief and recovery** in 2018

Climate change and tea industry

- climate change has caused impacts on agriculture globally and locally, necessitating possible adaptation/mitigation strategies
- **Changes in temperature and rainfall have led to changes in plant growth and yield**, chemical changes leading to reduced flavor and health benefits of tea
- **Increased temperatures have caused more threat from pests** (>30 °C less favorable for tea growth and higher susceptibility to diseases/pests, crop damage and failure
- **drought can increase the vulnerability of tea plants to insect pests**
- **Heavy precipitation- Soil erosion and water logging affect the root growth and tea yield**
- **Dry and eroded soils and changes in the productive areas**

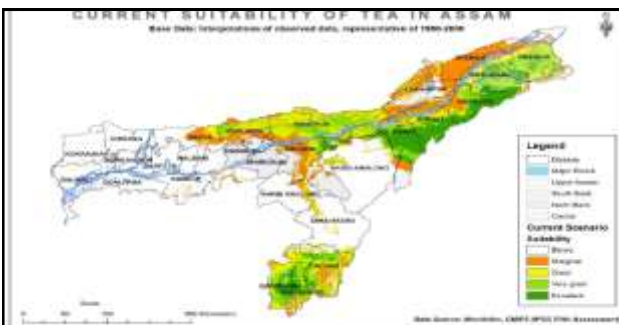
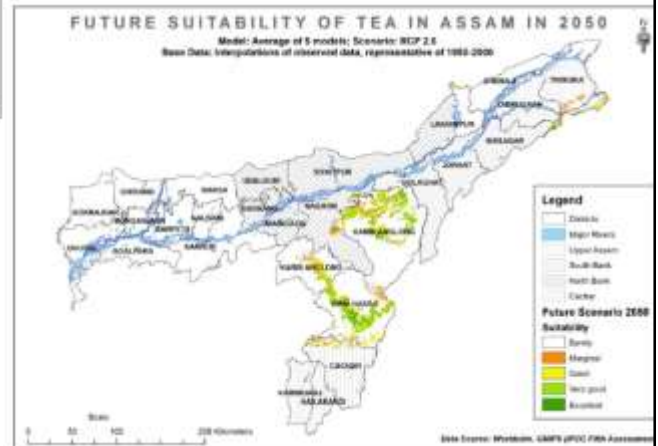


Figure 9 current tea growing areas of Assam

Climate modeling studies have predicted that several crops including tea will be greatly affected and production might disappear in some areas by 2050



(Source: Bhagat et al., 2016)

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Agricultural and Forest Meteorology

Volumes 272–273, 15 July 2019, Pages 102–117



Modeling the climate suitability of tea [*Camellia sinensis*(L.) O. Kuntze] in Sri Lanka in response to current and future climate change scenarios

Sadeeka Layomi Jayasinghe^{a, b}  , Lalit Kumar^a

Potential action in response to climate change

- **Adaptation**- To reduce the impact of climate change
- **Mitigation**- To reduce the sources (i.e. greenhouse gas emissions) of climate change

Adaptation measures in tea industry, which you already know..

- **Growing tea in association with agroforestry:** Crop diversification/intercropping with other trees (e.g. rubber, *gliricidia*)
 - shade, less evapotranspiration and soil erosion, and less damage to leaves from high heat (Seedling tea has better, more resilient root system in facing climate change)
- **Drought- and stress resistant varieties**
- **Mulching, cover crops, and other GAPs as adaptation** (soil conservation/management) measures
- **Increased organic matter would help soil conservation during drought periods and improved carbon sequestration**

Adaptation measures contd.

- Contour farming (crops or drainage ditches located along terraces) allows better percolation
- Other measures for preventing soil erosion
- Improved drainage and irrigation and overall climate-resilient infrastructure
- Organic farming with less nitrogen fertilizers



Mitigation measures (could be anywhere in the process..)



(Source: Dilmah)

Key milestones in climate change related global-level decision making

- UNFCCC (1992)

Common but differentiated responsibilities; heavier burden on industrialized nations in limiting their GHG emissions

- Kyoto Protocol (KP; 1997)

Commitment for developed countries for emission reduction (Emission reduction targets were set for each developed country)

- Paris Agreement (PA; 2015)

Universal and global commitment- Involves both developed and developing countries; Reaching the Paris goal is based on national-level action

Paris Agreement



- Goal (long-term): To hold the increase in global average temperature to **well below 2°C** (3.6°F) above pre-industrial levels
- Legally binding instrument applying to both developed and developing countries with equal commitment to all member countries
- National level Emission reduction plans to be developed by the member countries every 5 years

Opportunities through mitigation efforts:

Possible measurers/steps to be followed to minimize the GHG emissions
and
achieve carbon neutrality

- Process optimization
- Energy efficiency improvement
- Increasing the amount of renewable energy usage
- Other energy (and resource-) saving options
- Offsetting the remaining emissions through agroforestry

These measures might have higher initial costs but less operational costs and better gains/benefits over time

Process Optimization

Electricity usage can be reduced by using more efficient machines and technologies.

Potential process optimization options:

- Replacement of old machinery with new machines
- **Use of variable speed drives** (VSD; or variable frequency drives (VFDs)) for motors used for tea withering
- **Use of premium efficient motors which has efficiency level more than 92%** (e.g. in air-circulating fan of withering trough and Rotor vane rolling machine)
- Use of most suitable production strategy and appropriate production mix



Energy Efficiency Improvement

Energy efficiency can be further improved by minimizing any energy losses and improving process efficiency.

Potential energy efficiency improvement options include

- Minimization of machine breakdowns and machine idling
- Reduce air conditioning losses through leaking
- Use of energy efficient vehicle- and material handling equipment such as forklifts

Increment of share of Renewable Energy

Potential renewable energy projects are

- Day light and solar PV use for factory lighting
- Solar thermal energy use for water heating
- Hydro power generation (mini and micro level) and supply to national grid
- Solar powered air conditioning system for factory air conditioning
- Solar powered battery charging system for batteries used for forklifts

Other mitigation measures

- Optimized transportation plans (use of *bought* leaf vs. *estate-owned* leaf in processing plants) and overall minimization of the use of fossil fuels
- Recycling/upcycling- E.g. Biomass briquettes from tea waste (if we could save at least some part of the fuelwood use..)
- Reduction of moisture level in fuelwood used in tea drying
- **Carbon Offsetting through agroforestry:** Forest/perennial plantations for offsetting the remainder of the carbon

Kenyan tea factory switches to cleaner, greener briquettes



KENYAN TEA FACTORY SWITCHES TO CLEANER, GREENER BRIQUETTES

The Makomboki Tea Factory in Kenya is using briquettes, made from biomass byproducts, in its drying process, which will 'save' 60,000 trees each year.

Unlike most other factories which rely on firewood to process tea, the Makomboki Tea Factory feeds its boilers with briquettes of macadamia, cashew and rice husks mixed with

CLEANER ENERGY

Smoke-free briquettes for 12 tea factories

Project also to reduce firewood used by households in tea-producing areas with biomass briquettes

In Summary

- KTDA factories to use environmentally friendly energy to dry tea. Aims to achieve 30% reduction of firewood use in 12 pilot tea factories. This will save at least 156,500 trees, about 260 acres of forest plantation annually.
- Partnership with Rainforest Alliance to provide 50,000 households with cleaner energy to dry their tea.



SHARE:



Because tea factories use so much firewood for processing—estimated at 16000 tonnes of firewood per year—this project also aims to promote use of biomass briquettes for energy at the factory level as well. The Rainforest Alliance facilitated a biomass feasibility study for establishing a central biomass sourcing and briquette production facility (CPF) for tea factories. A CPF will make 11,000 tonnes of briquettes per year for use in 10 factories, displacing 30 percent of firewood use. Part of the CPF's proceeds will be set aside for community projects, such as scholarships for tea farmer's children. Currently the Rainforest Alliance is overseeing work with investors to mobilize finance for the CPF, which will also act as a hub to aggregate biomass for the briquette-producing centers in the communities (HECs). All told, the CPF, HECs, and biomass sourcing will create employment for 170 people (at least 30 percent women and youth).

Opportunities contd.

Becoming carbon neutral through mitigation-

- Better image and marketability for your product (i.e. tea)
- Saving of energy and costs with maximum resource use efficiency

BUSINESS TIMES

Bogawantalawa Tea set to become world's first Climate Positive plantation company

Views:

Bogawantalawa Tea Estates PLC (BTE), after becoming the first company in the world to secure Uncompensated Carbon Neutral certification for its tea growing, manufacturing and marketing processes, is now setting its sights on even more environmental achievements.

Dilmah is Carbon Neutral



Dilmah's journey towards becoming a Carbon Neutral facility began in 2011 following the completion of our first sustainability report carried out by the International Union for the Conservation of Nature (IUCN). This eventually led to a comprehensive analysis of Dilmah's carbon footprint being carried out by Dilmah Conservation together with the University of Colombo in 2013, resulting in the development of a Carbon Neutrality Action Plan which focused on four main areas: Energy, Transportation, Water and Waste. In addition, the plan included

Opportunities contd.

Involvement in Fair trade

- Fair trade organic tea: small-scale tea planters can be involved in this
- No chemical use (as fertilizers or pesticides) and complete organic farming
- Those farmers who are involved in fair trade get well recognized through certification by 'USDA organic (USA)' or EU organic label/s and many other labels to prove that their products are completely organic.
- Fair trade tea farmers need to respect and be concerned about the well-being of their laborers.
- The farmers are paid a reasonable price (i.e. US\$ 2 per 1 kg of **organic green tea leaf**), the internationally recognized fair trade price for **Ceylon Tea**
E.g. Bio foods (organic farming and fair trade)

- The producers certified under Fairtrade commit themselves **to meet environmental standards that protect the ecosystem.**
- **Farmers minimize the use of agrochemicals, protect watersheds through waste and water management, with no use of GMO seeds**
- Fair trade farmers **support local biodiversity through having buffer zones between fields and ecologically sensitive areas**, and it is prohibited to cut down primary forests for cultivation.
- **Fairtrade also encourages farmers to become organic by offering a higher Fairtrade Premium to those who are certified.**
- It promotes agroforestry



Fair trade carbon credit scheme for coffee

“Yet another broad initiative aimed at addressing the effects climate change in the coffee sector was brought to light at COP21 by Fairtrade International: Fairtrade Carbon Credits. The carbon credits program follows the Fairtrade Climate Standard, introduced in October and developed in coordination with The Gold Standard, a Switzerland-based third-party certifier specializing in accountability for greenhouse emissions projects and climate-related funding.

In short, each Fairtrade Carbon Credit represents one less ton of carbon dioxide entering the atmosphere. Organizations or individuals of any kind can purchase credits to support their own carbon-neutrality goals, while Fairtrade, The Gold Standard and project partners work with participating coffee producers to enact simple solutions in renewable energy (e.g. solar, wind), energy efficiency (e.g. improved cookstoves, water filtration) and agroforestry (e.g. shade trees, replanting deforested areas).”

(Brown, 2015)

Rain forest Alliance certified tea

- Rainforest Alliance's Sustainable Agriculture Standard promotes climate-smart agriculture
- "Rainforest Alliance Certified farms use methods that protect the health of farmers, their livelihoods, their land and the surrounding waterways. Through our training and certification programs, we are promoting farming techniques designed to protect the land for future generations." - *Rain Forest Alliance*
- integrated farm-planning and -management system, ensuring continuous improvement towards sustainable agriculture
- Biodiversity conservation
- Natural resource conservation
- Improved livelihoods and human well-being
- May also include sustainable cattle production



Paris Agreement



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Agriculture-sector NDCs of Sri Lanka

- Promote / Introduce develop IPM practices to minimize pest damages to improve environmental impacts and health
- Develop/ Introduce varieties resistant/tolerant to biotic and abiotic stresses arising from climate change
- Develop/ Introduce varieties resistant/tolerant to biotic and abiotic stresses arising from climate change
- Introduce suitable land and water management practices for Central Highland and other marginal areas to minimize land degradation and to improve the land and water productivity

More climate change related opportunities based on the goals under PA

Global Climate funding is available from

- GEF : global environment facility
- GCF: Green Climate Fund
- CTCN: Climate Technology Centre and Network (small /seed grants)
- Japanese Joint Crediting mechanism (JCM): arrangements are being made to have a bilateral agreement with Japanese and Sri Lankan governments for clean technologies
- EU funding for industry sector GHG emission reduction and achieve NDC targets
- World Bank climate change / loss and damage financing for mitigation and adaptation

On going activities by Climate Change Secretariat (CCS):

- NDCs will be revised with agriculture sector mitigation targets
- Sri Lanka Carbon Crediting scheme (SLCCS) will be strengthened for globally accepted carbon credits (as a component of world bank Partnership for market readiness (PMR) project; Local project known as **Climate Mitigation Action Support** project)
- Agriculture Sector: Capacity Building Initiatives for Transparency(CBIT) project for MRV (funded through FAO)

Opportunities through mitigation efforts contd.

- Research opportunities

Environmental Development 26 (2018) 43–54



Energy usage and greenhouse gas emissions associated with tea and rubber manufacturing processes in Sri Lanka

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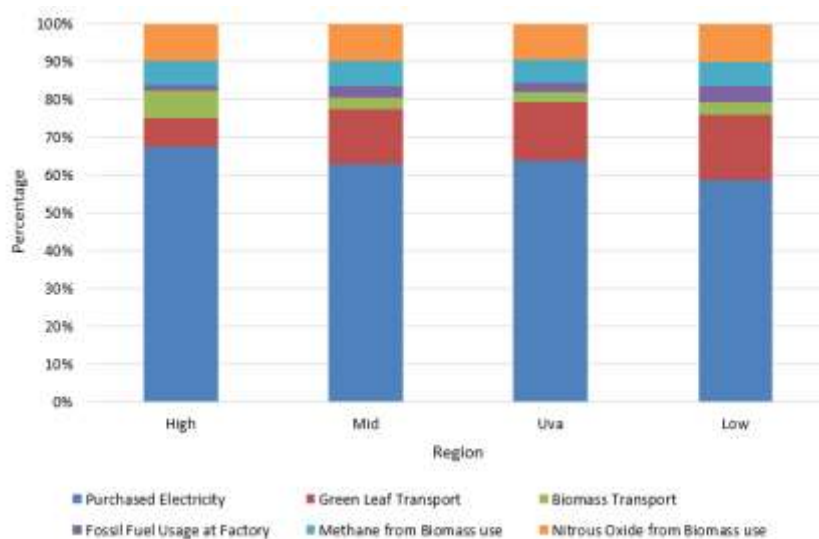
Keywords:

Tea
Rubber
Energy
Greenhouse gas

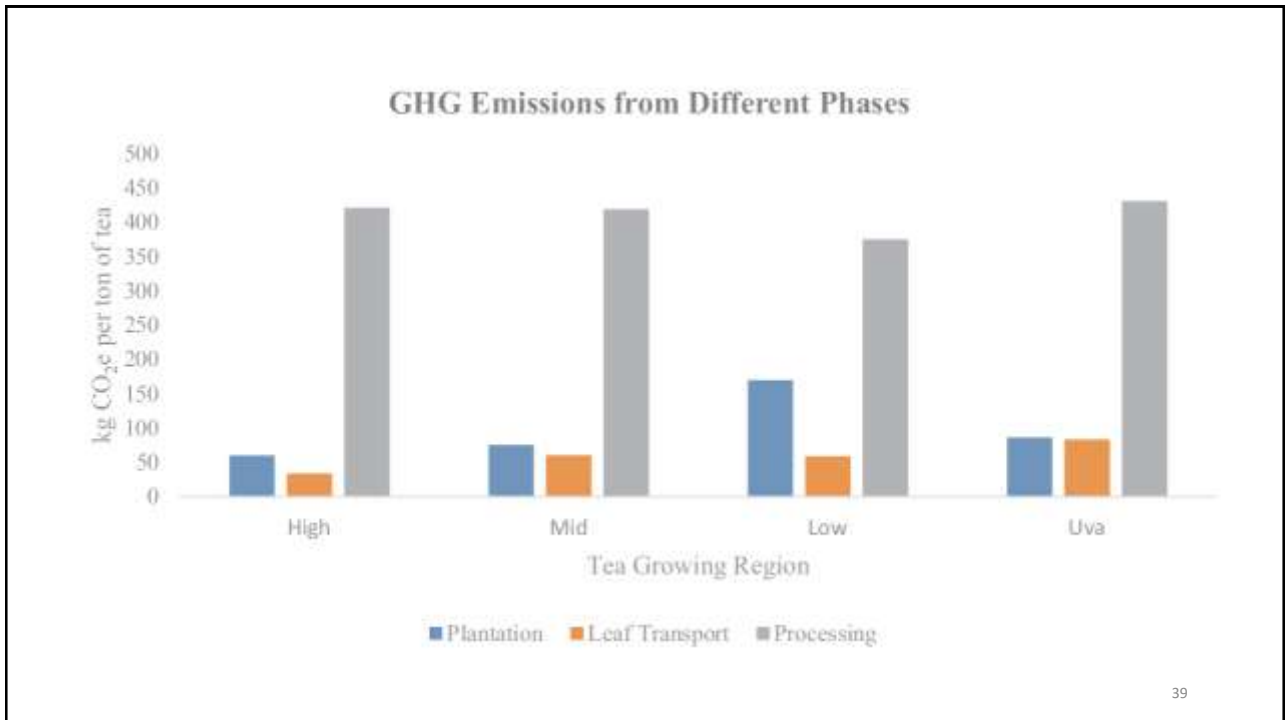
ABSTRACT

The objective of this study was to analyze the greenhouse gas (GHG) emissions associated with energy usage in tea and rubber industries in Sri Lanka. The scope of the study covered GHG inventory analysis of carbon dioxide, methane and nitrous oxide emissions associated with tea and rubber products, considering a life cycle approach starting from the plantations to the

GHG Emissions from Different Sources in Tea processing



Source: Vidanagama & Lokupitiya, 2016



Summary

- Climate change mitigation could play an important role in carbon (and overall GHG) management and it will help having a better sustained tea industry
- A proper carbon crediting scheme targeting the achievement of NDC's is under way
- Still there are untapped opportunities and benefits available for plantation industry including tea smallholders, when there is a need for achieving NDC's under Paris Agreement
- Overall, mitigation measures will help reduce the contribution of the tea industry towards climate change, better efficient production, while yielding better health- and other (short-term and long-term) cost saving benefits