Caribbean Academy of Sciences 2025
Bridging Science, Technology and Society:
Advancing the SDGs through Research, Innovation, and Action

ABSTRACTS

Theme 1 - Innovative Research for Sustainable and Resilient Futures

CAS25 004

From Waste to Value: Development of Edible Films from Chenet Shell (*Melicoccus bijugatis*) Pectin

Che John[1]* and Rohanie Maharaj[1]
[1]Food Science and Technology Unit, Department of Chemical Engineering, The University of the West Indies, St. Augustine Campus.

Abstract
The development of edible films and coatings from natural biopolymers has gained global attention as a sustainable alternative to conventional plastic-based food packaging. These films, particularly when infused with bioactive compounds, have been shown to enhance food preservation by providing antimicrobial and antioxidant properties. However, to this date, limited research in this area within the Caribbean has left the region reliant on outdated and unsustainable food packaging methods.
This study reports, for the first time, the extraction of pectin from *Melicoccus bijugatus* (chenet) shell waste and its use in fabricating bioactive edible films. Pectin was first retrieved from the shell waste through conventional hot-acid extraction and then used to formulate films comprising of 5% pectin, 30% glycerol (v/w pectin), and varying concentrations (0.5-1.5%) of nano-emulsified West Indian Bay leaf (*Pimenta racemosa*) essential oil. FTIR analysis indicated good compatibility between the essential oil and the film matrix. The nano-emulsion-infused films (NE-films) exhibited increased thickness and reduced transparency compared to the control (0% oil).

Furthermore, due to the hydrophobic nature of the oil, the NE films displayed reduced water vapor transmission rates, solubility, and moisture content compared to the control. Although the NE-films showed higher oxygen permeability than the control, they demonstrated significantly enhanced antioxidant activity, with DPPH radical scavenging rates ranging from 58% to 77%, compared to 25% for the control.
These findings demonstrate the feasibility of repurposing *Melicoccus bijugatus* shell waste into sustainable, bioactive films suitable for food packaging applications. Moreover, the valorization of *Melicoccus bijugatus* shells supports a circular economic model for food waste management, aligning with Goal 12 of the United Nations Sustainable Development Goals. These encouraging findings also underscore both the importance and the need for further, similar research within the Caribbean as it pertains to the regional advancement of sustainable food packaging technologies.

Keywords: *Melicoccus bijugatus*, chenet, pectin, edible film, *Pimenta racemosa*, essential oil

CAS25 006

Calcium Alginate Bioplastics from *Sargassum* for a Sustainable Future: Advancing Circular Economy Solutions in the Caribbean

Akeem Mohammed[a], Keeran Ward[b]
[a]Department of Chemical Engineering, The University of West Indies St. Augustine, Trinidad and Tobago
[b]School of Chemical and Process Engineering (SCAPE), University of Leeds, Leeds, LS2 9JT, United Kingdom

Abstract

The persistent influx of *Sargassum natans* onto Caribbean coastlines since 2011 has created significant ecological and socio-economic challenges, including waste accumulation, habitat disruption, and negative impacts on tourism and fisheries. In this work, we investigate the valorization of this invasive biomass as a sustainable feedstock for producing alginate-based bioplastics, offering a dual benefit of mitigating coastal pollution while developing bio-based alternatives to petroleum-derived plastics. Multistage extraction and precipitation were used to enhance the yield and purity of alginate compared to conventional single-stage methods, which yielded 17% with a 71% purity. By employing Response Surface Methodology (RSM) in combination with multistage extraction, the process was optimized and conditions validated, yielding 28% with 92% purity, among the highest reported for *Sargassum*. Process optimization revealed that temperature and time were the most critical factors influencing extraction efficiency, with optimal conditions of 80 °C, 12.63 mL/g Na_2CO_3 (3.75% w/v), and 6 h reaction time. Bioplastics fabricated from pure *Sargassum* exhibited subpar properties, limiting their practical applications. Thus, composite technology was employed and optimized composite films were formulated with plasticizers (sorbitol, PEG-200) and reinforcement agents (starch, carboxymethyl cellulose). Using a central composite design (CCD), the composite properties were optimized to

achieve favorable mechanical and barrier characteristics, including tensile modulus values up to 3.93 GPa, ultra-low oxygen permeability (0.2 cm^3 µm m^{-2} d^{-1} kPa^{-1}), and good water vapor transmission (2.18 × 10^{-12} g m/m^2 s Pa). The optimized prototype demonstrated biodegradability within 14 days and performance metrics comparable to polylactic acid (PLA) and polyethylene terephthalate (PET), highlighting its potential suitability for food packaging applications. Finally, a process flowsheet was developed integrating heat and mass balances, demonstrating feasibility for scale-up. This study illustrates how *Sargassum* valorization can contribute to the circular economy in the Caribbean and support the transition toward sustainable bioplastic industries aligned with the United Nations Sustainable Development Goals (UNSDGs).

Keywords: Calcium Alginate, Bioplastics, Alginate, *Sargassum natans,* Plastic Pollution

CAS25 009

Microplastic Pollution in Tilapia (*Oreochromis mossambicus*), Water, and Sediments from a Fish farm and Trench at No. 19 Road, Guyana

Usha Dalloo*, BSc., Faculty of Natural Science, University of Guyana, Berbice Campus | (Email: usha.dalloo@uog.edu.gy)

Maria A. Fraser, MSc., Institute for Marine and Riverine Ecologies and Economies, University of Guyana, Berbice Campus | (Email: maria.fraser@uog.edu.gy)

Phillip N.B. DaSilva, BSc., Advanced Diploma, MSc., Med., Institute for Marine and Riverine Ecologies and Economies, University of Guyana, Berbice Campus | (Email: phillip.dasilva@uog.edu.gy)

Darius Ramotar, MSc., Faculty of Natural Science, University of Guyana, Berbice Campus | (Email: dariusramotar@gmail.com)

Asaad Abdool, MSc., Faculty of Natural Science, University of Guyana, Berbice Campus | (Email: asaadabdool22@gmail.com)

Abstract

The presence of microplastics in edible freshwater fish tissues from Guyana remains largely unexplored. This study aimed to assess the occurrence of microplastics in environmental samples (water and sediments), and tissues of *Oreochromis mossambicus* (tilapia), comparing specimens from a fish farm and wild caught counterparts from an open trench at Borlam, No. 19 Road, Corentyne-Berbice, Guyana. Microplastics were extracted from tilapia tissues, sediment and water using potassium hydroxide (KOH) digestion, followed by density separation and vacuum filtration. Recovered particles were identified by microscopic examination and quantified statistically. A total of 68 microplastic particles were recovered from 18 specimens of *O. mossambicus*, with

farmed fish exhibiting a higher average (8.83 ± 15.68 particles/individual). Environmental samples yielded 61 microplastic particles, averaging 7.7 ± 8.3 particles/L and 8.7 ± 3.8 particles/L, in water from the fish farm and trench, respectively, and an average of 2.3 ± 4.0 particles/g and 1.7 ± 1.2 particles/g in the sediment. Morphological analysis revealed blue and black-colored fibers as predominant in all samples. No statistically significant differences were observed in the abundance of microplastics between farmed and wild fish, or between water and sediment samples from the two environments. The study was limited to one species and location, with particle identification based solely on microscopy, thus, further research to access the spectroscopic properties of particles over a larger geographic range can be done. Overall, these findings highlight the ingestion and accumulation of microplastics in tilapia, and its environment, raising concerns about their potential impacts on aquatic ecosystems, aquaculture sustainability, and human health through fish consumption. As the first known study to document microplastic contamination in tilapia and associated environments in Guyana, providing baseline data to support regional research, policy, and public awareness.

Keywords: **Microplastic, bioaccumulation, aquaculture, pollution, anthropogenic activities, Tilapia (*Oreochromis mossambicus).***

CAS25 019

Strengthening health resilience, monitoring, and FAIR management of biological data in Guadeloupe

David Couvin, Wilfried Segretier, Erick Stattner, Anne-Sophie Allaguy, Stéphane Cholet, Emmanuel Biabiany, Nalin Rastogi

Laboratoire de Mathématiques Informatique et Applications (LAMIA), Université des Antilles, Pointe-à-Pitre, Guadeloupe, France

Tuberculosis and Mycobacteria Unit, Institut Pasteur de la Guadeloupe, Abymes, Guadeloupe, France

Abstract

This study aims to explore how recent advances in bioinformatics and artificial intelligence (AI) can be adapted to strengthen health and environmental resilience in Guadeloupe and the wider Caribbean. Building on machine learning (ML) and other AI methodologies, we propose integrative software tools and frameworks to advance Sustainable Development Goals (SDGs), particularly SDG 3 (Good Health and Well-Being) and SDG 9 (Industry, Innovation, and Infrastructure). In this regard, we intend to provide effective capacity building and consolidate the work that has been started with members of the KaruBioNet network (Couvin et al. 2022). The approach synthesizes two complementary domains: (i) bioinformatics and ML/AI developments for integrative disease prediction and (ii) FAIR (Findable, Accessible, Interoperable, Reusable) data architectures for biomedical and environmental datasets following the “One Health” approach. Emphasis is placed on open data practices and AI-enabled early

warning/prediction for infectious diseases. Several algorithms were used to classify data, such as decision trees (DT), support vector machines (SVM), k-Nearest Neighbors (k-NN), Naive Bayes and neural networks.
The integration of FAIR data with ML/AI models enhances prediction accuracy, interoperability, and reproducibility. For Guadeloupe, the framework demonstrates potential to (a) improve surveillance of various infectious diseases and (b) support personalized characterization of diseases. A concrete example of application is the classification of *Mycobacterium tuberculosis* lineages from whole genome sequencing (WGS) data (Segretier et al. 2024).
This work is original in adapting cutting-edge computational biology and data infrastructure approaches. It bridges science, technology, and society by demonstrating how bioinformatics and AI can directly contribute to sustainable development in small islands. The paper provides a pathway for resource-efficient innovation, ensuring that scientific advances translate into actionable health strategies for Guadeloupe.

Keywords: Bioinformatics; Artificial Intelligence; FAIR data; Sustainable Development Goals; Guadeloupe; Caribbean

CAS25 022

Molecular Insights into Salinity Tolerance in Rice Genotypes (*Oryza sativa* L.): A Comprehensive Review with a Focus on Guyana's Role in Developing Salt-Tolerant Varieties

Bissessar Persaud
Lecturer
University of Guyana

Abstract

Salinity stress is a major abiotic factor limiting rice (*Oryza sativa* L.) productivity worldwide, particularly in coastal and arid regions. As global climate change exacerbates soil salinization, the development of salt-tolerant rice cultivars has become a critical goal in sustainable agriculture. This review provides a comprehensive analysis of recent advances in identifying and characterizing the molecular basis of salinity tolerance in diverse rice genotypes and the role Guyana plays in developing salt-tolerant rice genotypes. Traditional screening methods, including phenotypic evaluations under saline conditions, have facilitated the classification of genotypes based on tolerance levels. However, the integration of molecular tools, such as quantitative trait locus (QTL) mapping, has significantly enhanced the understanding of the genetic architecture underlying salinity tolerance. The researcher is PhD candidate at the University of Guyana and is working currently in collaboration with the Guyana Rice Development Board to identify rice genotypes with tolerance to salinity at 0ppm (T1), 500ppm (T2), 1000ppm (T3), and 1500ppm T4), analyze genetic diversity among rice genotypes in relation to salt tolerance using molecular

markers, analyze biochemical characterization of the salt tolerance genotypes and to determine the growth, yield, and yield attributes of the salt tolerance genotypes. For the first cropping season of 2025, a total of 100 rice genotypes were selected and evaluated with the four salinity treatments mentioned above under screen house conditions, where the experiment was replicated three times using a split-plot design. The germination test was completed, and the main result indicated that there were no significant differences in the rate of germination among the 100 rice genotypes under the various treatments. At the tillering and grain filling stage in treatment 4, there were significant differences among the 100 rice genotypes.

Keywords: Rice, salinity tolerance, genotypes, QTL mapping, gene expression, molecular markers, germination, abiotic stress

CAS25 023

Waterproof Cutin Chitosan Composite Coated Paper Packaging from Leaf Biomass

*Farrah Bridget Mathura, Rohanie Maharaj, Sarah Rachel Mathura

University of the West Indies, St. Augustine Campus

Abstract

Paper packaging is increasingly being used to replace single use plastics. However, there are growing environmental concerns associated with synthetic plastic coatings for paper packaging, particularly poly- and perfluoroalkyl-based polymers (PFAs), which are non-biodegradable. The study aimed to optimize the additive composition of paper packaging from leaves and develop a biodegradable, waterproof coating for the paper packaging using a cutin-chitosan composite.

A Box-Behnken Design was employed to determine the response surface methodology for optimizing tear strength for different combinations of starch, calcium carbonate and silica. Cutin was extracted from leaf biomass using a solvent-free, environmentally friendly approach. A cutin-chitosan composite was produced and the mechanical, optical, and water-resistant properties of the coated paper were assessed through tear strength tests, FT-IR, TLC, MS, XRD, and SEM. Additionally, the study examined the biodegradability of the cutin-chitosan-coated paper.

The paper with the 0.008% starch: 0.005% calcium carbonate: 0.005% silica paper had the highest mechanical strength properties. Chemical analyses confirmed the purity of cutin, and SEM imaging revealed a smooth topography. The cutin-chitosan composite had exceptional waterproof and mechanical strength properties, with a tensile strength of 60 N and completely biodegraded after one month. The novel contributions of this research are the low-cost, green

extraction of cellulose and cutin from leaves that were not previously studied, for value added paper packaging.
The scale of production from laboratory to industry needs larger equipment to lead to commercialization in a pilot plant.
Paper packaging with additives and biodegradable coatings form an environmentally safe alternative to single use plastics, notably for packaging where the lifespan can be as short as a few seconds. This is a circular bioeconomy approach for waste foliage.

Keywords: cutin; chitosan; Box-Behnken Design; biodegradable; waterproof; paper packaging

CAS25 026

Energy Forecasting and Energy Poverty using Machine Learning Techniques for regions within the Caribbean

Sarah Balkissoon[1,2] *, David A. Farrell[1], Neil Fox[2], Anthony Lupo[2], Sue Ellen Haupt [3], and Stephen G. Penny[4,5]
[1]Caribbean Institute for Meteorology and Hydrology, Bridgetown, Barbados
[2]Atmospheric Science Program, School of Natural Resources, University of Missouri, USA
[3]Research Applications Lab, NSF National Center for Atmospheric Research, Boulder, Colorado, USA
[4]Sofar Ocean, San Francisco, California, USA
[5]Cooperative Institute for Research in Environmental Sciences, Boulder, Colorado, USA
sbalkissoon@cimh.edu.bb
sarahsharlenebalkissoon@mail.missouri.edu

Abstract

Regression Problem

Tall tower wind speeds in Ragged Point, Barbados, were analyzed in study (1) to determine the forecast ability of Transformer Neural Network (NN) and the Long Short-Term Memory Network (LSTM) in this regression problem. These predictions were compared to a benchmark classical statistical method of Autoregressive Integrated Moving Average (ARIMA). The model's predictive system was multi-step using a sliding window approach where the input and output generated pairs of input sequence length or window size and output sequence length or forecast horizon were slide or shifted one element down. These models, which were constructed using PyTorch, consisted of hyperparameter tuning using a Random Search, as well as it utilized a Learning Rate scheduler and Early Stopping Implementations. It was determined that the LSTM outperformed the Transformer NN. However, when compared with the benchmark, the ARIMA incurred more errors when tested at the higher window size of 360 minutes for the largest evaluated forecast horizon of

30 minutes. This is an extension of forecast methods used in [1] for the tropical region of Barbados with changes to the models' infrastructure and forecasting architecture.

Classification Problem

Socio-economic data inclusive of energy expenditure and income are to be used in this study (2) of territories within the Caribbean region. A four-quadrant grid approach is to be utilized to determine the poverty classes of no risk, high risk, income risk and expenditure risk in keeping with the study, [2], done in the Mid-West, USA. Machine Learning will then be utilized to predict these energy poverty classes. These techniques are not restricted to Decision Trees, Random Forest, Extreme Gradient Boosting (XGB) and Support Vector Machine (SVM). The accuracy and thus predictability of these models will be analyzed to determine which is the most efficient for classification of these Caribbean datasets.

References:

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Keywords: Transformer Neural Networks, LSTMs, Moving ARIMA, Energy Poverty, Decision Tree, Random Forest, Extreme Gradient Boosting (XGB), Support Vector Machine (SVM)

CAS25 027

Orbital Trap Mass Spectrometry Combined with Molecular Modelling as a Fast Track for Drug Discovery within the Caribbean Hotspot of Molecular Endemism

Sonia Peter, Ph.D.; Director Biocultural Education and Research Platform, Andromeda Botanic Gardens, St. Joseph, Barbados; berp.speter@gmail.com

Abstract

The Caribbean has been identified as a hotspot of biodiversity with an estimated 72 % endemism among approximately 11,000 plant species and 182 genera. Taking into consideration the metabolomics of the endemic species, it is anticipated that the Caribbean hotspot is also a site of molecular endemism. These unique molecules biosynthesized via enzyme-controlled pathways,

including shikimate and polyketide, would exhibit diverse bioactive properties in the form of secondary metabolites including alkaloids, flavonoids, phenolics and terpenoids. This degree of molecular endemism should be defined and explored for potential therapeutic value by utilizing modern technologies accessible to island economies. In modelling species from the Lamiaceae family, Orbital Trap MS2 Spectrometry, followed by the application of the Schrodinger Suite for molecular modelling, led to the identification of flavonoids and glycosides with activity against the COVID 19 virus. Both novel and known compounds, including flavonoids and flavonoid glycoside quercetin, luteolin and rutin, were characterized from the acquired spectra. One known glycoside was shown to hinder proteins that regulate the replication of the COVID 19 virus, with more exothermic binding energies than the standard Remdesivir. This model paves the way for guided exploration of Caribbean plant biodiversity to reveal bioactive endemic therapeutics without the high input costs associated with extensive bench experimentation. This could prove to be invaluable in the management of the health burden associated with the occurrence of NCDs in the region.

Key Words: **Biodiversity, Secondary metabolites, Bioactive properties, Novel therapeutics**

CAS25 032

Expansive Soil Hazards and Sustainable Development: A Framework for Infrastructure Resilience in the Caribbean

Zaffir Mohammed1, *, Gregory Gouveia2 and Ricardo Clarke1
1Department of Physics, Faculty of Science and Technology, The University of the West Indies, St. Augustine Campus, Trinidad and Tobago
2Department of Food Production, Faculty of Food and Agriculture, The University of the West Indies, St. Augustine Campus, Trinidad and Tobago
*Corresponding author: Zaffir Mohammed, Zaffir.Mohammed1@my.uwi.edu

Soil-related hazards currently stand as an under-recognised barrier for achieving sustainable infrastructure development in the Caribbean. Expansive soils, a hidden geotechnical disaster that threatens infrastructure stability, are soils that undergo significant volume change due to fluctuations in moisture content, which is exacerbated by the local tropical climate. These soils cause widespread damage to buildings, roads, pavements, and other critical infrastructure, placing significant financial strain on communities. This study aims to develop a soil expansion map, which can be integrated into planning processes, thereby reducing infrastructure vulnerability and advancing the Sustainable Development Goals (SDGs 9, 11, and 13). A total of 100 soil samples were collected from Trinidad and were tested based on standard geotechnical properties along with the free swell index, which is a simple and low-cost method for assessing soil swelling potential. This data was used in conjunction with spatial interpolation using inverse distance weighting (IDW) in GIS to generate an expansive soil map. The approach provides an accessible decision-support tool for engineers, planners, and policymakers, bridging scientific data with societal needs. Results revealed critical areas vulnerable to infrastructure damage,

particularly in the central and southern regions of Trinidad. These findings demonstrate the feasibility of integrating low-cost laboratory testing with spatial modelling to identify high-risk areas at early stages of project planning. This work provides an integrated framework for expansive soil risk assessment in Trinidad, demonstrating how geoscience can be mobilised for sustainable development. Beyond the technical findings, this research offers a practical decision-support tool which can be incorporated into policy, land-use planning, and infrastructure design to reduce disaster risk, strengthen resilience, and progress towards SDG 9 (resilient infrastructure), SDG 11 (sustainable cities), and SDG 13 (climate action).

Keywords: Expansive soils, infrastructure resilience, risk mapping, Caribbean, sustainable development

CAS25 033

From Land to Reef: Detecting Nutrient Pollutio Caged using Macroalgae in Guadeloupe (Lesser Antilles)

De la tierra al arrecife: detección de la contaminación por nutrientes mediante el método de encajonamiento de macroalgas en Guadalupe (Pequeñas Antillas)

De la terre au récif: détection de la pollution en nutriments par la méthode d'encagement de macroalgues en Guadeloupe (Petites Antilles)

Hanna-May Mahalel[1], Laurine D'Herbomez[1], Pascal Claquin[2], Charlotte R. Ddromard[1]
[1]Laboratoire de Biologie des Organismes et des Ecosystèmes Aquatiques (BOREA), Université des Antilles - MNHN - CNRS 8067 - SU - IRD 207, Laboratoire d'Excellence "CORAIL", 97157 Pointeà-Pitre, Guadeloupe
[2]Marine Ecosystems and oRganisms reSEArch Lab (MERSEA) UR 7482, Centre de Recherche en Environnement Côtier, Station Marine - Université de Caen, Normandie BP49, 54, rue du Docteur Charcot, 14530 Luc-sur-Mer, France

The bay of Petit Cul-de-Sac Marin (PCSM), located on the southern coast of Guadeloupe, harbors a variety of marine habitats, including coral reefs that hold major ecological and economic value. Yet, these ecosystems face mounting pressure from land-based activities such as urban development, agriculture, port operations, and wastewater discharge. These inputs of nutrient-rich effluents drive habitat degradation and favor algal proliferation, a process leading to coral-algal phase-shift. This study aimed to map coastal discharge points within the PCSM, and to evaluate the level of nutrient pollution using caged macroalgae as bioindicators. Two macroalgae, *Dictyota sp*. (Ochrophyta) and *Tricleocarpa fragilis* (Rhodophyta), were transplanted from a reference site to six stations subject to varying levels of anthropogenic impacts and stayed exposed for ten days at each site. Following deployment, algal tissues were analyzed for nitrogen and carbon isotopic signatures (∂^{15}N, ∂^{13}C), elemental composition (%C,

%N), and biochemical content (proteins, lipids, carbohydrates). In parallel, seawater sampling provided nutrient concentrations (nitrates, nitrites, ammonium, phosphorus).
Between the two algae tested, *Dictyota sp*. emerged as the most reliable bioindicator. The $\partial^{15}N$ values ranged from 1.5‰ at the control site to 3.8‰ near industrial and wastewater discharge zones, pointing to moderate but spatially heterogeneous nitrogen enrichment across the bay. Overall, this caging method offers a practical, low-cost biomonitoring tool to track land-sea nutrient transfers and provides a basis for improving management strategies aimed at reducing land-derived pressures on coral reef ecosystems in tropical regions.

Keywords: macroalgae, transplantations, nitrogen inputs, monitoring

CAS25 035

Antibiotic resistance patterns of *E. coli* isolated from run-off water in a small island state impacted by increased intense rainfall events over 3 years

Lisa Benjamin[1*] and Alva Johnson [2]
[1,2]Department of Basic Veterinary Sciences, School of Veterinary Medicine, Faculty of Medical Sciences, The
University of the West Indies, St Augustine, Trinidad and Tobago; Email:
Lisa.Benjamin@uwi.edu and
Alva.Johnson@uwi.edu; * - *Corresponding Author*

Abstract

This study aimed to investigate the susceptibility of *Escherichia coli* (*E. coli*) isolated from run-off water to selected antimicrobials on weekly visits in three consecutive years (2023 to 2025) between January to April from in Trinidad and Tobago.
Using a 10 ft reducible pole, 90 mL of run-off water was collected in a sterile specimen cup from each location. The sample cups were transported to the laboratory on ice packs and standard laboratory methods were used to culture, isolate and identify *E. coli*. Disc diffusion was used for sensitivity testing. The coordinates of sample collection locations were recorded.
In Year 1, all of the 44.4% (16/36) unique water samples that were positive for *E. coli* were resistant to between one and six antimicrobials. In Year 2, 68.3% (28/40) samples from targeted sites were positive for *E. coli* and resistant to between one and eight antimicrobials. In Year 3, 68.6% (24/35) unique samples positive for *E coli* were resistant to between one and seven antibiotics. Resistance to ampicillin and/or cephalothin were most frequently identified.
This research is in support of the World Health Organisation's Global Action Plan on Antimicrobial Resistance which advises countries to understand how resistance develops and spreads in the environment. Further research is needed to elucidate the local transmission dynamics of resistant bacteria present in run-off water in both the dry and rainy seasons.
E. coli can disseminate resistance genes amongst its species and to other bacteria, some of which might be more virulent. This research provides preliminary data to guide the design of studies to

evaluate the risk posed to humans and animals by exposure to antimicrobials in run-off waters as the Caribbean region experiences more frequent flooding events of greater severity.

Keywords: antibiotic resistance, run-off water, Trinidad and Tobago, *Escherichia coli*, Geographic Information Systems, One Health

CAS25 038

Field-Based Crop Modelling of Sweet Potato (*Ipomoea batatas* Lam.) under Three Water Regimes and Projected Climate Scenarios in New Zealand

Ariel Coolman[1*], Oral O. Daley[1], Gaius Eudoxie[1], Ronald R. Roopnarine[1], Wendy-Ann P. Isaac [1]

[1]Department of Food Production, Faculty of Food and Agriculture, The University of the West Indies, St. Augustine Campus, Trinidad and Tobago

***Correspondence:** Ariel Coolman
ariel.coolman@my.uwi.edu

Climate variability and change results in shifts in distribution, quantity, and intensity of rainfall. In areas where these shifts result in drier outcomes, growers are under increasing pressure to adopt soil-moisture conservation practices, select drought-tolerant cultivars, and use supplemental irrigation to sustain production. This study assessed the impact of varying irrigation regimes on the growth and yield of the sweet potato cultivar 'Beauregard' and evaluated a crop model capable of simulating sweet potato performance under different climatic scenarios. The FAO AquaCrop model was used to simulate the growth and yield under different climatic scenarios (Baseline – 2020 to 2021; Hot+Dry – 2012 to 2013; Cold+Wet – 2011 to 2012) and irrigation treatments (T0 - fully rainfed (from planting to harvest), T1 - irrigation of 56 mm for the first 14 days and then 50 mm every 30 days, and T2 - irrigation of 56 mm for the first 14 days and then 100 mm every 30 days). There was a decline in yields for both the Hot+Dry and Cold+Wet scenarios across all treatments compared to the baseline scenario. The loss in yield was more severe under T0 and less severe under T1 and T2. The Hot+Dry scenario had a higher WUE when irrigated for the first 14 days. However, for the Cold+Wet scenario, the increase in water supply caused an increase in yield losses. The findings from this study highlight the benefits of crop modelling in predicting yield outcomes in the context of climate change as well as the importance of optimal water management and use during crop growth and development.

Key words: yield, water use efficiency, climate change, drought tolerance, AQUACrop, sweet potato model

CAS25 040

REVISITING BLUESHIFT INTERPRETATION IN LIGHT OF RECENT DISCOVERY OF MULTIPLE SYSTEMS OF QUASARS

*J. Singh and S. Haque
Department of Physics, University of the West Indies, St. Augustine, Trinidad
*Corresponding Author - Email: justin.singh1@my.uwi.edu, Address: Sookia St. East Extension, San Juan, Trinidad and Tobago, West Indies

Abstract

This study investigates the anomalies associated with redshifts from emission lines in certain quasar candidates and the viability of a blueshift interpretation instead. The sample was taken from the Million Quasars Catalog (MILLIQUAS), representing the unidentified class with a redshift greater than 1. This sample was further constrained to those with spectra available, giving 208 candidates in total. This paper presents results on the sample, with the reported redshifts and the proposed blueshift interpretation. A subset of 38% of the sample was further analyzed using the best redshift interpretation of the emission lines from our analysis, which differed from the reported redshifts, in comparison with the blueshift interpretation. The number of unidentified lines under each interpretation was compared and was found to be statistically different with a P-value 0.05, with a larger number of unidentified lines under the redshift interpretation. The average spread values were also compared and found to be statistically different with a P-value 0.05, with blueshift having the smallest spread. Eighty-eight percent (88%) of the analyzed sample, that is 183 quasar candidates, provided an overall better interpretation under the blueshift hypothesis, 9%, which is 19 candidates, had a better interpretation under the redshift hypothesis and 3%, which is 6 candidates, had no identifiable lines. This indicates the importance of considering this possibility as well in light of new discoveries such as the discovery of multiple quasar systems that can lead to ejections, which has implications for the dynamics of quasars and the line of sight.

Keywords: Quasars, Active Galactic Nuclei, Redshift, Blueshift, Multi-body systems

CAS25 041

Associations between clinical variables and cardiovascular disease in Trinidad and Tobago

Sasha Ramkhelawan, Andrea Joseph, Ricardo Clarke
Department of Physics, Faculty of Science and Technology, The University of the West Indies, St. Augustine Campus

Abstract

Cardiovascular disease (CVD) is the leading cause of morbidity and mortality in Trinidad and Tobago (T&T), yet much of its burden is preventable through risk factor management. Evidence also suggests that clinical measures alone may not fully capture CVD risk, particularly in females. This study examined the associations between clinical variables and CVD in males and females in T&T, with implications for sustainable health planning.

We conducted a cross-sectional study that utilized baseline data from the T&T site of the Eastern Caribbean Health Outcomes Research Network (ECHORN) cohort study. CVD status was self-reported based on a prior medical diagnosis of coronary heart disease, angina, myocardial infarction, heart failure or stroke. The clinical variables investigated were age, systolic blood pressure (SBP), glycated haemoglobin (HbA1c), low-density lipoprotein (LDL), high-density lipoprotein (HDL), total cholesterol and waist-to-hip ratio (WHR). Univariable and multivariable logistic regression models were used to estimate the odds ratios (ORs) and 95% confidence intervals (CIs) for associations between the variables and CVD. Sex-stratified analyses were also conducted.

The dataset, consisting of 829 participants, had a mean age of 56.3±10.4 years and was composed of 61.5% females. The CVD prevalence was 11.0% in males and 8.9% in females. In the univariable analyses, older age and high HbA1c values were significantly associated with greater odds of CVD, while other clinical variables were not. The multivariable models showed that age (OR = 1.04, 95% CI: 1.01-1.07) and HbA1c (OR = 1.28, 95% CI: 1.10-1.47) remained independently associated with CVD. Sex-stratified analyses indicated that HbA1c was consistently associated with CVD in both males and females, while age was significant only in females.

This study provides new insights into CVD risk factors in T&T using a local, high quality dataset and highlights the critical role of age and HbA1c.

Given that CVD status was self-reported, this may have introduced some uncertainty into the outcome. Future research should assess the association between CVD and non-clinical determinants.

The lack of association with SBP, lipid measures and WHR highlights the need for non-clinical variables to be incorporated into CVD risk assessment locally. Such approaches would strengthen health systems (SDG 3), reduce inequalities in outcomes (SDG 10) and build resilience in T&T.

Keywords: cardiovascular disease; risk factors; Trinidad and Tobago

CAS25 053

Optimizing Fungicide Application Strategies for Managing *Rhizoctonia Solani* on Sugar Beet in the Red River Valley

Sushmita Kalika-Singh[1,2], Mohamed Khan[2] and Luis del Rio Mendoza[2]

[1]Faculty of Natural Sciences, Department of Biology, University of Guyana, Berbice Campus, Tain, Corentyne, Berbice, Guyana.
[2]Department of Plant Pathology, North Dakota State University, Fargo, ND, 58102.

Abstract

Rhizoctonia solani is a destructive soilborne pathogen that causes substantial yield losses in sugar beet (*Beta vulgaris*), particularly in the Red River Valley. While fungicides are a key tool in integrated management, limited knowledge exists on how application methods influence their effectiveness. This study was undertaken to compare the efficacy of different fungicides and application techniques against *R. solani*, with the goal of identifying approaches that optimize disease suppression. A greenhouse experiment was conducted using a susceptible sugar beet cultivar inoculated with *R. solani* AG 2-2 IIIB at the four-leaf stage. The study evaluated four fungicides, including azoxystrobin (Quadris), prothioconazole (Proline), penthiopyrad (Vertisan), and fluxapyroxad combined with pyraclostrobin (Priaxor), applied through three distinct methods: foliar application with soil coverage, tray application below pots, and soil drench. Disease severity was evaluated 28 days post-inoculation using a 0–7 scale, and results were analyzed in a split-plot design with ranked severity data. The analysis revealed a significant interaction between fungicide and application method ($P < 0.05$). Quadris applied as a soil drench consistently produced the lowest mean disease severity (3.9), indicating superior performance compared to other treatments. Foliar and tray applications were generally less effective across all fungicides. This research highlights drench-applied Quadris as the most effective strategy, reinforcing the critical role of application techniques in disease management. The findings provide practical guidance to researchers, extension specialists, and growers seeking sustainable root disease management strategies. The foliar and tray applications are not practical field methods but were included to demonstrate comparative fungicide activity and illustrate how application strategy influences performance. Future research should include higher doses of fungicides along with plants at different growth stages. The findings suggest that prioritizing drench applications with Quadris can enhance the efficacy of fungicide treatments against *R. solani* and contribute to consistently higher yields.

Keywords: sugar beet, *Rhizoctonia solani*, soilborne, pathogen, fungicide, management

CAS25 054

A Study of Cluster Initiatives on SME Competitiveness in the Export of Maritime Services: Some Findings in the Caribbean

*Leroy F. Quildon and Kit Fai Pun
Faculty of Engineering, The University of the West Indies, Trinidad and Tobago, West Indies

Abstract
Can value-creation cluster initiatives strengthen the cluster's competitiveness and the small and medium-sized enterprises (SMEs) in the Caribbean? This paper reports the findings of a recent study that has investigated the extent to which cluster initiatives moderate cluster value creation strategies (CVC) in fostering efficiency-driven competitiveness in the export of maritime services in Trinidad and Tobago (T&T). Cluster value creation initiatives (VCCIs) are the interactions between SME strategies to improve business performance and government mechanisms to facilitate the cluster's growth and development. In this study, the impact of these factors on SME competitiveness are measured, for example, government's specialized training programmes to increase and upskill the workforce and SME's innovative capacity. Based on multiple regression analysis of the empirical evidence, the relationships between cluster initiatives and value creation strategies were examined in this maritime services sector. The findings objectively assess the application of value creation and diversification strategies in SMEs toward improving their competitiveness. It concludes by underlining the need for SMEs to adopt a CVC strategy with investments and the support from the government to foster competitiveness in the export of maritime services in T&T and The Wider Caribbean.

Keywords: Cluster, value creation strategy, maritime services, SME, T&T, Wider Caribbean

CAS25 056

Emerging Contaminants in Surface Water and Wastewater in Barbados, West Indies

Quincy A. Edwards[1,3*], Chris D. Metcalfe[2], Tamanna Sultana[2], Sergei Kulikov[1], Leah Garner-O'Neale[1]

1) University of the West Indies, Cave Hill Campus, Barbados; quincy.edwards@mycavehill.uwi.edu, sergei.kulikov@cavehill.uwi.edu, leah.garner-oneale@cavehill.uwi.edu
2) Environmental and Resource Studies, Trent University, Peterborough, ON, K9J 7B8, Canada; cmetcalfe@trentu.ca, tamannasultana@trentu.ca
3) Clarence Fitzroy Bryant College, Burden Street, Basseterre, St. Kitts; quincy.edwards@cfbc.edu.kn

Abstract

Barbados is a very popular island tourist destination that has been subjected to intensive development. Due to its unique karst geology, it is highly susceptible to contamination of its groundwater and coastal waters. This is particularly a problem in areas where there are inadequate sewage treatment and raw wastewater is discharged into subsurface pits that are hydrologically connected to freshwater aquifers. As a small island, Barbados is also highly susceptible to risk of sea level rise brought about by climate change. The major objective of this study was to develop an improved method to extract caffeine and pharmaceuticals from surface water and wastewater and measure their concentrations in highly populated areas in Barbados. Grab water samples were collected at several populated areas in Barbados to determine the extent of pharmaceutical contamination of surface water and wastewater. All analytes were separated from water via solid phase extraction and quantified using liquid chromatography with tandem mass spectroscopy. Caffeine was found in all water samples investigated and most of the seven pharmaceutical compounds (androstenedione, carbamazepine, estrone, gemfibrozil, ibuprofen, sulfamethoxazole and trimethoprim) studied were found in surface and wastewater locations. The concentrations of pharmaceuticals were found below the United States (US) Food and Drug Association (FDA) limit of 1 µg/L. However, there are increasing concerns as these compounds may have an impact on biological receptors as many pharmaceuticals are stable in the environment and have the potential to bioaccumulate and biomagnify. It is important for Barbados and other Caribbean islands to be able to evaluate the potential impact of emerging contaminants on the environment and have an approach to determine protective levels.

Key words: Barbados; Caffeine; Pharmaceuticals; Surface water; Wastewater

CAS25 059

From agro-waste to catalysis: transforming cassava by products into functional materials for environmental remediation

L. Nouville[a]*, C. Poulier[a], G. Cebrian-Torrejon[a], P. Bilas[b], C. Jean-Marius[a], S. Gaspard[a], J. L. Bordin[c], and C. Yacou[a]

a. Université des Antilles, laboratory COVACHIM-M2E (UR4p_2), Pointe-à-Pitre Cedex, Guadeloupe.
b. Université des Antilles, laboratory GTSI, Pointe-à-Pitre Cedex, Guadeloupe.
c. Entreprise TYRISIL, Marie-Galante Guadeloupe
*corresponding author : leila.nouville@etu.univ-antilles.fr

Abstract

Micropollutants, including pesticides such as chlordecone, pharmaceutical residues (such as antibiotics) or endocranial disruptors, represent a pressing challenge in the Caribbean, also in territories like Guadeloupe where wastewater treatment plants (WWTPs) are often outdated or undersized. Despite being present at trace levels, these compounds exhibit persistent ecotoxicological effects, threatening aquatic ecosystems and public health. The enforcement of the 2024 EU Urban Wastewater Directive, which also applies to overseas territories such as Guadeloupe, intensifies the urgency to develop advanced, cost-effective, and locally adaptable solutions for wastewater treatment.

In this study, cassava processing residues (peels, stems, leaves, and wastewater) were valorized as catalysts support for advanced oxidation processes (AOP) targeting the degradation of organic micropollutants. The solid fraction was transformed into biochars (via pyrolysis treatment at 600°C during 1 hour) for heterogeneous Fenton-like catalysis, while the liquid phase was explored as a precursor for carbon quantum dots (via hydrothermal treatment at 180°C during 12h) with potential photocatalytic properties.

As such, several methodologies were employed. Solid biochars were magnetized through co-precipitation of Fe^{2+}/Fe^{3+} salts, yielding Fe_3O_4-impregnated composites with enhanced recovery potential. These materials demonstrated promising performance in the catalytic degradation of model micropollutants under simulated wastewater conditions. For instance, magnetized biochars synthesized from cassava branches, leaves, and peels achieved over 80% tetracycline degradation within 120 minutes, underlining the effectiveness of this approach for antibiotics removal. Ongoing work aims to shorten both degradation time and removal efficiency by varying the testing conditions (ie. pH, catalyst dosage and H_2O_2 concentration). In parallel, material characterization using SEM-EDX, FTIR, RAMAN spectroscopy and thermogravimetric analysis (TGA) revealed a homogenous dispersion of catalyst within the carbonaceous matrices, along with the identification of iron phases. To further enhance catalytic performance, biochars were engineered by optimizing pyrolysis conditions or by extracting bioactive compounds prior to carbonization, aiming to improve both surface functionality and reactivity. For instance, microwave-assisted extraction successfully recovered biomolecules such as 14-Taraxen-3α-ol, Trigonelline or Valine.

Future work will focus on converting the resulting residues into biochar for use in the Fenton-like system. This approach showcases how traditional crops, often linked to pollution concerns, can become a key enablers of circular innovations for water treatment in tropical regions.

Keywords: Biochar, cassava, micropolluant, fenton-like, wastewater, dregradation

CAS25 061

Synthesis of Activated Carbon from Cocoa Plantation Waste

Desiree Koonj Beharry, Jeffrey V. Smith
Department of Chemical Engineering, The University of the West Indies, St. Augustine, Trinidad and Tobago, West Indies

Email: desiree.koonjbeharry@uwi.edu
Email: jeffrey.smith@uwi.edu

Abstract

In 1830, Trinidad and Tobago was the world's third highest producer of cocoa with 20% of the world market share. Annual cocoa production peaked at 75 million lbs in 1921 led by the superior quality Trinitario bean. Economic factors, disease and competition from the sugar and later oil industries led to a decline of the sector such that current production is ~1.1 million lbs annually. The sustainability of the cocoa sector is supported by the Cocoa Research Centre (CRC) at The University of the West Indies (The UWI), St. Augustine which runs the International Cocoa Genebank with over 2400 varieties of cocoa situated on ~100 acres, as well as a model 5-acre cocoa orchard with 1500 trees and 8 varieties located at The UWI field station.

The synthesis of activated carbon (AC) from local waste biomaterials presents a promising opportunity towards sustainable material innovation via the form of waste valorisation, while promoting environmental sustainability. This research is investigating the synthesis of AC from cocoa plantation waste products (cocoa pods husk, cocoa bean shells/ testa and cocoa pruning) obtained from the CRC model orchard, using a two-step process – carbonization via pyrolysis in an inert atmosphere, followed by physical activation in an oxidizing atmosphere. This presentation highlights work to date, including sample collection and preparation, carbonization, initial activation (facilitated via a Design of Experiments approach) and preliminary surface area analysis via BET analysis. Further analyses such as TGA, FTIR, SEM/EDX, Methylene Blue/Iodine adsorption would be carried to characterize the produced carbons. This would assist in optimizing process conditions for producing carbons to meet specific applications e.g. carbon dioxide capture or removal of phenolic compound from 'produced water' in the downstream petroleum sector. This research aligns with the United Nations Sustainable Development Goals 2, 3, 6, 12 and 13 focusing on transforming agricultural waste products into a high-value product.

Keywords: Activated Carbon, Carbon Dioxide Capture, Cocoa, Environmental Sustainability, Trinidad, Waste Valorisation

CAS25 062

Empowering Women in the Caribbean's Energy Transition: Designing a Cooperative Model for Female Renewable Energy Entrepreneurs

Gabriela Pella (Lead Researcher) & Carol Lue (Practitioner Partner)
CaribShare

Abstract

Across the Caribbean, the energy transition is not only a technological challenge, it is a human and social one. Women entrepreneurs hold enormous potential to drive inclusive renewable energy solutions, yet they remain underrepresented and underserved. This paper proposes a cooperative model designed to leverage, support, and amplify the role of women entrepreneurs in the Caribbean renewable energy sector, contributing to SDG 13 (Climate Action), particularly targets 13.5 and 13.6. By strengthening local capacities for planning, knowledge sharing, and leadership, the research aims to transform climate action into a more inclusive and community-driven endeavor.

Using a design-thinking approach and cooperative governance theory, the study combines participatory research, multi-stakeholder workshops, and qualitative fieldwork across several Caribbean countries. Women entrepreneurs, government institutions, universities, and private actors co-designed the proposed model, ensuring that the framework reflects both structural realities and community aspirations.

The research revealed persistent financing gaps, fragmented policy frameworks, and limited access to technical training that restrict women's participation in renewable energy entrepreneurship. Yet, it also uncovered powerful networks of trust, leadership, and local knowledge that cooperatives can activate. The proposed model uses collective financing, shared infrastructure, and capacity-building strategies to enable women to integrate into energy value chains and regional markets, thereby accelerating the region's climate transition.

This paper offers a region-specific, gender-inclusive cooperative model tailored for small island developing states. It contributes to SDG 9 (Industry, Innovation and Infrastructure) by promoting sustainable and resilient energy infrastructure (9.1) and enhancing access to financial services and markets for women-led enterprises (9.3). By bridging academia, industry, and government, this work proposes a scalable pathway for inclusive climate action rooted in local leadership. While based on pilot studies, further research is needed to assess long-term governance and scalability.

The model provides development agencies, policymakers, and communities with actionable tools to foster inclusive renewable energy entrepreneurship, empowering women as catalysts of systemic change.

Keywords - Renewable Energy; Women Entrepreneurs; Cooperative Models; Latin America and the Caribbean; Climate Action (SDG 13); Inclusive Innovation

CAS25 071

Two Islands Two Futures: Contrasting LS Factor-Based Erosion Susceptibility in the Eastern Caribbean Region

Kent Thomas (1)*, Andrea Gaymes (1), Mark N. Wuddivira (2), Michele D. Singh (3), Gaius Eudoxie (2)
(1) Centre for Resource Management and Environmental Studies, Cave Hill Campus, The University of the West Indies, Bridgetown BB11000, Barbados
(2) Department of Food Production, Faculty of Food and Agriculture, The University of the West Indies, St. Augustine, Trinidad and Tobago
(3) The Centre for Agricultural Research and Innovation (CAGRI), The University of the West Indies, Cave Hill Campus, The University of the West Indies, Bridgetown BB11000, Barbados.

*Corresponding Author email address: kent.gary.thomas@gmail.com

Abstract

This paper examines how geomorphology, expressed through the slope length and steepness (LS) factor of the Universal Soil Loss Equation, shapes contrasting erosion futures in St. Vincent and the Grenadines (SVG) and Barbados. It interprets why volcanic and coral terrains differ in susceptibility and reflects on implications for food security, water resources, and climate resilience in the Caribbean. As a viewpoint paper, this study uses the LS factor as a comparative lens, contrasting St. Vincent's volcanic slopes with Barbados' coral terrain. It also draws on practitioner perspectives to reflect on how changing soil futures may affect community risk perception, adaptation, and resilience. SVG's rugged topography produces higher LS values and greater susceptibility to erosion, while Barbados' lower relief yields reduced values. These bounds illustrate erosion risk across Eastern Caribbean SIDS. The findings show that technical modeling must be complemented by adaptive perspectives, since community risk perception and capacity to sustain interventions shape hazard management.
The paper presents the LS factor as both a technical and interpretive tool for comparing erosion susceptibility across contrasting island geomorphologies. Its novelty is in linking geomorphic evidence with policy and practitioner insights to show how erosion futures shape community adaptation and resilience. The value lies in offering researchers an integrated physical–social approach and giving policymakers and practitioners practical baselines for regional comparison, governance, and community engagement.
The study relies on SRTM datasets, which provide a regional baseline but may lack the precision of higher-resolution DEMs. Comparative testing across DEM resolutions may refine LS modeling in small islands. Psychological perspectives on risk perception and adaptive capacity are drawn from practitioner insight, underscoring a research gap for empirical studies. Nevertheless, the LS factor remains a practical entry point for regional erosion assessment, supporting consistent comparisons and informing risk communication. Embedding geomorphic baselines in adaptation planning can strengthen policy, enhance community response, and build sustained conservation buy-in.

Keywords: Soil erosion, Geomorphology, LS factor, Eastern Caribbean SIDS, Food security, Policy adaptation

CAS25 079

Developing a Circular Economy Model for the Utilization of *Sargassum* Seaweed in the Caribbean

Srinivas Popuri, University of the West Indies, Cave Hill Campus

Abstract

Since 2011, recurrent blooms of *Sargassum* spp. have invaded Caribbean coastlines, creating severe environmental, social, and economic disruptions. This research aims to transform *Sargassum* from an environmental hazard into a sustainable bioresource through the development of a circular economy model aligned with the UN Sustainable Development Goals (SDGs 7, 12, and 13).

Compositional and physicochemical analyses of *Sargassum* biomass were conducted to evaluate its potential for producing high-value bioproducts. Sodium alginate and nutrient fractions were extracted and characterized. Bioethanol generation potential was assessed through preliminary fermentation studies. Additionally, a chitosan–*Sargassum* composite sorbent was synthesized and tested for Cu(II) and Ni(II) removal from aqueous solutions. Further valorization avenues explored include biohydrogen and biofuel production, as well as the use of processed residues as biofertilizer.

The integrated valorization approach demonstrates that *Sargassum* biomass can yield high-quality sodium alginate, exhibit metal adsorption efficiency in chitosan composites, and serve as a viable feedstock for renewable energy and soil amendment applications. These findings support the feasibility of an end-to-end circular utilization model.

This work pioneers a regional framework that bridges environmental management, renewable energy, and sustainable materials development. By linking scientific innovation to community and policy action, it showcases how the Caribbean can convert a transboundary marine nuisance into a driver of green growth and resource circularity.

Keywords: *Sargassum* seaweed; circular economy; alginate extraction; bioethanol; biosorbent; sustainable development

CAS25 081

The Performance of a Physical Scaled Model of a Low-Head Seawater Pumped Hydro Storage System

Prashant Birbal[1*], Hazi Azamathulla[2]

[1] Research Scholar, Department of Civil and Environmental Engineering, University of the West Indies, Trinidad and Tobago, ORCID ID: 0000-0002-9409-5332

[*]Corresponding Author: birbal.prashant58@gmail.com

[2] Professor and Head of Civil and Environmental Engineering, University of the West Indies, Trinidad and Tobago, 0000-0002-5436-4147. Email: azmatheditor@gmail.com

Abstract:

The majority of energy produced in Small Island Developing State (SIDS) is from fossil fuels. Therefore, in order for the SIDS to reduce their carbon footprint, there becomes an increasing need for the adoption of variable sources of energy. In this study a low head Seawater Pumped Hydro Storage System (SPHS) was investigated for energy production within the small island state of Trinidad and Tobago (one of the larger SIDS nations by population size). A scaled physical model of the system was then developed and tested using seawater from the north coast of Trinidad. The geometric dimensions of the system were adjusted as required to achieve maximum energy efficiency based on varying flow at limited low head. Experimental validation confirmed the importance of pipe size and configuration for system efficiency, with larger pipes and minimized bends yielding the best performance, emphasizing the practical implications for SPHS implementation in a SIDS. For the proposed scalability aspect, a small diameter pipe connected to the pump should be used to transport the seawater from the sea to the upper reservoir by harassing a combination of solar and wind power during the daytime. Then at night or when energy demand increases, the seawater can be released from the upper reservoir through a substantially larger pipe diameter connecting to the impeller's turbine (at least 4 times that of the pump pipe's diameter). The outcome of this research found that the higher the flow rate from the upper reservoir due to the increase pipe size, would exponentially increase the power generated for a shorter time frame and limit energy losses due to pipe friction, given that the other conditions remain the same.

Keywords; Hydropower, Scalable, Low head, Seawater, Pumped Hydro storage, Physical Model, Small Island Developing States (SIDS)

CAS25 082

Comparative Assessment of Yield, Pod and Seed Quality Characteristics in Selected Dwarf Vegetable Pigeon pea (*Cajanus Cajan* (L.) Millsp.)

*Albertha Joseph-Alexander [1, *] and Pathmanathan Umaharan [2]
[1]Caribbean Academy of Sciences, Trinidad and Tobago Chapter;
[2]The University of the West Indies, St. Augustine Campus;
[1]e-mail: albertha.josephalexander@alumni.uwi.edu;
[2]e-mail: pathmanathan.umaharan@uwi.edu
* Corresponding Author

Abstract

Pigeon pea (*Cajanus cajan* (L.) Millsp.) is an important multi-use leguminous shrub of the tropics and subtropics. In the Caribbean its immature seeds are consumed as a green vegetable, and it is the most popular legume consumed locally. Although dwarf short-duration vegetable pigeon pea varieties have been developed and released by the University of the West Indies (UWI), they have not been successfully adopted by farmers due to inferior consumer quality traits. This investigation therefore assessed fifteen newly selected dwarf vegetable pigeon pea recombinant inbred lines (RILs) for yield, physical and biochemical quality traits against three control varieties previously developed for year-round production. The eighteen varieties were evaluated in the field using a randomised complete block design with four replications. The study revealed that there were RILs showing improvements in total pod number per plant, hundred seed weight (HSW), crude fibre, phenolic content, total sugar content, days to flowering and final height when compared with previously developed varieties. Additionally, there were RILs with comparable green pod yield (mass/weight of unshelled green pods), seeds per pod (SPP) and total starch content. None of the RILs possessed superior crude protein. Overall, UW326 had the best combination of yield, physical and biochemical quality traits and is recommended as a replacement for previously developed dwarf short-duration year-round varieties. In dwarf short-duration vegetable pigeon pea, physical (hundred seed weight and seeds per pod) and biochemical quality traits can be simultaneously improved without negative compensatory effects on green pod yield. The implications of these findings for local pigeon pea breeding programmes are discussed.

Keywords: pigeon pea; yield; yield components; quality traits; biochemical; Recombinant Inbred Lines (RILs).

CAS25 088

Strengthening Healthcare Technology Policy & Procedure in the English-Speaking Caribbean SIDS: Advancing Climate-Resilient Health Outcomes through the SDGs

Lesford Y. Loney[1] and Nicole Ramlachan[2]
[1] Eastern Regional Health Authority, Ministry of Health, Trinidad and Tobago
[2] Biosciences, Agriculture and Food Technology, University of Trinidad and Tobago

Abstract

Healthcare systems in the Caribbean face significant challenges exacerbated by natural disasters. Healthcare technology management (HTM) optimization is critical for health service delivery in Small Island Developing States (SIDS), most vulnerable to adverse impacts of climate change. Climate change has increased in severity, visible post Hurricane Melissa decimating healthcare capabilities in SIDS, where systemic challenges in managing biomedical assets risk healthcare resilience and Sustainable Development Goals (SDG) commitments in: SDG 2, 3, 6, 7 and 13. HTM policies in English-Speaking SIDS are compared to international best practices and innovation-driven reforms, with more resilient HTMs conforming to SDG commitments proposed. Smart facilities to strengthen and promote HTM policy are necessary as an effective climate adaptation strategy for healthcare resilience to climate-based disasters. A review English-speaking SIDS on HTMs, provided comparisons on day-to-day versus post-disaster. Institutional documents, national health policies, and regulatory frameworks from World Health Organization (WHO) are cited. Evaluation of implementation of aspects of the Smart Hospital Initiative by Pan-American Health Organization (PAHO) with regional cooperation to support a more climate-resistant health system locally was performed.
Adoption of digital transformation processes, technology acceptance, reactive and failure mode maintenance processes provide resilience. Unstandardized and inconsistent asset tracking, ineffective inventory systems, obscure procurement procedures dominate these systems without neither integration of SDS goals nor climate resilience system maintenance. Implementation of best practice climate-resilient HTM policy with SHI, require centralized biomedical engineering and biotechnical expertise amidst disaster relief. Renewable energy integration, with digital health, allows scalable continuity and remote monitoring during climate-related disasters. Innovation across sectors is achievable with HTM reforms to SDGs 2, 3, 6, 7, and 13. SIDS can create resilient healthcare systems safeguarding food security, water safety, energy independence while maximizing recovery and climate resilience. Climate-smart facilities are an adaptation strategy to mitigate climate-related impacts, improving health outcomes regionally.

Theme 2 - Science, Policy and Social Impact

CAS25 034

Production and Characterisation of Biochar from Broiler Poultry Litter by Slow Pyrolysis

Diandre Stephen
Department of Food and Agriculture, Faculty of Food and Agriculture, The University of the West Indies, Sr. Augustine Campus, Trinidad and Tobago

Abstract

The paper aims to explore the potential of broiler poultry litter, a widely available agricultural waste, as a feedstock for biochar production through slow pyrolysis. The study seeks to characterise the resulting biochar to determine its suitability for agricultural and environmental applications such as soil enhancement, waste management, and carbon sequestration. Broiler poultry litter was subjected to slow pyrolysis at varying temperatures and residence times using a biochar conversion drum. The biochar produced was analysed for pH, electric conductivity (EC), total carbon (C), nitrogen (N), phosphorus (P), and potassium (K), carbon to nitrogen ratio (C:N), and ash using proximate and ultimate analysis. It was also tested for phytotoxicity. The study found that pyrolysis temperature significantly influenced the yield and quality of biochar. Higher temperatures reduced biochar yield but increased carbon content, making it more stable for long-term carbon storage. The biochar demonstrated desirable properties such as high nutrient retention, suggesting strong potential for soil amendment and pollutant remediation. This paper demonstrates a sustainable approach to managing poultry waste while producing a value-added product that supports climate-smart agriculture. The originality lies in providing detailed characterisation of biochar from broiler poultry litter, which can guide future applications in soil fertility improvement, greenhouse gas mitigation, and proper waste management and utilisation. Conversion of poultry litter to biochar will require additional technologies for drying prior to pyrolysis, as pyrolysis conditions require biomass to have a low moisture content (less than 30%). Research and development efforts are needed to optimize biochar production processes, improve its quality and stability, and assess its long-term impacts on soil health and ecosystem functioning. The study highlights a practical waste-to-resource pathway for poultry producers and policymakers, offering a dual benefit of waste management and soil health improvement. Adoption of biochar production from poultry litter can contribute to circular economy goals and sustainable agricultural practices.

Keywords: Biochar, Poultry litter, Slow pyrolysis, Waste management, Soil amendment, Carbon sequestration

CAS25 051

Is Trinidad and Tobago Warming at Two and a Half Times the Global Average

Reynold J. Stone
Caribbean Academy of Sciences-Trinidad and Tobago Chapter, West Indies
Email: reynold.stone@gmail.com

Abstract

In Trinidad and Tobago's First Biennial Update Report to the United Nations Framework Convention on Climate Change, the following claim was made based on a statistical analysis conducted by the Trinidad and Tobago Meteorological Service (TTMS): *"The average annual temperature has warmed by about 2.1˚C over the period 1946 to 2019, at a rate of 0.28˚C per decade. This is approximately two and a half times the global average."* This claim was critically investigated to determine whether it is based on solid scientific evidence, whether it is based on reliable empirical data that has been rigourously tested using an appropriate statistical procedure. I accessed the data from the TTMS and discovered several fundamental flaws in the statistical analysis conducted by the TTMS. Firstly, the surface air temperature data series used in the analysis came from one poorly sited Class 3 station situated at the old Piarco airport that may be representative of the area surrounding the station but is not representative of the entire land area of Trinidad and Tobago. Secondly, the data series was not tested for inhomogeneities (artificial shifts or step changes due to change of instruments and their locations as well as changes in the environmental surroundings of the station) to ensure that any observed temporal fluctuations are due only to the vagaries of weather and climate. Thirdly, simple linear regression was employed to analyse the data series without the use of regression diagnostics to determine whether the underlying statistical assumptions were satisfied. I first performed a homogeneity analysis using four change point tests which detected several change points – the major one being an upward step change in 1986 which coincided with the change from manual temperature measurements using liquid-in-glass (mercury) thermometers to automated measurements using the HO83 platinum wire resistance hygrothermometer. It is important to note that the HO83 hygrothermometer was subsequently discovered to have a design flaw which yielded higher biased measurements of surface air temperature. Regression diagnostics performed on the results from simple linear regression revealed that the assumptions of linearity and independence were violated. These findings suggest that a simple linear regression model is inappropriate and that the regression results were spurious. It is concluded that the claim that Trinidad and Tobago is warming at the rate of two and a half times the global average has no valid empirical or statistical basis and is therefore false and misleading. For the accurate and reliable detection of non-random patterns in the data series such as this trend, it is first necessary to remove the detected inhomogeneities before undertaking appropriate statistical analyses. It is therefore recommended

that the Piarco meteorological Station's history be constructed using all the relevant available metadata and that reference stations be established to assist with the data homogenisation process.

Keywords: Trinidad and Tobago, surface air temperature, global warming, climate change, homogeneity testing, linearity, independence, spurious regression

CAS25 060

Linking Livelihood Resilience and Climate-Smart Agriculture Adoption: Evidence from Farmers in Trinidad and Tobago

Authors: Brandon Murphy[1], Wendy ann Isaac[2], Marquitta Webb[2]
[1,2] The University of The West Indies
Corresponding Author: name: email: brandon.murphy@my.uwi.edu

Abstract

Small Island Developing States (SIDS) are among the most vulnerable regions to climate change, facing disproportionate risks to food security, livelihoods, and ecosystems despite contributing minimally to global emissions. In this context, the adoption of climate-smart agricultural (CSA) practices emerges not only as a technological imperative but also as a societal necessity for strengthening resilience and advancing the Sustainable Development Goals (SDGs). This study applies the Livelihood Resilience Framework to examine the drivers and barriers influencing the intensity of CSA adoption among smallholder farmers in Trinidad and Tobago. The results show that farmers' ability to absorb shocks and disruptions, their capacity to build flexible and adaptive networks, and their aptitude for acquiring new knowledge and skills significantly increase the likelihood of adopting CSA practices. Younger and female farmers were also more inclined to adopt and intensify CSA, highlighting the influence of generational and gendered dynamics in shaping adaptive capacity. Paradoxically, however, membership in farmer groups and heightened concern about climate change were associated with lower levels of adoption, suggesting that institutional arrangements and perceptions of risk may at times constrain rather than enable adaptive responses. These findings demonstrate that CSA adoption in SIDS cannot be reduced to questions of technological availability; rather, it depends on the strength of enabling environments that combine financial support, institutional effectiveness, and social trust. By situating farmer adaptation within the broader sustainable development agenda, the study contributes a systemic understanding of how science, technology, and society must be bridged to accelerate agricultural transformation in vulnerable contexts.

Keywords: Climate Smart Agriculture, Livelihood Resilience, Adaptive Capacity, Agricultural Transformation, Small Island Developing States

Theme 3 - Youth, Education and Scientific Empowerment

CAS25 011

Solving the Maths Problem in Science – Insights using Smart Worksheets in the UK and South Africa

Dudley Shallcross,[1,2,4] Bill Heslop,[2] Joyce Sewry,[3] Mike Davies-Coleman[1,2,3,4]

1. School of Chemistry, University of Bristol, UK.
2. Learning Science Ltd. Bristol, UK.
3. Department of Chemistry, Rhodes University, South Africa.
4. Department of Chemistry, University of the Western Cape, South Africa.

Abstract

Quantitative skills (mathematics) are essential for the sciences. University students can be left behind in science courses very early on, depending on their entry numerical skills. Identifying student skill sets is vital in order to provide appropriate support. In this paper we show how Smart Worksheets (SWS) provide unique insights for UK and South African contexts. All year 1 students complete a series of SWS, some rehearse key mathematical skills (pre-16) and others embed skills in a variety of (chemical) contexts. SWS are formative, containing hints and tips to aid students and an auto-complete function if the student is completely stuck. SWS scores are analyzed, e.g. male/female scores, post-16-maths students (e.g. A level) versus pre-16-maths (e.g. GCSE). Students are supported each week following new taught material with workshops and the information obtained from the SWS are used to shape these workshops, focusing on areas where students are struggling. All students struggle with Units, uncertainty analysis and graphing. Pre-16-maths students show considerable learning gain in term 1, revising mathematical concepts and associating these with chemical contexts (reporting this helps to cement the skills). Some post-16-maths students struggle to apply their mathematical skills to new contexts and identifying this allows us to model translation in workshops. We believe this is the first study using SWS in this way. Data on student cognition in key mathematics skills and problem areas in real-time are then addressed through tailored workshops. All UK students have excellent post-16 Chemistry qualifications. However, a very wide range of entry qualifications and socio-economic groups are represented in South Africa, supporting the assertion that SWS impact positively on quantitative skill development. Using SWS allows a wide cohort of students to be admitted to university to study science subjects, providing essential information to support students.

Keywords: Quantitative skills, learning gain, formative assessment, quality education, educational equity, personalized learning

CAS25 024

Pedagogical Challenges in Implementing Place-Based Environmental Education in Trinidad and Tobago: Mangrove Ecosystem Conservation and Sustainable Development Goals.

Nayanti Rambarran
University of Trinidad and Tobago
nayanti.rambarran@utt.edu.tt

Abstract

This article critically examines the pedagogical challenges of implementing Place-Based Environmental Education (PBEE) in Trinidad and Tobago's primary education system, focusing specifically on mangrove conservation. Drawing from Dewey's (1997) educational philosophy that advocates experiential learning and Gruenewald's (2003) Critical Pedagogy of Place, it reviews literature, curriculum analyses, and policies highlighting a curriculum insufficiently tailored to diverse learners, inadequate teacher preparation, restricted experiential resources, restrictive educational policies and poor stakeholder coordination as principal impediments. These barriers significantly affect Trinidad and Tobago's ability to achieve key Sustainable Development Goals (SDGs), particularly Quality Education (SDG 4), Life Below Water (SDG 14) and Life on Land (SDG 15). The article provides recommendations for overcoming these constraints, suggesting classroom-based alternatives and policy improvements aligned with the nation's Vision 2030.

Keywords: Mangrove conservation, pedagogical challenges, place-based environmental education, primary education, Trinidad and Tobago, Sustainable Development Goals, Vision 2030.

CAS25 039

Scientific Communication

LOLLIA Manuel, FORISSIER Thomas, ISSAÏEVA Elisabeth

Université des Antilles,

Abstract

Our research concerns oral communication as a teaching object in the context of the Grand Oral of the Baccalaureate. We were interested in public speaking and learning oral communication in an evaluative context among Guadeloupean students in their final year of high school specializing in science.

We wanted to grasp the concept of oral communication and understand how students and teachers appropriate this concept within a specific cultural and linguistic context. Indeed, Guadeloupe is a

society with a strong oral tradition and a unique sociolinguistic situation that facilitates the shifting between Creole and French in conversation.

To achieve our objective, we implemented three phases of research.

An initial study was conducted among students in their final year of high school specializing in science. Through 337 questionnaires and eight semi-directive interviews, we examined the way in which they engage in learning oral communication.

A second study was conducted to identify the way in which teachers structure and plan the teaching and assessment of the oral. We submitted 139 questionnaires to them, conducted two semi-directive interviews and carried out seven observations within their classes.

The final part of the investigation focused on the Grand Oral training. We wanted to know what the trainers' perceptions were regarding the Grand Oral in relation to the Guadeloupean context.

The questionnaire results reveal that learning oral skills remains difficult for students, and most of them say they have not received any real oral instruction. Paradoxically, they report having made progress in verbal, paraverbal, and nonverbal areas. Furthermore, peer assessment and the use of video are underutilized by students. Finally, the semi-structured interviews reveal four profiles of students preparing for the Grand Oral. On the teachers' side, we note irregular work on oral skills in classes with late preparation for the Grand Oral.

CAS25 043

Towards integrating climate science empowerment into college and university science Courses

Kim Whitehall, Ph.D.

Abstract

Many colleges and universities offer basic introductory primers on climate change, environmental policy, and sustainability to non-science majors through physical science-based credit courses that fulfill the general education requirements for a bachelor's degree. These courses generally use an introductory text - to include its online platform - in the respective scientific fields as the required text. The inclusion of a core credible reference text is paramount, but the practice of leveraging introductory science textbooks in science-credit courses does not intuitively support scientific empowerment for a non-science learner as the knowledge acquired is siloed in nomenclature and concepts are not interwoven into the learner’s core studies, interests or culture. A classroom environment rich in discussions and assessments that integrate the physical sciences into the social sciences, culture, and current events provide the non-science learner (and science learner alike) with opportunities to unlock scientific jargon, better understand scientific ideas in their disciplines, and fuel a growth oriented mindset. Beyond the science credit for the learner these outcomes are desirable from the educators and school administration. However, it is challenging to create such a classroom environment within the time allotted a scheduled 3-credit course.

This paper proposes a framework to weave scientific empowerment into these types of courses for learners. Though the framework has been curated from implementations within various classes within the Caribbean and United States, a common science credit course in Floridian colleges and universities - Introduction to Earth Sciences – is highlighted as an implementation example. The proposed incorporates existing STEM (science, technology, engineering, and mathematics) education frameworks, Bloom's taxonomy, flipped classroom approaches and active learning strategies into the course's instructional design and implementation. Key syllabus topics are presented with examples and learner feedback shared.

Keywords: STEM education framework implementation; scientific empowerment

CAS25 047

Expanding Accessibility for Computer Programming Courses

Colin Depradine
Department of Computer Science, Mathematics and Physics
Cave Hill Campus
246- 17-4375
colin.depradine@uwi.edu

Computers have existed for over two hundred years. During that period, its related disciplines, such as computer science and information technology, have become integral to the advancement of all countries, including economic, social, and educational development. Despite their importance, these areas continue to be male dominated, with the industrialized nations commanding the majority share of large-scale digital innovations. In the Caribbean, Governments have been paying increasing attention to these disciplines. However, given the constrained resources and limited funding of small island states, a key success factor is the provision of equal access to relevant education. Fundamentally, this translates to the adoption of an inclusive approach to computer science education in view of the increasingly diverse nature of the student population.

This presentation looks at the use of inclusive computing, specifically around computer programming. Inclusive programming seeks to remove those barriers that exclude students based on social factors, such as gender and disabilities, from successfully completing computer programming courses. The experiences within two compulsory computer programming courses are discussed and recommendations are made for the way forward.

The primary goal is to increase the accessibility of computer programming courses for all students, irrespective of gender, economic background, age or disabilities.

Preliminary results show improvements in class attendance, meeting coursework deadlines and overall pass rates. However, external barriers to learning, such as managing the demands of heavy coursework loads and doomscrolling, can negate the benefits of improved accessibility.

CAS25 072

Building Scientific Capacity for Sustainable Aquaculture in Caribbean Tertiary Institutions

Juli-Anne Russo PhD, Lisa Benjamin
Caribbean Aquaculture Education and Innovation Hub
Caribbeanaquaculturen876@gmail.com

Abstract

Despite global aquaculture production reaching record levels, the Caribbean accounts for only 0.05% of global output, highlighting its underutilized potential. Current practices in the region are largely restricted to tilapia and shrimp, reflecting a limited scope when compared to the diverse range of blue foods cultivated worldwide. While intensive salmon farming dominates aquaculture in developed nations and low-cost species characterize developing contexts, the Caribbean's rich ecosystems provide unique opportunities for diversification. These include the cultivation of marine finfish, conch, sea urchins, sea cucumbers, oysters, mussels, seaweeds, and aquarium species, the latter of which has already offered livelihood opportunities in Jamaica.

Blue foods are nutrient-dense, rich in bioavailable micronutrients, and can be produced in environmentally sustainable ways. For Caribbean nations, aquaculture represents a strategic pathway to strengthen food and nutrition security, to alleviate pressure on overfished marine resources, and stimulate inclusive socio-economic growth. However, regional aquaculture development has historically been constrained by insufficient human and technical capacity, limited research infrastructure, and inadequate knowledge transfer across institutions. These barriers have curtailed innovation, slowed adoption, and reduced the sector's competitiveness.

To address these gaps, the Caribbean Aquaculture Education and Innovation Hub (CAEIH) was established to advance scientific capacity building across the region. CAEIH aims to integrate aquaculture into secondary and tertiary education curricula, promote applied and interdisciplinary research, and cultivate partnerships with regional industries and international collaborators. The Hub emphasizes the use of key performance indicators to track growth and impact across the aquaculture value chain, with particular focus on gender equity and youth participation.

By strengthening technical expertise, fostering innovation, and embedding aquaculture within STEM education, CAEIH seeks to position the Caribbean as a leader in sustainable aquaculture. This initiative underscores the transformative potential of education-driven capacity building to unlock the region's blue economy.

Keywords: aquaculture, mariculture, technical skills training, innovation, STEM, Caribbean

CAS 064

Redesigning Chemistry Laboratories for Meaningful Learning at the Tertiary Level: A Barbadian Intervention

Maria Butcher and Leah Garner-O'Neale

Facaulty of Science and Technology
Department of Biological and Chemical Sciences
The University of the West Indies, Cave Hill Campus

Abstract

Being in a laboratory is often where chemistry comes alive. It is the place where abstract ideas turn into real experiences, where students learn not only by reading and listening, but also by doing, seeing, and reflecting. Yet in small island developing states (SIDS) such as Barbados, laboratories face unique challenges that shape how students and educators experience this vital part of science education. Limited resources, crowded classes, and the pressure to complete tasks often leave little room for deeper engagement and meaningful connections between theory and practice.

This study aims to address these challenges by redesigning a single chemistry laboratory activity at the post-CSEC tertiary level. Conducted over two academic years, the intervention involved 130 students across 22 focus group sessions, alongside input from four teachers, three technicians, and two demonstrators. A control group worked with the traditional materials, while the experimental group used the redesigned version, which emphasized reflection, conceptual linkages, and skill development. To enhance accessibility and cater to diverse learning styles, QR codes were embedded into the materials, linking to video demonstrations of the laboratory procedures. Students from the experimental group later participated in group-based think-aloud sessions that captured their reasoning and emotional responses in real time.

The results indicated that students in the experimental group were more engaged, collaborative, and better able to connect what they were doing in the laboratory to the underlying concepts. Educators and laboratory staff observed that the activity felt more purposeful and reflective than before, while the think-aloud sessions revealed learning gains and challenges in transferring knowledge across contexts.

This intervention demonstrates how small, targeted changes can transform laboratory experiences in resource-limited settings advancing the United Nations Sustainable Development Goal of Quality Education and offers practical lessons for strengthening STEM education across the Caribbean.

Keywords: Chemistry education, laboratory intervention, meaningful learning, SIDS, Barbados, Quality Education

CAS25 085

When Breadfruit Meets the Bunsen Burner: Reimagining Science Education Through a Caribbean Lens

Zhane Bridgeman-Maxwell

The University of the West Indies Cave Hill Campus

Abstract

This paper examines the potential for integrating Caribbean indigenous knowledge systems and cultural practices into science education as a means of advancing education transformation in the region. It argues that aligning science curricula with local epistemologies ,which are rooted in community practices, creativity, and lived experience, it can enhance relevance, engagement, and critical thinking among learners. Drawing on frameworks in decolonial and transformative education, the paper considers how traditional practices such as bush medicine, local agriculture, craftsmanship, food preservation, and cultural expressions like dance embody principles of observation, experimentation, and problem-solving. These practices illustrate that scientific inquiry has long existed in Caribbean societies, though often unrecognized within formal education. By bridging local knowledge and scientific reasoning, this approach offers a framework for cultivating learner identity, sustainability awareness, and a sense of contribution to knowledge creation. The paper further highlights implications for curriculum design, teacher professional development, and STEAM education policy, advocating for a model of science learning that honors cultural heritage while promoting rigorous scientific understanding.

Keywords: Caribbean education, science curriculum, decolonization, indigenous knowledge, cultural integration, sustainability

Theme 4 - Regional Solutions to Global Challenges

CAS25 001

The Role of Recency Testing and Linkage to Care in Enhancing Viral Suppression in Guyana

Tariq Jagnarine
University of Guyana,

Abstract

Recency testing is a cutting-edge surveillance tool, identifies individuals recently infected with HIV to enable targeted interventions. The objective of this study was to assess the role of recency testing in identifying recent infections, linking newly diagnosed individuals care, and achieving long-term viral suppression. This retrospective observational study included 120 individuals newly diagnosed with HIV across Regions 3, 4 and 5. Recency testing was conducted using samples processed at the National Public Health Reference Laboratory (NPHRL). Of the confirmed cases, **23 were identified as recent infections** after verification. **All participants** were linked to care and initiated on dolutegravir (DTG)-based antiretroviral therapy (ART). Viral load measurements were recorded at baseline, six months, and one year. Quantitative data were analyzed using chi-square and logistic regression to assess associations between recency status, care linkage, and treatment outcomes. Ethical approval was obtained. 23 Positives out of 150 test, 15.3 % positivity rate, with more females than males- 91.3%. 100% linkage to care and ART initiation. Baseline viral loads ranged from 704 to 1,820,000 copies/mL. Following treatment, viral loads demonstrated reductions of **80–95% at six months p=0.00**. By the one-year mark, **95%** of participants achieved viral suppression below 1,000 copies/mL. Statistical analyses revealed significant associations between early treatment initiation on ART and viral load suppression with an odds ratio of better viral suppression with ages below 30 years, and high viral load.

Recency testing proved instrumental in identifying individuals at high risk, facilitating rapid linkage to care, and optimizing treatment outcomes. These findings underscore the potential of integrating recency testing into routine HIV programs as a tool for improving epidemiological tracking, addressing gaps in care, and contributing to global HIV elimination goals.

CAS25 003

CARIAN: Building a Caribbean Atmospheric Network to Advance SDG-Driven Research, Innovation, and Action

Thomas Plocoste[1]*, Sébastien Luissaint[2], Mark N. Wuddivira[3], Ulises Jauregui-Haza[4]
[1]Department of Research in Geoscience, KaruSphère Laboratory, Abymes 97139, Guadeloupe (F.W.I.)
[2]Myditek, Baie-Mahault 97122, Guadeloupe (F.W.I.)
[3]Faculty of Food and Agriculture,The University of the West Indies, St. Augustine, Trinidad and Tobago
[4]Area of Basic and Environmental Sciences, Instituto Tecnológico de Santo Domingo (INTEC), Santo Domingo 10602, Dominican Republic
*Correspondence: thomas.plocoste@karusphere.com

Abstract

The Caribbean region faces increasing environmental pressures due to the combined effects of climate change and transboundary air pollution events, particularly Saharan dust intrusions [1]. Rising temperatures, shifting rainfall patterns, and the intensification of extreme weather events exacerbate the vulnerability of island ecosystems. Within this context, Saharan dust can significantly impact air quality, climate regulation, and terrestrial and marine ecosystems, yet systematic and regionally integrated monitoring of these phenomena remains limited [2]. To address this gap, the CARIbbean Atmospheric Network (CARIAN), co-financed by the Interreg Caraïbes 2021–2027 programme, will initially deploy solar-powered monitoring stations in Guadeloupe, the Dominican Republic, and Trinidad & Tobago. These stations will simultaneously measure air pollution, meteorological parameters, and soil properties, enabling a comprehensive assessment of environmental dynamics in tropical island contexts. The ultimate objective is to expand this network so that, within five years, every Caribbean island will operate its own atmospheric observation system with special focus to air quality. By combining scientific expertise, technological innovation, and local stakeholder engagement, CARIAN aims to (i) strengthen predictive capabilities for air quality and climate-related hazards, (ii) assess environmental and socio-economic impacts, including on agriculture and aquaculture, and (iii) support evidence-based policy actions in line with the Sustainable Development Goals (SDGs 3, 13, 14, 15 and 17). This initiative also fosters North–South cooperation and capacity-building, positioning the Caribbean as an active contributor to global atmospheric research. The first deployment phase is scheduled for 2025, with early results expected to enhance regional resilience to environmental and climatic challenges.

Keywords: Saharan dust; Air quality; Climate change; Environmental monitoring; Caribbean climate

CAS25 008

From Waste to Pavement: Runoff Contamination Risks

Lee P. Leon, Monique Aldana

Department of Civil and Environmental Engineering, University of the West Indies, St. Augustine, Port of Spain,
Trinidad and Tobago

Abstract

The growing use of waste-derived materials in asphalt pavements is driven by the need to conserve natural resources, reduce costs, and support circular economy practices. While these materials such as crumb rubber (CRM), recycled asphalt pavement (RAP), and recycled concrete aggregate (RCA) offer proven mechanical and economic benefits, their potential environmental impacts remain less understood. Of particular concern is the leaching of pollutants into stormwater and groundwater systems, especially in tropical climates where high rainfall and infiltration rates may accelerate contaminant release. This study investigated the short-term leaching behaviour of conventional hot-mix asphalt (HMA) and three waste-modified mixtures containing CRM, RAP, and RCA. Cylindrical specimens were fabricated and submerged in potable water for periods of 0.5, 1, 2, 4, 6 and 24 hours. The leachates were analysed for colour, turbidity, pH, nitrates, phosphates, and chlorides, with results benchmarked against international and national drinking water quality standards. Findings showed that all mixtures remained within permissible limits, but waste-modified specimens released higher contaminant loads than HMA. RCA was the most critical, with chloride concentrations peaking at ~313 mg/L and stabilising near 210 mg/L, close to the 250 mg/L threshold. RCA also exhibited phosphate levels ~40% higher than HMA. CRM displayed late-stage increases in turbidity (~3 NTU) and colour (~15 Pt-Co units), while RAP performed most similarly to HMA with only marginal nitrate increases. These results highlight that while waste incorporation supports sustainability, environmental risks must be managed. The study underscores the importance of material screening, substitution limits and monitoring to ensure that waste-modified roads contribute positively to SDG 6 (Clean Water), SDG 11 (Sustainable Cities), and SDG 12 (Responsible Consumption) without compromising ecological integrity.

Keywords: Asphalt pavements, Waste materials, Leaching behaviour, Water quality, Sustainable development, Stormwater runoff

CAS25 010

Obesity and complications

Alain Pietrus

Université des Antilles
UFR des Sciences Exactes et Naturelles
Département de Mathématiques et Informatique
Campus de Fouillole

Abstract

In the Caribbean obesity is a real problem, 25% of the people are obese and 60% are overweight. The root cause of obesity, and being overweight, is an energy imbalance between calories consumed and calories expended. Obesity contributes to cancer and to hypertension by mechanisms such as insulin resistance and hyperinsulinemia. An interesting way to understand these diseases and their links is to use compartmental models. The objective of this study is to gain a better understanding of the links between obesity and its complications.
The problem is described by a system of ordinary differential equations. The mathematical concepts used in this study are dynamical systems and optimal control theory.
We give some stability results and existence of a control on obesity. This will refer to analysis and discussion in the context of the OBECAM project which will be presented at this CAS Conference. This study offers a model to link obesity to its complications in a unified way. The study could be used for future research, and our aim is to also give some recommendations to the authorities in order to reduce the complications. The advantage of considering a unified way is to simplify the recommendations to be made to the authorities and to promote the chances that they will be applied.

CAS25 012

Profiling the Pharmacological Properties of Prunus dulcis

Brij Bhushan Tewari*[1] and Subramanian Gomatinayagam[2]
[1]Department of Chemistry, Faculty of Natural Sciences, University of Guyana
[2] Director, University of Guyana, Berbice Campus
* Presenting author E- mail: brijtew@yahoo.com

The aim of this study is profiling the pharmacological properties of Prunus dulcis (Almond). Present research work has investigated the antibacterial and antifungal screening and pharmacological properties of various leaves extract of a Guyana flora, Prunus dulcis. Prunus dulcis green leaves were collected from University of Guyana, Turkeyen Campus, dried in oven at 50 -55 ^{0} C for 72 h and moisture content is calculated. The dried and grounded leaves of Prunus

dulcis were extracted in each ethanol, methanol and acetone solvents. The evaporation of solvent was done on rotavapors. The respective solvents were added to viscous semi solid liquid extract to make up desired volume of extract solution. Antimicrobial and antifungal potential of all leaves extract were studied using diffusion, poison plate, paper disc plate and streak plate methods against microorganism Escherichia coli, Staphylococcus aureus and Candidus albicans. All assay was studied in duplicate and central plates without leaves extract were used for reference. All leaves extract showed antibacterial and antifungal potential against organisms E. coli, S, aureus and C. albicans. In most assays studied maximum and minimum antimicrobial potential was observed for methanol and acetone solvents, respectively. Among four methods used for antimicrobial and antifungal assay studies, poison plate method and streak plate method were found to have highest and lowest inhibitory zone, respectively. Almonds have been used traditionally for curing wounds, anemias, insomnia, headache, sore throat, brain infection, kidney disorder etc. Results obtained from present studies are useful for researchers of similar research interests.

Key words: Prunus dulcis, Leaves extracts, Antibacterial, Antifungal, Screening

CAS25 014

Co-occurrence of Six Alien Terrestrial Flatworms in an Urban-Academic Ecosystem in Jamaica: Ecological, Economic and Public Health Implications

Javin Wollaston[1], Ralph Robinson[1], John Lindo[2], Kamron Bennett[3], Kerri-Ann Bennett[1], Stacy-Marie Bennett-Monroe[1] and Marco-Dean Brown[1]*
*Corresponding Author
marcodean.brown02@uwimona.edu.jm

[1]Department of Life Sciences, The University of the West Indies at Mona, Kingston 7, Jamaica
[2]Department of Microbiology, University Hospital of the West Indies, Kingston 7, Jamaica
[3]KSAHD GIS Transformation Unit, Kingston and St. Andrew Health Department, Kingston 5, Jamaica

Abstract

Alien terrestrial flatworms (Tricladia: Geoplanidae) are primarily introduced through soil associated with the ornamental plant trade. Several species disrupt soil biodiversity by preying on native invertebrates, with implications for agriculture and food security. Others pose public health risks: notably, *Platydemus manokwari* is a paratenic host of *Angiostrongylus cantonensis*, the main aetiological agent of eosinophilic meningitis, an emerging infectious disease in the Caribbean. This study was conducted on the Mona Campus of The University of the West Indies, Kingston, Jamaica. The area was divided into 10 sectors demarcated by major roadways, aligning with distinct ecological zones. Within each zone, a representative plot was surveyed using informed visual searches and soil sampling. Flatworms were identified through diagnostic morphological features. Six alien geoplanid species were documented, representing a 43% increase in the number confirmed from Jamaica and the first global record of such high species richness within such a small locality. Findings include the first Jamaican record of *Kontikia*

ventrolineata (n=29), confirmation of *Caenoplana* sp. (n=4) and *Rhynchodemus* sp. (n=2), and the presence of *Dolichoplana striata* (n=29), *Bipalium vagum* (n=7), and *P. manokwari* (n=60). *P. manokwari* was the most abundant, comprising 47.6% of specimens, and showed range expansion from northern into southeastern Jamaica. Species richness (n=5) was highest at the campus plant nursery, whereas residential areas with gardens exhibited the greatest abundance (p=0.002), reinforcing soil movement in plant trade as a major introduction pathway.
The detection of multiple alien flatworms within this small urban ecosystem (<700 acres) highlights how anthropogenic activities facilitate establishment of exotic taxa. Abiotic conditions, including soil pH of $\bar{x}$=6.8, ambient temperature of $\bar{x}$=22.4°C, and soil moisture of $\bar{x}$=11.6%, provided favourable colonisation conditions. These findings reveal gaps in biosecurity frameworks and the urgent need for surveillance and monitoring, given the potential synergistic threats posed to biodiversity, agriculture, and public health.

Keywords: Geoplanidae, flatworms, alien, *Platydemus manokwari*, *Angiostrongylus cantonensis*, soil, biodiversity, Jamaica

CAS25 016

Climate Smart Agriculture Practices in Guyana

Raymond Jagessar* [1],
.[1]Lecturer, Department of Chemistry, Faculty of Natural Sciences, University of Guyana, South America
raymond.jagessar@uog.edu.gy

Abstract

Our world is faced with global warming and its effects, due to the net accumulation of greenhouse gases such as CO_2, N_2O and CH_4 in the atmosphere. Global warming has been the impetus for Climate Change and has caused havoc on Caribbean infrastructure, affected agriculture production and productivity and the livelihood of many in the Caribbean States. Agriculture production has decreased across the Caribbean. Agriculture is the key backbone of Guyana's economy and thus all efforts are directed to protect Guyana's agriculture industry amidst Climate Change. This would necessitate the implementation of Climate Change Sustainable Smart Agriculture Practices, adding resiliency to agriculture production and productivity. These measures will enhance Guyana's Low Carbon Development Strategies, LCDS. The objectives of this presentation are to examine Smart Agriculture Practises internationally and in Guyana and to examine how Guyana can improve on its Smart Agriculture Practises (SAP). A total of twenty-five (25) research articles were reviewed. Amongst SAP implemented are shade houses, vermicomposting, development of crop varieties that are resistant to arduous climate change effects, induced by global warming. The Agriculture and Innovation Entrepreneurship Programme

(AIEP) will continue to see the construction of shade houses across Guyana to enhance the production of high-value crops such as broccoli and cauliflower. The pilot project, comprising 25 shade houses, can generate close to $70 million of the selected crops per year. Other Climate Change Smart agriculture practices include drip irrigation, greenhouse cultivation, crop rotation, and diversification. These will promote water conservation, reduce erosion, improve soil formation and structure, and encourage more stable ecosystems which will boost the supply of organic nutrients to the soil, and reduce the need for artificial fertilisers. Also, the implementation of genetically modified crops (GMO) to resist the arduous climate change effects and the implementation of zinc fortified rice variety. The Government of Guyana has implemented several Climate Smart Agriculture practices outlined above and it has brought food security to Guyana.

Keywords: Global warming, Climate Smart Agriculture Practises, Shade houses, hydroponics, drip irrigation

CAS25 021

The Caribaea Initiative – Building Capacity in the field of Biodiversity Conservation

Nicole A M Herbert, Mark A Freeman, Frank Cézilly
Caribaea Initiative and Ross University School of Veterinary Medicine

Abstract

The Caribbean is one of the world's major biodiversity hotspots, and one of the most threatened. Preserving its natural heritage must be based on solid scientific foundations and coordinated at the regional level. Nearly two-thirds of recent scientific publications do not include Caribbean researchers as authors. It is therefore essential to strengthen the region's capacities in conservation biology. In this context the NGO Caribaea Initiative (CI), officially based in Guadeloupe, has been working over the past decade to strengthen expertise within Caribbean islands by training researchers from the region at master's and doctoral levels and by developing research geared towards biodiversity conservation. We illustrate by using two research programs that are relevant from a socioeconomic perspective. The Caribbean Spiny Lobster (*Panulirus argus*) is fully- or over-exploited throughout its geographical range. Its sustainable management is therefore essential at the regional level. CI partnered with Ross University School of Veterinary Medicine, St Kitts & Nevis to develop a research program on the biology of the species. This research revealed the presence of an egg-predator worm, *Carcinonemertes conanobrieni*, which reduces the reproductive potential of the host, with consequences for fisheries. *Carcinonemertes* has been reported in *P. argus* in Florida, Saint Kitts, and South

America, suggesting that it is present throughout the host's range and highlighting the need for regional efforts to reduce the parasite's impact. The second program focuses on managing the impact of exotic vertebrates on biodiversity and public health. In collaboration with partners in Haiti, the Dominican Republic, Guadeloupe, Dominica, and Martinique, and with the support of the Interreg Caribbean program, CI has developed research on exotic reptiles, birds, and mammals, to propose management measures. We discuss why strengthening networking and collaboration between countries in the Caribbean islands are essential to addressing common challenges in biodiversity conservation.

KEYWORDS: Biodiversity, *Carcinonemertes*, Conservation Biology, Invasive Species, *Panulirus argus*

CAS25 030

Assessing Risk Perception, Safety Behaviours and Types of Knowledge in a Small Island Developing State of the Caribbean: Contributing Factors to Household Actions and Inaction

Tracy Marshall[a], Arlette Saint Ville[a], Gabrielle Thongs[a], and George Legall[a]

[a]The University of the West Indies, St. Augustine Campus
St. Augustine, Trinidad and Tobago

Abstract

This research paper presents an evidence-based approach to better understand factors that influence risk perception (RP), examining safety behaviours (SB) and the role of knowledge types and sources. It develops an integrative framework and assessment tool (IFAT) that demonstrates the potential utility in operationalizing and integrating these concepts. Data items were collected from May 2021 to May 2022 in Barbados, a SIDS in the Caribbean, exposed to multiple hazards. An online and telephone questionnaire was administered to households using a purposive sample (n=185). Chi-square tests identified variables associated with household actions and inactions with their levels of RP and SB. Pearson's Product-moment Correlation identified all pairwise correlations among knowledge scores, RP scores, and SB scores. Logistic Regression identified predictors of levels of RP, SB, and knowledge. Results showed significant associations between inaction to certain hazards and selected socio-demographics, personal experiences, and value of basic items. Levels of RP and SB were associated with levels of formal and informal knowledge. It was found that age was a predictor of types and sources of knowledge, and type of occupancy was a predictor of RP and SB levels. Combined worldviews were found to be a predictor of RP levels via Multinomial Logistic Regression. These findings highlight the essential need for baseline data collection and analysis for monitoring household behaviours in target groups. These findings make a case for follow-up research; however, the findings cannot be generalised to the national population. The results can be used as baseline

information to start building a profile for a country for future research. The IFAT can be used to indicate changes over time and for monitoring and evaluating DRR interventions.

Keywords: Disaster Risk Reduction, hazards, safety culture, integrative framework, assessment tool, Barbados

CAS25 036

Resilient Communities, Resilient Heritage: Museums, Climate Change, and Social Sustainability in a Changing World

Shanice Martin

Abstract

As the global climate crisis intensifies, particularly in climate-vulnerable regions such as Small Island Developing States (SIDS), the Caribbean, and parts of Europe increasingly impacted by extreme weather events, museums face unprecedented physical and existential threats. Yet these institutions are not only custodians of objects, but they are also community anchors, education hubs, and platforms for dialogue. This paper explores how museums can respond to climate change through the lens of social sustainability and community-based social work approaches, emphasizing inclusive, participatory models of resilience.

By aligning their missions with the United Nations Sustainable Development Goals, museums can foster deeper community engagement and environmental advocacy. Drawing from case studies across the Caribbean, SIDS, and climate-affected parts of the UK, this paper examines how museums have co-created climate action initiatives with local communities, engaged in intergenerational knowledge-sharing, and utilized principles of social work such as empowerment, inclusion, and cultural competence.

CAS25 049

Investigating the prevalence, attitudes, knowledge, and impact of AI tools among physicians in Trinidad and Tobago: A pilot study of physicians' perspectives

*J Morean[1], J Beepat[1], J Ramdeen[1], K McClean[1], K Jaisingh[1], K Jadoo[1], J. Liverpool[1], A Adenekan[2], A Williams-Persad[2]

[1]Faculty of Medical Sciences, The University of the West Indies, St Augustine, Trinidad and Tobago; [2]Public Health and Primary Care Unit / Pharmacology Unit, Department of Paraclinical Sciences, Faculty of Medical Sciences, The University of the West Indies, St Augustine, Trinidad and Tobago

Corresponding author: josiah.morean@my.uwi.edu

Abstract

The objective of this study is to identify AI tools currently used by physicians, to assess attitudes, knowledge and the impact of AI on clinical practice, and identify factors that influence their willingness to adopt AI tools in clinical practice across Trinidad and Tobago.

A cross-sectional design in this pilot study was conducted over a six-week period. Quantitative data were collected through an online survey using purposive sampling. Distribution was restricted to professional networks and medical associations, inviting the target size of 905 physicians practicing in private and public sectors across Trinidad and Tobago to participate. 57 responses were uploaded to SPSS (v.30.0.0.0) and analyzed using descriptive statistics, cross-tabulations, logistic regression analyses and chi-squared tests. All responses were securely stored with password protection.

On analysis it was found that 33.3% of physicians reported using AI tools in clinical practice, of which ChatGPT accounted for 89.5% and Gemini 10.5%. Most were hesitant mainly due to fear of misdiagnosis, dependence, data privacy and bias. Education and addressing these concerns will be pivotal in implementation. Younger doctors showed higher adoption, with 100% of those aged 28–30 using AI compared to 0% over 60, reinforcing the importance of education, especially to physicians over 50. In the public sector, only 5.3% with over 20 years' experience used AI, compared to 52.7% with under 10 years. In private practice, 57.1% reported use, highest among those with under 10 years' experience. Regarding attitude, 89.5% believed AI will revolutionize medicine and 52.6% of non-users were in favour. 100% of current users were in favour. 53.8% viewed AI as useful and believed it should be implemented in healthcare.

AI use among physicians remains limited. Future studies should aim to raise awareness, ensure safe clinical integration, and evaluate long-term effects on patient care.

CAS25 050

Getting the Community Ready for Climate Change: A Scenario Planning Framework for Climate Change Education for Resilient Coastal Communities

Shivanie Betty Ramcharitar and Dr Julia Kotzebue

Department of Geomatics Engineering and Land Management, The University of the West Indies, St Augustine Campus

Abstract

Climate change has resulted in vulnerable coastal communities that are unprepared for its impacts. In the coastal region of Icacos in Trinidad and Tobago, the permanent inundation of coastal areas has resulted in the loss of homes and livelihoods. Interestingly, some coastal communities in the region have experienced accretion, prompting residents to resettle without planning, coordination, or government intervention. Similarly to other coastal communities, this informal solution is not without its hazards, as these newer locations are also under threat of climate change impacts. Therefore, there is an urgent need for planning at the community level, including education on the impacts of climate change. Scenario planning, a disciplined method for imagining possible futures, has been used in community planning, where representative stakeholders collaborate in a workshop setting to create inputs, identify strategies, and propose solutions for shared visions of the future of their communities based on impacts. Since many community members may not be formally educated or have been exposed to specific subjects that teach about climate change education, they may not be aware of the impacts or potential solutions. For scenario planning to be effective, the community planning exercise must involve educating community members about climate change impacts where planners are translational intermediaries between scientists and members of the public. The climate education exercise would support residents' experiential knowledge and perception of risk for appropriate decision-making for their communities. This research introduces a theoretical framework that will critically reflect the discourse on scenario planning and climate change education for community planning using an urban planning lens. The resulting Scenario Planning Framework for Climate Change Education would be presented for practical implementation in community planning to foster resilient communities.

Key words: Scenario Planning, Climate Change Education, Coastal Communities, Community Planning

CAS25 058

The Extraction of Cellulose from *Bambusa vulgaris* (Bamboo) Biowaste for the Synthesis of Useful Products for Environmental Purposes

Bhanumattee Ramdhanie, Dhurjati Prasad Chakrabarti, Faisal Mohammed, Sharad Maharaj, Khadir Manwah and Oshaine Blake

Department of Chemical Engineering, Faculty of Engineering, The University of the West Indies, St Augustine, Trinidad & Tobago.
bhanumattee.ramdhanie@uwi.edu

Abstract

Cellulose is a naturally occurring polymer, commonly found in lignocellulosic biomass, and has no adverse effects on health or the environment. The degradability, sustainability and ability to form self-supporting structures makes cellulose an ideal compound to be explored, as a possible solution to satisfy the increasing demand for biodegradable and environmentally safe solutions to existing, and growing issues. This research aims to investigate extracting cellulose from waste *Bambusa vulgaris* (bamboo) biomass by using the physical extraction techniques: autoclave, pressure vessel, and supercritical fluid extraction (SFE). The recovery of cellulose from waste bamboo biomass at reduced reagent concentrations was also explored. The autoclave operates at 121˚C and 15 psi which can aid extraction of cellulose by disrupting the lignocellulosic structure. A pressure vessel was used to securely contain pressures higher than atmospheric pressure. As such the biowaste was exposed to pressures ranging from 30 psi to 90 psi and temperatures between 70°C and 90°C. SFE uses supercritical fluids (a fluid which exhibits both gaseous and liquid properties at temperatures and pressures beyond the critical point) to extract the compound of interest. SFE was used to subject the sample to the changes in temperature and pressure, enough to fracture the biomass structure and was carried out using the conditions 300 bar and 60 ˚C for 2 hours. The effects of the autoclave, pressure vessel and SFE on the biowaste were explored over a sodium hydroxide concentration ranging from 1.5% to 20%. It was determined that the pressure vessel method of extraction was the most appropriate of all the methods explored. The optimized extraction conditions for the maximum yield, determined using the Design Expert software, utilizing the pressure vessel, resulted in a pressure of 90 psi, temperature of 70 ˚C and a sodium hydroxide concentration of 1.5 %.

Keywords: biowaste, cellulose, lignocellulose, autoclave, pressure vessel, supercritical fluid extraction

CAS25 069

A Framework for Assessing Household Innovation in Selected Regions

Cilla Pemberton
The University of the West Indies, St. Augustine
cilla.pemberton@uwi.edu

Abstract

The purpose of this paper is to present a framework for a year-long study measuring household innovation among selected participants from the Caribbean, West Africa, Canada, the United States and the United Kingdom. Household innovation is the term used to describe the massively underreported and unmeasured innovation that occurs for personal use or limited use, without the commercialization aspect. The 4th Edition of the Oslo Manual recognizes household innovation and Gault, Arundel and Kraemer-Mbula (2023) outline innovation indicators and a means for measurement via a questionnaire. The framework includes the adjusted questionnaire design, the design of an additional participative element which will include an Innovation Jam based on Design Thinking with associated Q-Study and the execution of a pilot study.

The study proposed by this paper is important because sustainable and resilient futures require that most individuals be innovators. Innovation can originate anywhere in the world, from any population and while the innovation created out of need, for example, has generally not been acknowledged or measured, these types of innovations may eventually solve local, regional and extra-regional issues. The proposed study will record a list of some of these innovations and assess the motivation of youth to engage in social and industrial innovation, pre- and post-innovation jam. Research limitations may arise with ethical approval for the study and willingness of participants to share, even though they may not be aware of the value and potential of their ideas. Practical limitations will include the limited budget for the project in which items which qualify will be funded through the researcher's Study and Travel Grant and Institutional Visit Allowance and those which do not qualify will be funded through personal funds.

Keywords: Household Innovation; Q-Study; Design Thinking; Caribbean; West Africa

CAS25 074

Sustainable Roof Insulation: Modelling the Effects of Recyclable Materials on Energy Efficiency and Comfort

*Nathaniel Cassim, Aneil Ramkhalawan, Ejae John and Prakash Persad.
University of Trinidad and Tobago
nathaniel.cassim565@we.utt.edu.tt

In tropical regions like Trinidad and Tobago, rising temperatures and energy costs emphasize the need for sustainable building solutions. This study evaluates the effectiveness of recycled materials as roof insulation in Trinidad and Tobago. The key objectives were to assess the impact of various recyclable materials on heat transfer, optimize insulation design and analyse the cost and environmental benefits.

The methodology involved creating a MATLAB model to simulate heat transfer through a roof using equations for conduction, convection and radiation. The model also calculated total heat load and estimated energy costs. Materials tested utilized data from our local waste management facility in Trinidad and Tobago which included materials such as aluminium foil, construction plastic, cardboard, paper, calendared paper, styrofoam and rubber from tyres at different thicknesses. The air gaps between the materials and roof were also investigated to determine the effects.

The key findings showed that styrofoam and paper were the most effective insulating materials respectively by significantly reducing heat transfer when compared to no insulation. The addition of air gaps further enhanced the insulation performance, with reductions of 8.3% in BTU for styrofoam and 8.18% for paper. Energy savings reached up to $0.96 (TTD) every three (3) hours with styrofoam and $0.93 (TTD) with paper respectively. However, a cost-benefit analysis revealed that paper was the most economical option due to its lower recycling costs and environmental benefits.

The study acknowledges that further validation of the model is required for more accurate heat transfer and heat load calculations. Additionally, assessing the impact of the insulation solutions on thermal comfort and exploring their feasibility in the local context of Trinidad and Tobago are recommended for future research.

This study demonstrates the potential of using recycled materials as roof insulation to combat climate change impacts. It can lead to notable energy and cost savings while also being environmentally friendly and sustainable. The developed model also provides a useful tool for evaluating different insulation strategies and informing decision-making during the design process.

Keywords: heat transfer, recyclable materials, MATLAB, energy efficiency, comfort

CAS25 075

Convective Organization in the Tropical Atlantic using Two Precipitation Datasets

*Shem Robinson[ab], Hans Segura[b], Sebastian Ortega[b], Bjorn Stevens[b]

[a]Caribbean Institute for Meteorology and Hydrology, St. James, Barbados
[b]Max Planck Institute for Meteorology, Hamburg, Germany
Corresponding Author: Shem Robinson, shem.h.robinson@gmail.com

Abstract

This study investigates the representation of convective organization over the Tropical Atlantic region, utilizing the latest versions of two widely adopted satellite-based precipitation estimate products- NASA's Integrated Multi-satellitE Retrievals for GPM v07 (IMERG v07) and the JAXA Global Satellite Mapping of Precipitation Microwave-IR Combined Product Version 8 (GSMaP_MVK v08). A climatological comparison of daily precipitation rate estimates from both datasets was conducted over the period January 1st, 2001, to November 30th, 2024, to assess their consistency and regional biases in global tropical rainfall representation. Differences in precipitation estimates in the Tropical Atlantic, Tropical Pacific and Tropical Warm Pool are represented by linear relationships. To quantify and compare convective organization, the Convective Organization Index (Iorg) is computed across the Tropical Atlantic domain using daily precipitation fields from both products from January 1st, 2024, to November 30th, 2024. The results of this investigation indicated that there are notable differences in the interpretations and representations of the clustering of convective systems in the datasets from the region of study, particularly in the characteristics of identifiable clusters, as well as variation in computed Iorg values throughout the year. The findings of this investigation show how convective activity in Tropical regions may be modeled. In addition, the research may be used to examine the causes of the disparities previously described.

CAS25 076

The Feasibility of a Smoke Forecast Model in the Caribbean: A Focus on Barbados

Adria Leben, Nathan Collymore, Rebecca Chewitt-Lucas, Andrea Sealy
The Caribbean Institute for Meteorology and Hydrology

Abstract
The Caribbean region is highly susceptible to forest and grass fires due to its tropical climate. During the dry season (December – May), reduced rainfall and increased sunshine lead to drier soils and vegetation, creating conditions which are conducive to the ignition and spread of grass and forest fires. According to the Barbados Fire Service, grass fires account for 25%–50% of the reported fires annually. This highlights the importance of understanding smoke plume behaviour in the tropics – specifically, how smoke plumes disperse vertically under varying atmospheric stability and are transported horizontally by prevailing winds. The particulate matter (PM) within smoke aerosols, such as PM2.5 and PM10, can adversely affect the health of vulnerable

populations. In this study, two grass fire events occurring on 25 February 2024 and 10 March 2025 are examined. While the PM concentrations of the smoke aerosols did not exceed the short-term (24-hour) air quality guidelines as recommended by the World Health Organization (WHO): 15µg/m3 for PM2.5 and 45µg/m3 for PM10 spikes in the 10-minute averaged PM concentrations were observed to have surpassed these thresholds. These spikes may pose significant health risks to individuals with respiratory conditions or compromised immune systems. Since this a novel idea to the region, challenges were encountered in gathering the data, however, the findings demonstrate the value of developing a mesoscale smoke forecasting model for Barbados and other Caribbean countries. Such a model would not only project plume dispersion but, by incorporating 10-minute averaged PM concentrations, also reduce the likelihood of underestimating fire event impacts.

Keywords: smoke aerosols, grass fires, Barbados, air quality, health impacts

CAS25 077

An Investigation into the Relationship Between Saharan Dust and Weather Elements

Nathan Collymore
Caribbean Institute of Meteorology and Hydrology

Abstract

Saharan dust is a collection of mineral dust particles and organic matter that is transported by wind across the Atlantic. Dust plumes are known to travel great distances across oceans and land masses from their point of origin in the Sahara Desert, North Africa. Saharan dust is categorized by size with the most frequently used categories being PM2.5 and PM10 (Particulate matter with a diameter of 2.5 or 10 micrometres or less). The main aim of this research is to assess whether the presence of Saharan Dust impacts weather elements like Temperature and Relative Humidity. In this study the 500nm Aerosol Optical Depth (AOD) from NASA's Aerosol Robotic Network (AERONET) was used for the selection of three significant dust events with consistent data collection which are 18th-24th June 2020 (GODZILLA Event), 14th-15th August 2023 and 20th-24th March 2024. Additionally, ERA5 reanalysis Satellite data from Copernicus was used to obtain the Temperature and Relative Humidity at the 300mb, 700mb and 1000mb levels for each event. In all three cases the Pearson Correlation Coefficient revealed a fair-strong positive relationship between Aerosol Optical Depth and Temperature at the 100% significance level. However, regarding AOD vs Relative Humidity, the June 2020 and March 2024 events showed extremely weak positive and negative relationships respectively, but they exceeded the limit for statistical significance and could not be used to quantify the linear relationship. Fortunately, the August 2023 event showed a strong negative correlation between these variables at the 100% significance level, meaning that this could be referenced as a valid indicator of the linear relationship present. During the data collection phase of this study, the major challenges faced were in relation to missing data within datasets or improper media coverage of the dust events which made it exponentially more difficult to define dust event time scales. Nevertheless, this study showed that there is a need for further research on the possible relationships between Saharan dust and Weather Elements, where future projects could focus on the inclusion of variables such as wind speed or even how these relationships change with varying Saharan dust particle sizes.

CAS25 080

A Stakeholder Driven Framework for Prioritizing Farm Climate Adaptation Practices in Trinidad and Tobago

Murphy, B[1*]

Department of Food Production, Faculty of Food and Agriculture, The University of The West Indies (St. Augustine Campus), Trinidad and Tobago

* brandon.murphy@my.uwi.edu

Abstract

Climate adaptation in agriculture must be locally tailored, particularly in Global South countries like Trinidad and Tobago, where climate vulnerability and limited resources create urgent challenges. Climate-smart agriculture (CSA) offers a promising pathway for driving agricultural transformation and enhancing resilience within agri-food systems. However, the success of CSA depends on a deep understanding of local contexts and the value that agri-food system actors place on specific adaptation practices.

This study developed and tested a participatory prioritization methodology that captures these perspectives across Trinidad's agri-food value chain. The approach engaged multiple stakeholders to evaluate and rank CSA interventions based on their perceived ability to strengthen farmer resilience, improve farm biodiversity, and boost productivity. By integrating stakeholder values with adaptation priorities, the methodology also explored how bundled climate-resilient practices can be aligned with emerging climate finance tools.

The resulting co-developed framework offers a context-sensitive decision-support tool for governments, investors, and other agri-food system stakeholders aiming to design inclusive, finance-ready CSA strategies aligned with national adaptation goals. Beyond prioritization, this participatory approach fosters systems thinking by embedding local knowledge into climate planning processes, enabling more equitable and effective agricultural transformation. It presents a scalable and adaptable model for translating stakeholder insights into actionable CSA investments across small islands, and developing nations, while strengthening coherence between grassroots innovation, climate finance mechanisms, and policy development.

Keywords: Climate Adaptation, Agri-Food Systems, Agricultural Transformation, Climate Finance.

CAS25 087

The Role of Ocean Modelling in the Analysis of Hydrometeorological Hazards in the Eastern Caribbean

*Shanice Whitehall, David Farrell, Lawrence Pologne, Andrea Sealy, Ashford Reyes

Caribbean Institute for Meteorology and Hydrology

Abstract

Recurrent rapid-onset events, such as tropical cyclones, produce $835 million in damage each year in the Caribbean (Lewis, 2022). These cyclones leave a lasting economic footprint which lingers for up to twenty years, affecting recovery efforts and the slowing resilience building efforts of the impacted communities. The limited hydro-meteorological, climate and marine observation data, particularly near the Lesser Antillean chain (LAC), increases the vulnerability of these small island states to hydrometeorological hazards. Goni et al (2017) highlighted that observational data provided by ocean liders, profiling floats, and drifters deployed in the tropical Atlantic during hurricane season provide upper-ocean and atmospheric observations key to initialising coupled numerical ocean-atmosphere forecast models. Unlike the continental US and their dependencies, the islands of the eastern Caribbean lag, with limited real-time upper ocean observations in support of risk-informed decision-making for coastal communities. Given the lack of these observations, there is a heavier reliance on satellite retrievals and ocean modelling. The suite of marine modelling products developed at the Marine Forecasting Support Center at the Caribbean Institute for Meteorology and Hydrology reduces the gap in the observational network.

Hindcasts of the oceanic conditions before and after the passage of TC Maria (2017) and TC Beryl (2024) using the HYCOM ocean model reveal that the tropical Atlantic was ideal for hurricane development. Low salinity, warm water with multiple anticyclonic warm core eddies from the North Brazilian Current were analysed near the LAC. These hindcasts show that oceanic model outputs should also be a part of early warning systems used in regional forecasting. These tropical cyclones resulted in over USD$500 million in damage across multiple islands in the Lesser Antilles. (NHC, 2017, CDEMA, 2024).

For the Caribbean to sustainably develop, it is critical to understand the marine processes at play in the region. Small Island Developing States (SIDS) have marine exclusion zones, and related resources are significantly greater than their land mass. As a result, the coastal and marine environment plays a critical role in the evolution of nearly all aspects of SIDS, including their socioeconomic development, which includes food security and is not limited to marine forecasting. (CIMH 2024)

Theme 5 – Industry-Academia-Government-Partnerships

CAS25 002

Fast-Tracking Climate-Smart Cassava Research through Multi-Stakeholder Partnerships: Insights from Project Grow in Jamaica

Fradian Murray[a,c], Racquel Williams[a,c], Nickeisha Reid[b], , Stephannie Coy[a], Lisa Myers-Morgan[b], Alex Sybron[b], Dale Rankine[d], Jane Cohen[c], Michelle Sherwood[b], Michael Williams[a], Narado Richards[a] , Fitz Hoad[a]

[a]Desnoes & Geddes Foundation, Kingston, Jamaica
[b] Ministry of Agriculture and Fisheries, Kingston, Jamaica
[c] Department of Life Sciences, The University of the West Indies, Mona Campus, Kingston, Jamaica
[d] Department of Physics, The University of the West Indies, Mona Campus, Kingston, Jamaica
Corresponding author: Fradian Murray email: Fradian.murray@uwi.edu
*Corresponding author: Currently at Department of Biological and Chemical Sciences, The University of the West Indies, Cave Hill Campus, St. Michael, Barbados

Abstract

This case study presents *Project Grow: Accelerating the Inclusion of Small-Scale Farmers and Youth into the Commercial Cassava Value Chain*, a multi-stakeholder initiative implemented by the Desnoes & Geddes Foundation (D&G) and funded by IDB Lab (2016–2020). The project responded to Jamaica's persistent challenges of low cassava yields (9–14 tons/ha) and fragmented research by establishing a collaborative framework that united industry (Red Stripe), the government (Ministry of Agriculture and Fisheries MOAF), academia (UWI Climate Studies Group Mona), and international partnerships (ACDI/VOCA).
From 2018 to 2020, the research component focused on building climate-resilient cassava systems through four key objectives: (1) replicated varietal trials across five agroecological zones to identify high-yielding (≥28 tons/ha), high-starch (≥25%) cultivars; (2) genotypic and phenotypic characterization of nine varieties, confirming three Jamaican landraces; (3) intercropping trials using non-branching and branching cultivars, which increased profitability when paired with pumpkin or corn; and (4) development of the ACCEPT Agri platform to generate climate-informed yield forecasts via DSSAT-MANIHOT modeling.
Over 90 disadvantaged youth were trained in field data collection and agronomic techniques. Despite challenges such as farmer delinquency, labour shortages, and limited lab starch tests, major deliverables were achieved: Jamaica's first cassava identification handbook, increased varietal adoption, and institutional use of ACCEPT Agri at UWI. Collaborators benefited in tangible ways: MOAF accessed established field experiments and data, renovated greenhouses, and advanced characterizations that were previously limited to phenotypic data. ACDI/VOCA facilitated staff training and eliminated the need for external consultants. Red Stripe and the

D&G Foundation provided land, inputs, funding, and field support—which are typically major constraints for government research divisions and university-based research groups. These results offer scalable models for regional crop improvement, support SDG targets, and contribute to food import reduction in the Caribbean. Sustainability is embedded through capacity building and tangible outputs in agricultural innovation.

Keywords: Climate-Smart Agriculture; Intercropping Systems; Capacity Development; Decision Support Systems; Cross-Sectoral; Acceleration; Jamaica

CAS25 052

Strengthening the Use of Statistics in Guyanese Rice Research

Reynold J. Stone

c/o Caribbean Academy of Sciences-Trinidad and Tobago Chapter, West Indies
reynold.stone@gmail.com

Abstract

The reliability and usefulness of applied agricultural research depend, inter alia, on the choice of an appropriate experimental design, high-quality measurements, the proper selection and application of statistical methods, accurate, complete reporting and correct interpretation of statistical results. In the Caribbean, Guyana is well known for rice production and, more recently, for its rice research. However, an assessment of the quality of this research has never been undertaken. In this study, I examined the reported results from ten experiments (laboratory, greenhouse and field) on Guyanese rice research which investigated the efficacy of plant extracts, bioagents and new generation fungicides in the control of sheath blight (*Rhizoctonia solani kühn*) and rice blast (*Pyricularia oryzae Cav.*) diseases. To undertake the assessment, I developed several numerical algorithms executed in Excel using the reported treatment means and one other statistical measure of variability such as Fisher's Least Significant Difference (LSD), Standard Error of the Mean (SEM) or Coefficient of Variation (CV) to construct the corresponding Analysis of Variance (ANOVA) table for each experiment. Several methodological and statistical flaws were discovered in these experiments. These include but are not limited to: (1) the failure to report F and P values for ANOVAs; (2) the use of ANOVA for experiments with more than five treatments; (3) the conduct of post-hoc pairwise comparison of treatment means using Fisher's LSD tests despite statistically non-significant results in the ANOVAs; (4) the failure to adjust for multiple comparison of treatment means; (5) the improper use of two-way ANOVA without replication instead of one-way ANOVA for Completely Randomized Designs; (6) incongruences in reported LSDs, SEMs and CVs; (7) the existence of statistical anomalies in treatment means of some parameters. These issues with the application of statistical assessment can cast serious doubt on the reliability, validity, credibility and

trustworthiness of the results, findings and conclusions from these experiments. In the interest of openness and transparency in research, it is recommended that the authors make the raw data available to interested third parties for proper statistical analyses. It is further recommended that Guyanese rice researchers consult with a competent, professional biometrician before embarking on experimental rice research.

Keywords: Guyana, rice research, sheath blight, rice blast, plant extracts, bioagents, new generation fungicides, ANOVA, completely randomised design, randomised complete block design

CAS25 055

Management of Waste Cooking Oil in the Kingston Metropolitan Area, Jamaica: Steps towards creating a Circular Economy

Aisha Trimmingham[1], Michael Coley [2]*

1. Department of Physics, The University of the West Indies, Mona, Kingston 7, Jamaica
2. Department of Chemistry, The University of the West Indies, Mona, Kingston 7, Jamaica

* Corresponding author: Email address: michael.coley@uwimona.edu.jm

Abstract

Waste cooking oil (WCO) is a potential raw material for several valuable products. Because most Caribbean islands do not have organized systems for collecting, managing and valorizing WCO, it is often improperly disposed of and can become a source of serious environmental problems. This work explores options for establishing a sustainable system for collecting WCO from commercial food operations in the Kingston Metropolitan Area (KMA) of Jamaica. It also examines the potential for converting the oil into high demand products. Stakeholders involved in generating, collecting or processing WCO either completed questionnaires or were interviewed and their perspectives were used to design a collection system to serve food preparation entities that operate in the rural, sub-urban or highly commercialized areas of the KMA. Findings show that about 58% of the waste cooking oil generators sampled dispose of their used oil on land or through the municipal waste services, thereby making it unavailable for reprocessing. While large restaurants and international food chains contract private recyclers for direct WCO collection, small restaurants and rural cookery shops are underserved and consider micro-hubs as a practical option to ensure access. Improving WCO management in the KMA requires a carefully designed collection system, a clearer regulatory framework, and a targeted environmental awareness programme. Strengthening collection at the restaurant level can secure a consistent feedstock for processors, reduce improper disposal, and position WCO as a building block for Jamaica's circular economy.

Keywords: Waste cooking oil; Waste cooking oil management; Circular economy; Waste cooking oil derived products; Yellow grease; Biodiesel.

Poster Presentations

CAS25 020

Identifying the spatial temporal variability of rivers in Jamaica

*Jevon Yearwood, Dr. Isabelle Gouirand
Dept. of Biological and Chemical Sciences, The Faculty of Science and Technology,
The University of the West Indies, Cave Hill Campus

Abstract

Understanding the seasonality and variability of streamflow across Jamaica's rivers is critical for water resource management, disaster risk reduction, and climate adaptation. This study aims to (i) identify the annual and sub-seasonal variations of the river flow and quantify its relationship with precipitation and (ii) determine spatial patterns. Streamflow data was provided by the Jamaica's Water Resources Authority website to analyzed, specifically with a focus on streamflow variability from sub-seasonal to long-term time scale. Emphasis was placed on summer seasonality, to potentially detect the mid-summer "drought" in the river flow, as a response to the reduced rainfall in June and July. Multivariate analysis was used to identify the spatial pattern in the variability of the river. Work is currently underway; it is expected to retrieve the summer bio-modality pattern in streamflow across the rivers with cross country variation. Correlation should quantify the influence of the Jamaica's rainfall on the streamflow given that rainfall directly affects run off. However, magnitudes could be varied by the watershed, which could indicate differences in catchment characteristics and response times. This study will provide one of the first cohesive approaches of the spatial temporal variability of rivers in Jamaica. The findings contribute to a deeper understanding of Jamaica's hydro-climatology, offering practical value for integrated water resource management, flood forecasting, and climate adaptation strategies. The study is limited by data availability and accessibility, and temporal coverage of streamflow and rainfall records, which constrains long-term trend detection. The identification of rivers with strong relationship between rainfall and streamflow could provide critical inputs for developing seasonal flood forecasting models. These models can improve early-warning systems, guide infrastructure planning, and enhance community preparedness, thereby reducing flood-related risks to lives, livelihoods, and ecosystems in Jamaica

Keywords: Jamaica, streamflow variability, rainfall correlation, hydro climatology, seasonality, rivers

CAS25 029

Hypoglycin A content and proximate analysis of *Blighia sapida* pods

Shawneca Monroe, Giselle Brown, Raymond Reid, Andrea Goldson-Barnaby*

The Department of Chemistry, The University of the West Indies

Abstract

Blighia sapida (ackee), is a tropical fruit with origins in West Africa. The arilli of fully mature fruits may be cooked and consumed as food. Immature fruits have high levels of the toxin hypoglycin A and should not be consumed. The pods of the fruit although rich in antioxidants and saponins are not edible and are discarded or utilized as compost. The current research seeks to explore the nutritional profile of the ackee pods by analyzing for its protein, lipid, moisture and hypoglycin A content. Proximate analysis was conducted on ackee pod extracts and its hypoglycin A content determined utilizing reverse phase liquid chromatography. The total lipid content of the pod was determined by Soxhlet extraction and the fatty acid profile assessed utilizing gas chromatography mass spectrometry. Protein was determined utilizing the Kjeldahl method. A gravimetric assay was utilized to determine moisture content. The pods contain high levels of moisture (82 %), protein (5 %) and lipids (3.7 %). Oleic acid (37.3 %) predominates as the major fatty acid, followed by palmitic acid (30.8 %). Gondoic acid and arachidic acid were also detected. Hypoglycin A, a natural chemical toxicant is present in the pods of the fruit (341 ppm). Consideration could be given for the extraction and purification of hypoglycin A from the pods for use as an analytical standard. Removal of hypoglycin A from the pods can also lend to its utilization in other commercial applications such as in the production of animal feed.

Keywords: *Blighia sapida*, pod, protein, lipid, hypoglycin A

CAS25 042

Hierarchical Clustering of Gravitationally Lensed Quasars

Reshan Ramjattan
Department of Physics, Faculty of Science and Technology, The University of the West Indies, St. Augustine, Trinidad and Tobago

Abstract

Gravitationally lensed quasars are a subset of quasars which have undergone a lensing effect due to foreground objects such as galaxies or galaxy clusters. The lensing effect increases the resolution and brightness of the information received from the quasars which facilitates the study of high redshift quasars. Hierarchical clustering is a machine learning algorithm that groups objects into clusters using a specified distance metric based on the linkage method and the resulting clusters are represented on a dendrogram. In this study, four linkage methods were used to determine clusters in the dataset. A subset of 210 quasars were taken from the gravitationally lensed quasar database. The data consisted of right ascension, declination and a redshift range of $0.658 < z < 6.51$. These coordinates were converted from celestial to cartesian using the de Vaucouleur's method where the celestial coordinates were converted to supergalactic coordinates. Using the redshift distance, the supergalactic coordinates were then converted to cartesian coordinates allowing for the determination of distances between quasars. Four dendrograms were plotted and the optimal number of clusters were obtained using the average silhouette method. The dendrograms were then analyzed and similar clusters were isolated which are discussed.

Keywords: Quasars, gravitational lensing, hierarchical clustering, dendrogram

CAS25 046

Closing the Gap: Science Communication for the SDGs

*Albertha Joseph-Alexander [1, *] and Celeste Chariandy [2]
[1]Caribbean Academy of Sciences, Trinidad and Tobago Chapter
[1]e-mail: alberthaj@hotmail.com; [2]e-mail: cellyandy@gmail.com
* Corresponding Author

Abstract

The Sustainable Development Goals (SDGs) represent an ambitious vision for achievement of key global targets for peace and prosperity of people and planet. Science and technology are important components of efforts to achieve these goals, as work within this discipline has and can advance, with great efficiency, progress towards these goals. Governments have a responsibility to adopt the positive results of science and technology to remove barriers to sustainable development. However, there is a need to build understanding, gain trust and improve the decision-making process that leads to the achievement of the SDGs in society. Public engagement through science communication closes this gap.

The practice of science communication creates avenues for: improving accessibility of society to important information; learning about what is being done to advance the key goals outlined in the SDGs and engaging in progressive actions towards the achievement of the SDGs at the personal level. Some examples of the issues which are currently being solved by science and technology in the Caribbean region are outlined as well as ways in which regional scientists can put science communication into practice, to close the gap, are shared.

Keywords: Caribbean, public engagement, science communication, sustainable development goals, SDGs

CAS25 057

Anaerobic Digestion Technology: The Key to a Sustainable Caribbean

De-Mar Browne - Faculty of Science & Technology, The U.W.I., Cave Hill Campus. De-mar.browne@mycavehill.uwi.edu
Tamaira Rowe - Faculty of Science & Technology, The U.W.I., Cave Hill Campus. Tamaira.Rowe @mycavehill.uwi.edu
Nandi Yard - Faculty of Science & Technology, The U.W.I., Cave Hill Campus. Nandi.Yard @mycavehill.uwi.edu
Nikolai Holder* - Faculty of Science & Technology, The U.W.I., Cave Hill Campus. Nikolai.Holder @uwi.edu
*Corresponding Author

Abstract

Anaerobic digestion (AD) offers a dual sustainability pathway for Small Island Developing States by transforming locally abundant biomasses into renewable biomethane and nutrient-rich digestate. At The University of the West Indies, Cave Hill Campus, we operate a grass-fed AD system, and both utilize and evaluate the agronomic potential of the resulting digestate across three strategic crops aligned with national and regional goals. These are corn (food security), lemongrass (health/pharmaceuticals), and castor (energy independence). Digestate was surface applied at graded rates, and crop responses were monitored over time. Across the species, digestate created clear, dose-responsive gains: corn exhibited higher terminal biomass relative to controls; lemongrass produced more tillers with increasing application rate; and castor showed increases in fruit number and fruit retention time. The integration of AD technology in the cultivation of these crops demonstrates circular bioeconomic benefits, which include diverting agro-residues from landfills, lowering synthetic fertilizer dependence, and supplying biomethane as a fuel. These occur while simultaneously advancing SIDS in the SDGs on clean energy, responsible production, climate action, industry/innovation, and decent work. These results support digestate as a practical organic fertilizer to boost productivity and position the campus-scale anaerobic digester and bioeconomic pilot projects as replicable models for coupling waste management, renewable fuel, and resilient agriculture and sustainable production.

CAS25 063

Water Utility Management Using Artificial Intelligence for Small Island Developing States (SIDS)

Anthony Chadee[1]* and Kit Fai Pun[2]

[1]Manager, Technical Services, WASA, and Vice Chair, IET TT LN and IEEE TT TEMS, Trinidad and Tobago, West Indies; Emails: Anthony.Chadee@wasa.gov.tt; simschadee@gmail.com
[2]Faculty of Engineering, The University of the West Indies, St. Augustine Campus, Trinidad and Tobago, West Indies; Email: KitFai.Pun@sta.uwi.edu
*- Corresponding Author

Abstract

Access to clean drinking water is a challenge especially in SIDs where there are aggressive water management strategies being practiced due to burgeoning water stressed situations from dwindling freshwater reserves as a direct result of the climate change phenomenon (less annual rainfall due to the La Nina and El Nino events resulting in longer dry season events Dec-June) and a prime component of the UN sustainable development goals (SDGs)
Artificial Intelligence (AI) has been used since the 1960s and has been fast emerging to overcome the complications of operational traditional methods with the simulation of human water strategies into embedded computer systems, using the general artificial intelligence standard ISO/IEC 22989:2022. Over the last 15 years, water utilities are investing in AI, and according to market research, this investment is expected to reach $3.3 billion by 2030. AI is expected to save 20 to 30% of operational expenditures by optimizing the cost of the usage of water treatment chemicals, energy conservation, water transmission/distribution management, equipment maintenance, artificial recharge and disaster management.
In water-scarce areas, stress on water abstractions increases as surface water runoff and rain-water aquifer percolation may decline by up to 30%, due to urbanisation. In agriculture, AI models built with intelligent techniques have encouraged the use of smart appliances which would utilize less water (drip type irrigation, face-basin faucets control, automatic valving systems) and restrict the amount of water usage at homes, industry and commerce. AI is expected to affect global productivity, equality and inclusion, environmental outcomes, and several other areas, with water management practices required to maintain the water resource sustainable over the long term
This presentation highlights some applications and limitations that have hindered the widespread applications of artificial intelligence techniques in water utility in a SIDs, with the lessons learnt and experience references drawn upon the Water and Sewerage Authority of Trinidad and Tobago (WASA) that is one of the largest providers of water and wastewater services in the Caribbean.

Keywords: Sustainable Development Goals (SDGS), Artificial Intelligence, water and wastewater services, WASA, Caribbean

CAS25 065

Remote Sensing for Analysis of Land Use Changes and Sustainable Development in Small Island Developing States

Hugh Atherley[1], Grahame Niles[1]
The Caribbean Institute for Meteorology and Hydrology1

Abstract

The expansion in urbanisation and industrialisation presents global challenges. These challenges are especially acute for Small Island Developing States (SIDS) due to their size, population density and competing development interests. One of the typical drivers for significant land cover change within Caribbean SIDS has been commercial activities and urban expansion in part due to increased industrialisation.
A major consequence of this transformation is the creation of urban heat islands (UHIs), where urban areas are significantly warmer than their rural surroundings. This phenomenon directly challenges the achievements of several targets under United Nations' Sustainable Development Goals (SDGs), particularly SDG 11 (Sustainable Cities and Communities) and SDG 13 (Climate Action). This research investigates the extent to which land use trends are linked to surface temperatures, UHIs, and the implications for sustainable urban development in Barbados.
The research agenda is supported through the processing and analysis of freely available satellite data. Google Earth Engine was used to access USGS Landsat 8 Level 2 collections to acquire images for Barbados from 2014 to 2024. Using the optical bands, a random forest model was implemented to calculate the land cover changes between 2014 and 2024. The thermal band was used to calculate the median annual temperature and compute land temperature trends for the same period (i.e. 2014 to 2024). For the latter stages of the research, spatio-temporal analyses of trends in land cover changes versus land surface temperatures were performed. This poster presents preliminary results which suggest intensification of the UHI effect with increasing development of the island's urban corridor and the loss of natural vegetation.
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CAS25 070

Urban Heat and Humidity: Exploring the Urban Heat Island Effect through Relative Humidity Patterns in Rural and Urban Areas in Barbados.

[1]Kanzi Scott and [2]Hugh Atherley

[1]University of the West Indies, Cave Hill Campus
[1]The Caribbean Institute for Meteorology and Hydrology

Urban areas often experience higher temperatures than their rural surroundings, a phenomenon known as the Urban Heat Island (UHI) effect. While temperature differences are well documented, the role of relative humidity in shaping local microclimates remains less explored. In Small Island Developing States (SIDS) such as Barbados, understanding how UHI influences microclimatic conditions is essential for advancing climate action (SDG13) and creating sustainable, resilient cities (SDG11). This study investigates the UHI effect in Barbados through a comparative analysis of surface relative humidity between urban and rural areas.
Hourly 2-meter surface temperature and dew point temperature from the European Centre for Medium-Range Weather Forecasts (ECMWF) reanalysis v5 Land (ERA5-Land) datasets were used to calculate relative humidity across Barbados. Relative humidity was then compared between urban and rural sites for the period from 2014 to 2024. Results show that urban areas exhibited higher relative humidity values compared to rural areas. Further analysis revealed that dew point temperature had a more substantial influence on relative humidity patterns than surface temperature, which showed only minor differences between sites. These findings suggest a significant relationship between the dew point temperature and UHI. This preliminary analysis contributes to a deeper understanding of how urbanisation shapes climate variability in SIDS.

CAS25 083

Assessment of Barbados' Endemic Biota: Status, Threats, and Priorities

[1]Linton Arneaud and [1]Martin Weekes

[1]Department of Biological and Chemical Sciences, The University of the West Indies, Cave Hill Campus, Barbados

Email: linton.arneaud@uwi.edu

Abstract

At present, Barbados lacks a comprehensive inventory of endemic species, hindering effective conservation planning. To address this critical knowledge gap, we compiled the first systematic checklist of Barbadian endemic species by synthesizing peer-reviewed literature, data-bases, historical records, and technical reports. The review was supplemented with targeted interviews with government agencies, community members, and local and international experts, to ascertain the status of data-deficient species. Our findings reveal that a significant proportion of Barbados' endemic biota is Critically Endangered or already extinct. Habitat loss and the proliferation of invasive alien species were identified as the primary drivers of this decline. This research enabled the successful compilation of the first systematic inventory of Barbadian endemics to establish a definitive list of the island's unique biota. It fills a critical knowledge gap and establishes a foundational baseline for future transformative conservation initiatives and priorities.

Keywords: conservation status, extinction, habitat loss, invasive species, island conservation, annotated checklist