



XX OIL PALM
International Conference

THE TRANSFORMATIVE
POWER OF OIL PALM

Palmiculture and Climate Change

Denis J Murphy

University of South Wales, UK

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Acknowledgements:

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Summary background



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<https://scholar.google.co.uk/citations?user=GQc6wQsu-BkC&hl=en>

CURRENT POSITION

Emeritus Professor of Plant Biotechnology,
University of South Wales, CF37 4AT, United Kingdom

Other key roles:

- * **Fellow of the Royal Society of Biology**
- * Crop Biotechnology Advisor, **United Nations Food and Agriculture Organization**
- * Chair, Biology Advisory Committee, **Malaysian Palm Oil Board**
- * Member of Science Council of the **Malaysian Oil Scientists and Technologists Association (MOSTA)**
- * Plant Biology Series Editor, Oxford University Press
- * Consultant on Biotechnology to **European Chemicals Agency**
- * Executive Editor of the international open access journal, **World Agriculture**
- * Founder and Chief Executive Officer of **Oleatech Ltd**, a successful UK-based life sciences SME

Oil palm in Malaysia: Measuring GHG emissions in Sarawak in 2019



Ground level sampling



Measuring tower



Discussing data



Oil palm in Malaysia 1995-now



Sime Darby operations in peninsular Malaysia



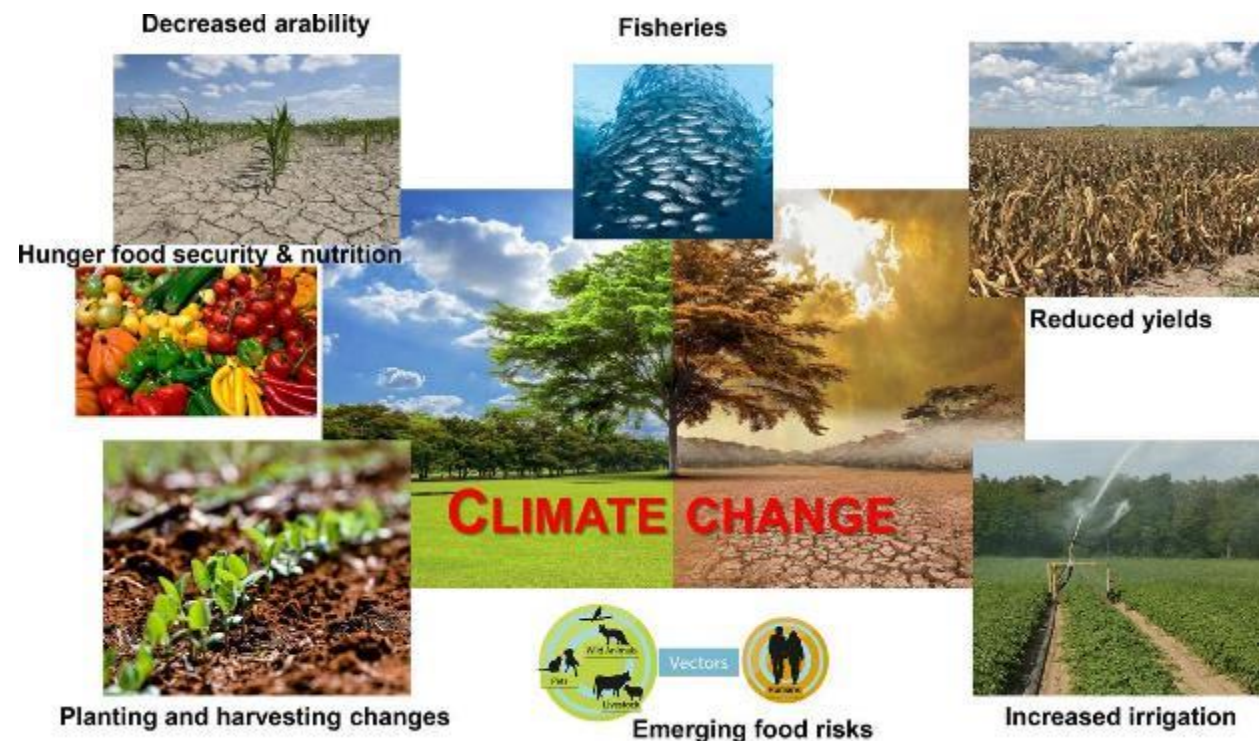
OP plantations on peatland in Borneo

Colombia currently produces about 2.3% of global Palm Oil

- The major export markets are Europe (>\$200M) and Latin America (>\$160M)
- There is considerable potential to more than **double exports to Europe** providing that sustainability and traceability criteria are met
- Major challenges will be to increase production to satisfy this demand
- In the short term there is considerable scope to increase yield via **management practices**
- In the medium biological improvements can be deployed via **replanting new varieties**
- In the longer term **climate change** remains a largely unknown but potentially catastrophic threat

Climate change

- The likely negative impacts of climate change are **well documented** in the scientific literature and are increasingly accepted by the general public
- Climate change threatens the sustainability of **crop production** via factors such as fluctuating temperatures (mostly but not always upwards) combined with erratic rainfall and disease patterns
- While these effects are well understood in temperate regions, **the likely impacts of climate change on tropical crops remain less well known**



B B C

NEWS

26 Sept 2022

More than half of the world's palm trees in danger

By Helen Briggs
Environment correspondent

According to the research, published in Nature Ecology and Evolution, at least 185 palm species that have a use may be threatened in 92 regions, further emphasising the need to protect these plants.



RBG KEW

| The palm family includes tall trees and climbing plants

More than a thousand species of palm tree are at risk of extinction, according to a study.

Scientists used artificial intelligence to assess risks to the entire palm family, from tall trees to climbing plants.

The data gives a much better idea of how many, and which, palm species are under threat.

Palms are a huge plant family that provide millions of people with food, drink and shelter.

Oil palm, *Elaeis guineensis*, is by far the most important global edible oil crop, supplying about 40% of all traded vegetable oil

- Palm oils are key dietary components consumed daily by over **three billion people**, mostly in Asia
- Palm kernel oil also has a wide range of important **non-food uses**, such as in cleansing and sanitising products that include vital anti-viral products used to combat the spread of covid-19
- There are currently no realistic alternative crops to oil palm that are able to supply the huge amounts of edible and healthcare products with such a low footprint in terms of land use

Oil palm cultivation is concentrated in three major regions of the global tropics

- For 2022 the annual global oil production (million tonnes) is estimated at **<80 Mt**
- **70 Mt (88%) in SE Asia** (mainly Indonesia and Malaysia)
- **5 Mt (6.55%) in Latin America** (Colombia = 1.8 Mt)
- **3.4 Mt (4.2%) in Africa**

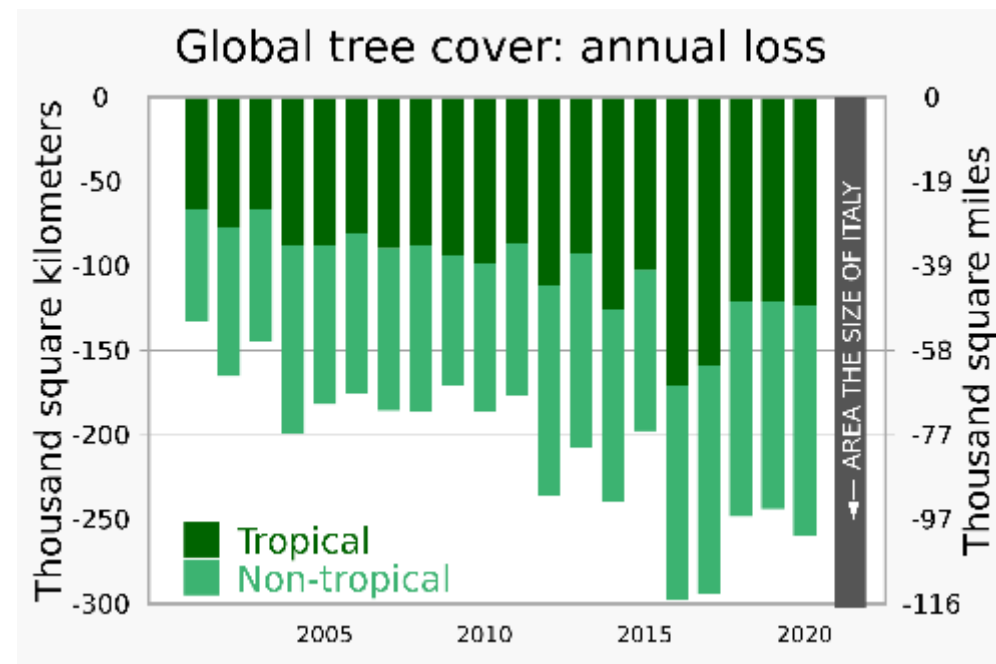
**Colombia produces about
2.3% of global Palm Oil**

These three regions of the global tropics represent very different climatic zones with different predicted responses to climate change

- The three regions also have very different **geopolitical features** that will affect their capacity to respond to climate change
- While SE Asia is overwhelmingly the current centre of gravity of global OP cultivation this very concentration could impact future resilience, for example, if a local disease outbreak drastically reduced production
- Although West Africa is the centre of origin of the crop, recent efforts to increase production have faltered, mainly due to adverse political and infrastructure issues
- These factors make it more important for **OP cultivation in Latin America** to be increased

Tree species are in decline across the world

- Annual losses of both tropical and temperate tree species have accelerated considerably over the past 20 years but there is very little data on **tree crops**, especially from the tropics
- In this presentation, I will review recent research that has started to address the climate change impacts on oil palm cropping systems
- I will also cover the importance of improved communication between the industry and other stakeholders, especially consumers

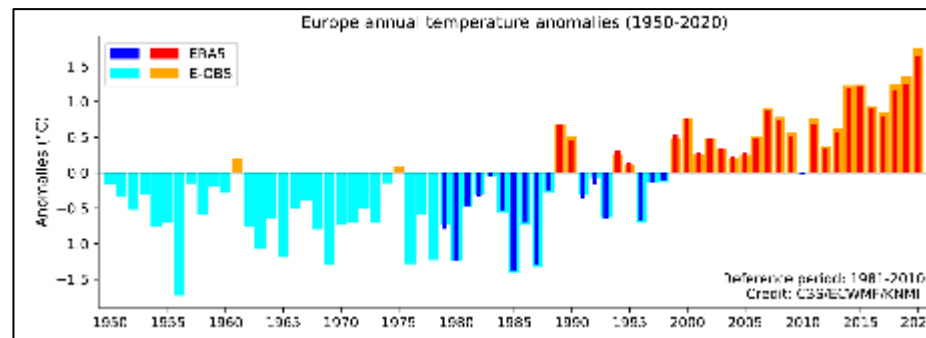


Q. Are there any existing climatic trends?

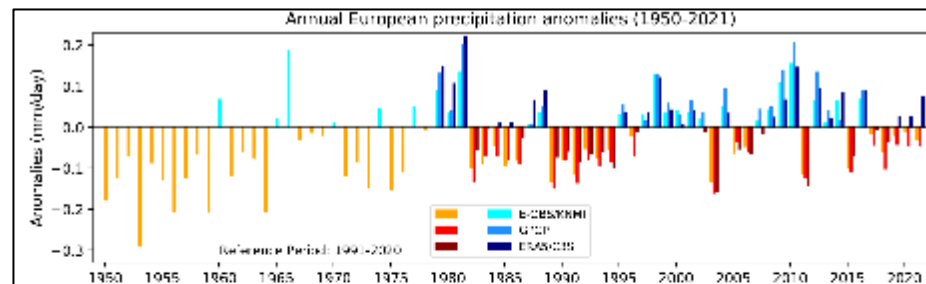
A. Yes in Temperate regions

In Europe, **significant anomalies** for both temperature and rainfall have been observed over a comparable period

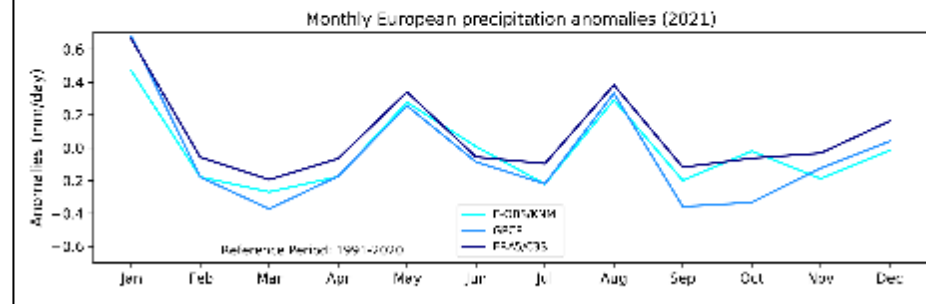
As expected for a climatically seasonal region, European rainfall anomalies have winter/summer patterns that would not be expected for the Tropics



Annual temperature



Annual precipitation



Monthly precipitation

Q. Are there any existing climatic trends?

A. But not in the Tropics

- Current data from Malaysia **do not show** dramatic temperature or rainfall changes over the past 45 years (from Abubakar et al 2022)
- However, there is a **slight suggestion** of rainfall declines over the past few years – **see red arrow**

Fig. 3 Trend of temperature in Malaysia from 1975 to 2020. Source: Climate Change Knowledge Portal, 2020

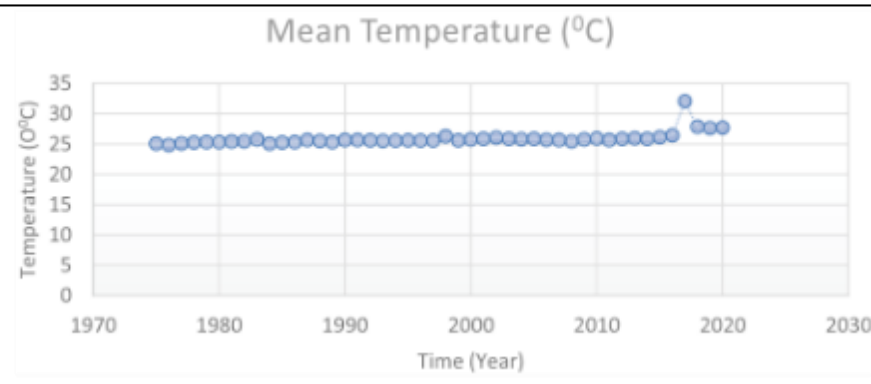
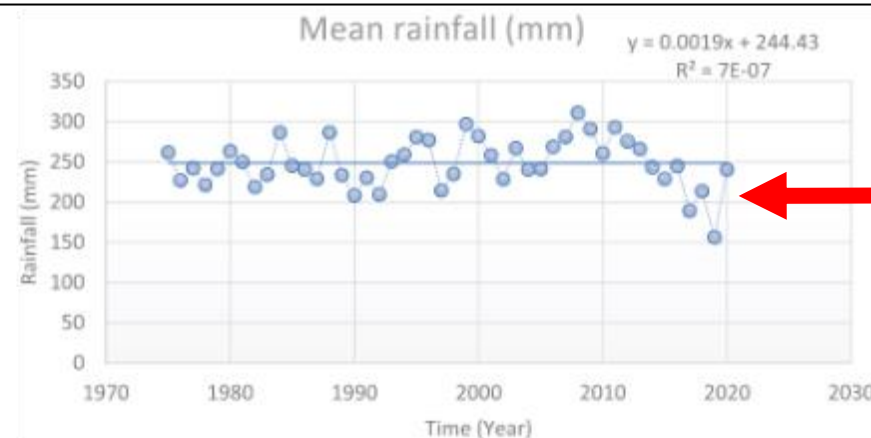


Fig. 4 Trend of rainfall in Malaysia from 1975 to 2020. Source: Climate Change Knowledge Portal, 2020



Predicting future trends using the CLIMEX model*

- **Climate change effects on natural systems require robust predictive models able to generate data enabling policymakers to mitigate consequential changes in diversity and ecosystem function**
- **For example, mapping of plant disease distributions can influence biosecurity planning by specifying areas that qualify for eradication or containment**
- **The model used by us has been developed for current and future species distributions where knowledge about climate change effects on species distributions is essential in mitigating negative impacts**

* **CLIMEX** is an increasingly widely used computational tool for studying the effects of climatic conditions on species distribution and relative abundance. CLIMEX has two main functions, and each function includes a total of 10 applications. The first function is called “CLIMEX Model,” and its main applications are Compare Locations, Compare Years, and Compare Locations/Years, whereas the second function is “Climate Matching” and includes applications of Match Climates and Match Climates (Regional). The CLIMEX Model is based on the assumption that we can infer the suitable climatic conditions for a target species when information about its habitat is known.

Case study 1: Overall OP mortality

Predicted oil palm mortalities (%) with climate change in selected South American and SE Asian countries, plus the Kalimantan province of Indonesia.

The Latin American countries, particularly Brazil and Colombia, were assessed to have **high future mortalities**, whereas the figures for Malaysia and Indonesia were much lower

Adapted from data provided in Paterson (2020b)

Countries	Years		
	2050	2070	2100
Indonesia	0	3	10
Malaysia	0	1	10
Kalimantan	0	5	10
The Philippines	0	ND	10
Papua New Guinea	0	ND	40
Myanmar	5	ND	60
Thailand	10	ND	70
Colombia	20	ND	90
Ecuador	0	ND	75
Brazil	15	ND	100

ND not determined

Case study 2: OP mortality due to disease

Predicted effects of climate change on mortality due to stem rot caused by *Ganoderma boninense* disease

Ganoderma disease is just one out of several important fungal diseases that already affect oil palm crops across the world

Fruiting bodies of *Ganoderma boninense* on oil palm stems

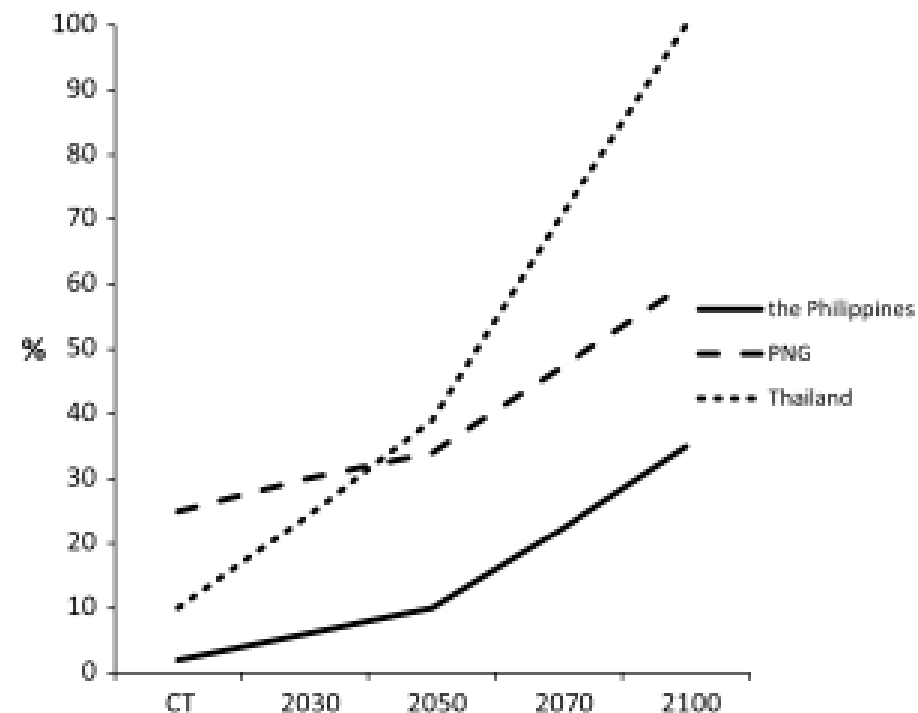


Case study 2: Predicted increased incidence of stem rot disease in oil palm mortality due to climate change in selected tropical countries

Here we show scenarios for basal stem rot in three Southeast Asian countries

The data show a huge increase in *Ganoderma* incidence from low levels of 0 to 25% today to between 30 and 100% by 2100

Similar scenarios were found in other oil palm-growing regions of the tropics and would result in massive decreases in crop yield and the likely abandonment of cultivation in affected areas



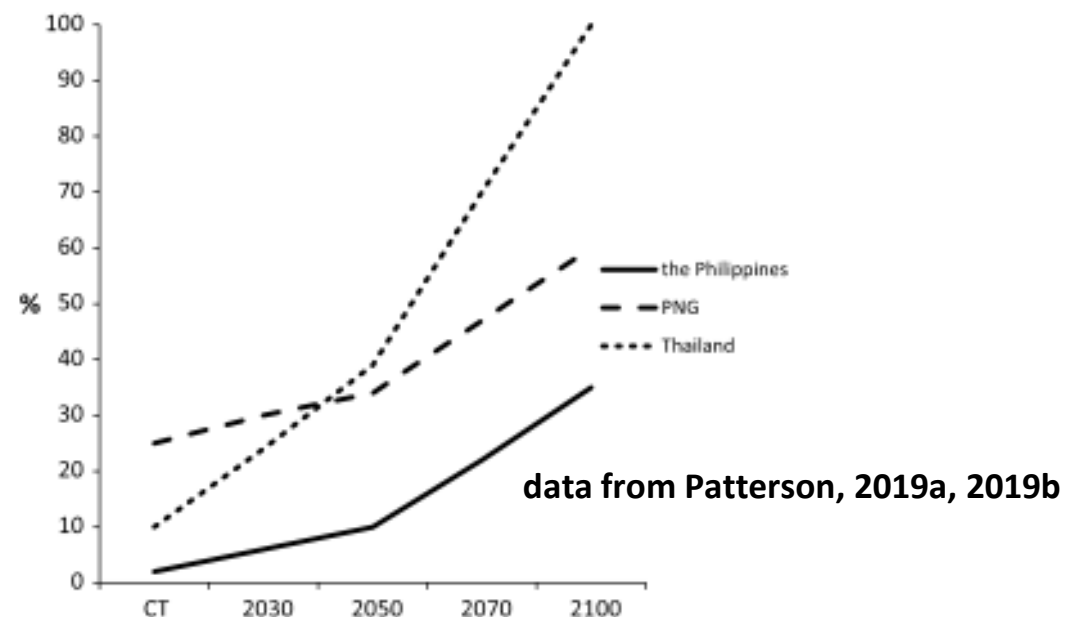
data from Patterson, 2019a, 2019b

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Breaking news: a new study published on 15 September 2022

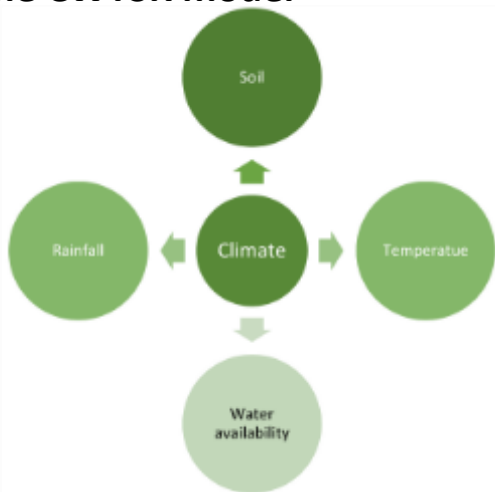
Climate change projections indicate that *G. boninense* will have a greater impact on oil palm in the future, particularly from 2050 onwards. In Sumatra, some parts of Malaysia, and other oil palm growing regions, *G. boninense* is **predicted to have a 41–100% impact by 2100**

Abubakar et al 2022 *Env Sustain* <https://doi.org/10.1007/s42398-022-00244-7>

Extending the model parameters

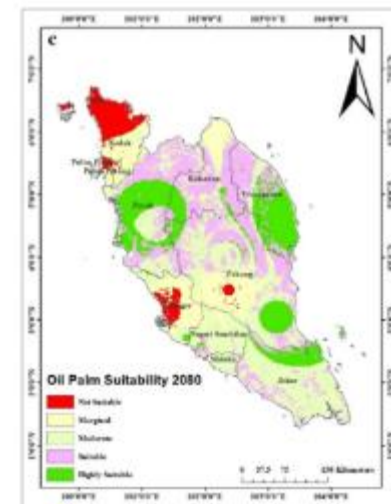
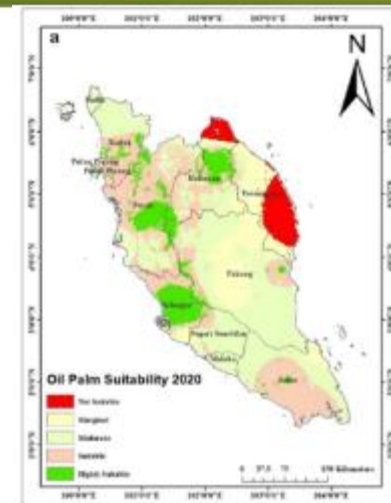
(Abubakar et al 2022)

The CWTSR model



Climate suitability maps for Malaysia 2020 and 2080

Modeling Earth Systems and Environment
<https://doi.org/10.1007/s40808-022-01465-9>
11 August 2022



Case study 3: Climate change scenarios for a second tropical tree crop, coffee

- The world could lose half of its best coffee-growing land under a moderate climate change scenario with Brazil, seeing its most suitable coffee-growing land decline by 79%*
- An important innovation in the study is to examine land and soil parameters in addition to purely climatic factors such as temperature and rainfall patterns.
- These studies are beginning to reveal the surprising extent and complexity of the impacts of climate change and associated factors on some of the most grown crops in the tropics.
- Importantly, the impacts will not be distributed evenly and some regions might even benefit from climate change.

Grüter et al (2022) Expected global suitability of coffee, cashew and avocado due to climate change. *PLoS ONE* 17 e0261976 <https://doi.org/10.1371/journal.pone.0261976>

Coffee may become more scarce and expensive thanks to climate change – new research



Denis J Murphy

Professor of Biotechnology, Head of Genomics & Computational Biology Research, University of South Wales

Published: January 27, 2022 1:27pm GMT

<https://theconversation.com/coffee-may-become-more-scarce-and-expensive-thanks-to-climate-change-new-research-175766>

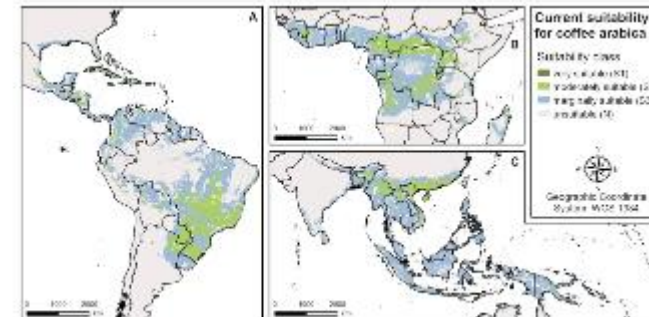
Distill.pub and original: The world could lose half of its best coffee-growing land under climate change

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The world could lose half of its best coffee-growing land under a moderate climate change scenario. Brazil, which is the currently world's largest coffee producer, will see its most suitable coffee-growing land decline by 79%.

That's one key finding of a new study by scientists in Switzerland, who assessed the potential impacts of climate change on coffee, cashews and avocados. All three are important globally traded crops that are mainly produced by small-scale farmers in the tropics.

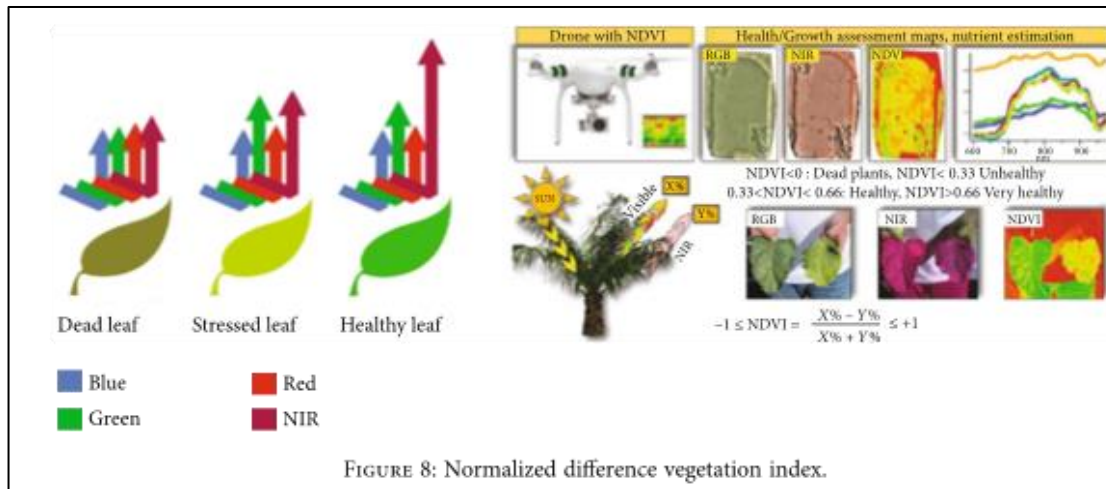
Coffee is by far the most important with an expected revenue of US\$480 billion (£344 billion) in 2022, while the figures for avocado and cashew are respectively \$13 billion and \$6 billion. While coffee mainly serves as a stimulatory beverage, avocados and cashews are widely consumed food crops that are rich in monounsaturated plant oils and other beneficial nutrients.



Distill.pub and original: The world could lose half of its best coffee-growing land under climate change

New technologies for monitoring and surveillance

- Application of UAV/drones in plantations

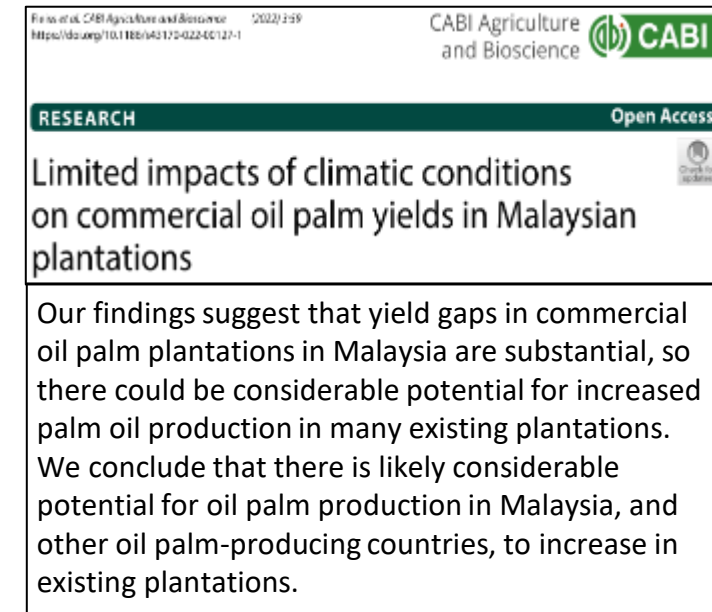


Data from Khuzainah et al (2022)
UPM Malaysia & RIKEN Japan

Objective	Task	Technical characteristics and payload
To detect the drainage pipe	For a monitoring purposes	VIS-C, MS, and TIR camera
To monitor the vegetation level	For a monitoring purposes	Camera GNSS IMU LiDAR Multispectral
Monitoring vegetation state	For a monitoring purposes	Camera Compass First person view platform FlightCTRL GPS system GSM modem Magnetic Multispectral NaviCTRL 3-axis accelerometer 8 GPS system Digital compass FlightCtrl NaviCtrl
Evaluation water stress	For a monitoring purposes	Pressure sensor Storing device Thermal sensor
Monitoring vegetation state	For a monitoring purposes	IMU LiDAR Multispectral sensor Single-board computer
Spraying with consideration of climate conditions	For a spraying process	Spraying device Barometer IMU
Spraying fruits and trees	For a spraying process	Magnetometer Multispectral sensor Servos Spraying device Autonomous power supply Control switches
Estimating chlorophyll density	For a monitoring purposes	GPS system Hyperspectral sensor LCD screen Storing device
Oil palm harvest prediction	For a data acquisition	20.2 mega pixel digital camera
Palm tree detection	For a data acquisition	Panasonic Lumix G3 with a 20 mm lens

Climatic effects *versus* other limiting factors on OP yields

- A recent (9 September 2022) report suggests that in Malaysia the effects of current local climatic variations are dwarfed by yield variations between comparable plantations due to management practices
- Local differences in climatic conditions explained only < 1% of the total variation in yield. In contrast, variation in yield among plantations accounted for > 50% of the explained variation in yield (median annual fresh fruit bunch yield 16.4–31.6 t/ha)
- This implies that in the **immediate short term**, improved plantation management will be a much more effective strategy than climate resilience (in terms of increasing yield)
- However, increasingly extensive climatic fluctuations are likely to become more important in the coming decades



Conclusions 1

- Evidence is now growing of the likely future impacts of anthropogenic climatic changes on the oil palm industry at a global level
- Most climatic threats identified to date involve periods of elevated temperature and reduced rainfall, both of which cause stresses that impact on crop performance, and yield
- In some cases, these effects are already being observed during fieldwork from ourselves and others in the tropics but in many other cases we still need more data

Conclusions 2

- **Immediate priorities should include further research to understand climatic effects on oil palm in the principal regions of the tropics where the crop is now grown, namely SE Asia, Latin America and Africa**
- **This improved understanding can then be used to implement targeted mitigation strategies in order to minimise adverse effects in each region**
- **The research would also have applications to the many other crops, especially perennials, that are grown in the tropics and play such vital roles in food security**

Practical recommendations

- Initiate a **coordinated multinational research effort** focused on likely climate change impacts in the three major OP growing regions
- Establish **improved surveillance systems** for the emergence/spread of new and existing pests and diseases

The future

- **We are only beginning to generate useful predictive models for tropical crops and many uncertainties remain about their accuracy**
- **However, climatic threats have the potential to massively disrupt some (but not all) crop yields and quality with likely impacts on food security**
- **Recent events in Ukraine have demonstrated the surprising impact of a relatively small regional conflict on food security that has particularly impacted some developing countries – climate impacts are likely to be much longer and more severe**

The importance of improved communication

- In the case of oil palm, it is now even more important that the crop is regarded as an essential and sustainable part of the solution to long-term food security rather than as an environmental threat
- In order to develop such a dialogue, it will be vital to redouble efforts to ensure that future supplies of palm oil products are certified as sustainable and not linked to deforestation, use of peatland, poor labour practices etc
- Improve outreach and information efforts aimed at key stakeholder groups such as retailers, NGOs and the general public in order to underpin the role of OP as a truly sustainable crop that is uniquely positioned to contribute to food security and wellbeing for billions of people around the world
- Relatively new palm oil-producing countries such as **Colombia can play a key role in such a process**



XX
Conferencia
Internacional sobre
20th International

**PALMA
DE ACEITE**
Oil Palm Conference

EL PODER TRANSFORMADOR DE LA PALMA DE ACEITE

And finally a few words about Colombia from a European perspective

COLOMBIA CLAIMS ITS PALM OIL IS “UNIQUE AND DIFFERENTIATED”

IN 2018 COLOMBIAN PRODUCERS SIGNED THE FIRST NATIONAL ZERO-DEFORESTATION AGREEMENT FOR PALM OIL

- With the signature of this groundbreaking commitment in 2017, various Colombian sector leaders have gathered to champion their efforts for the elimination of deforestation in the palm oil supply chains
- *The declaration was also signed by a wide array of signatories such as the **Colombian, UK and Norwegian governments, WWF, TNC, WRI, Unilever and Team Foods.***
- Colombia is the first country on the globe to present such a [national agreement on deforestation](#). The initiative will reaffirm Colombia's growing reputation as a sustainable tropical agricultural commodities provider.
- **NEXT STEP IS TO PENETRATE THE VERY SCEPTICAL ANTI-PALM MARKETS IN EUROPE USING SMART MARKETING AND BRANDING STRATEGIES THAT WILL APPEAL TO THE TARGET AUDIENCES**

Kerrygold butter: an example of smart branding from Ireland



- *“World-renowned Kerrygold butter is rated amongst the highest-selling products in its category in the USA and is praised by celebrities such as Sarah Jessica Parker”*
- *“Record sales for Kerrygold butter in Germany and the USA”*
- Recent increase in sales of 30% and profits >\$2.5 billion
- **In reality, Kerrygold is just butter**, ie an ordinary dairy fat, and is hardly different from other brands
- But **smart branding** allows it to be sold in supermarkets at a **premium of >25%** compared to other less differentiated brands





THE IRRESISTIBLE TASTE OF KERRYGOLD BUTTER & CHEESE

Kerrygold butters and cheeses are produced with milk from grass-fed cows that graze on the lush green pastures of Ireland.

All our products are natural, hormone and antibiotic free, containing no GMO ingredients.

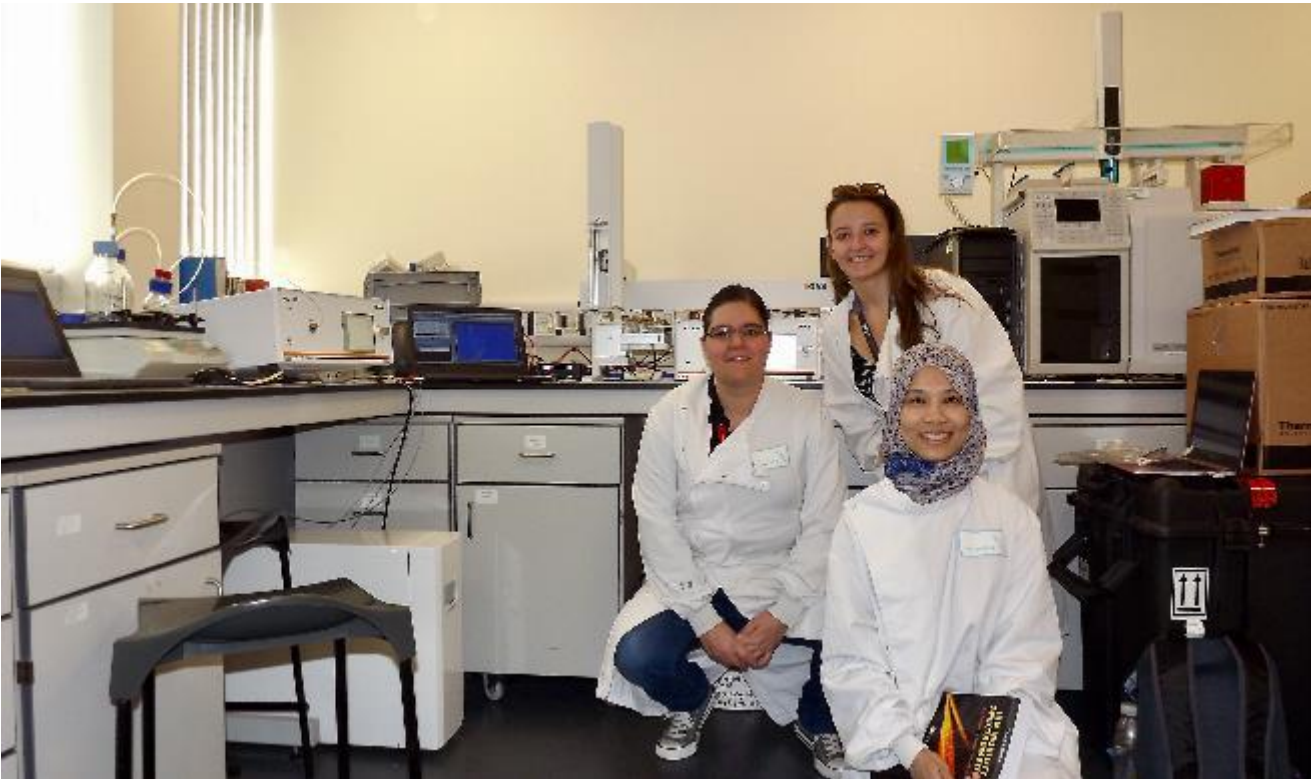
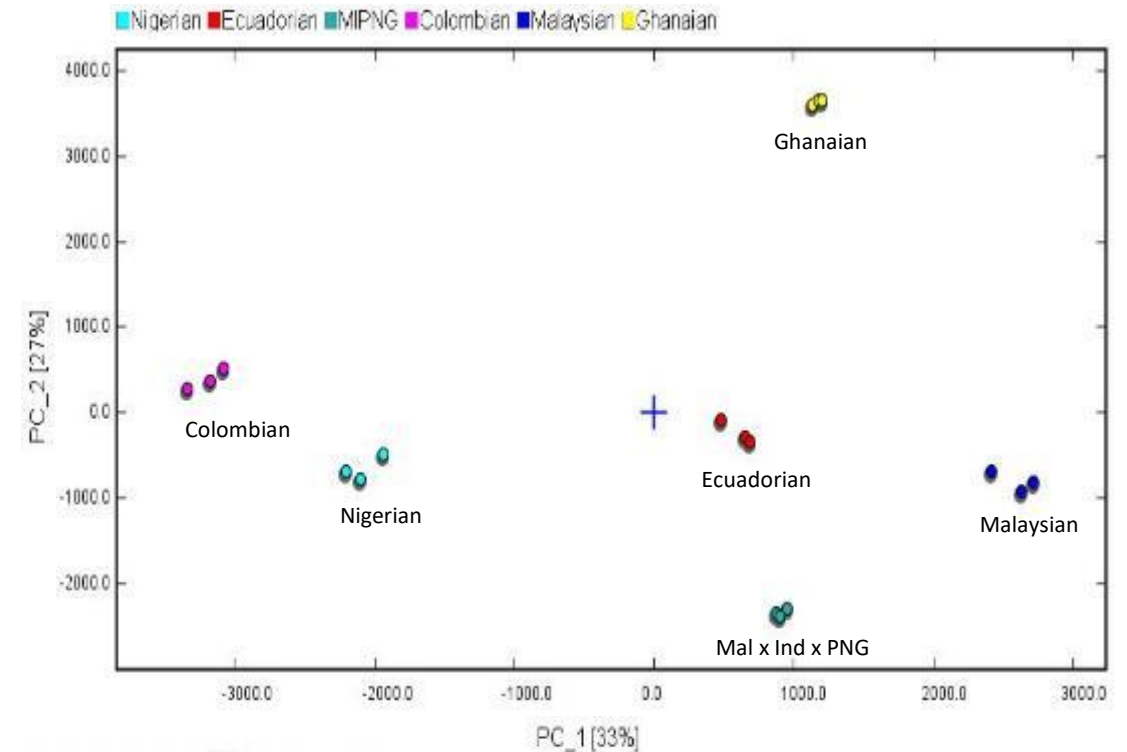


www.kerrygoldusa.com



Fast GC-IMS for Authenticating Geographical Provenance of Vegetable Oils

EU-funded research at University of South Wales
Collaboration with MPOB, Malaysia



Our project on palm oil traceability is aimed at reassuring consumers that food labels are accurate

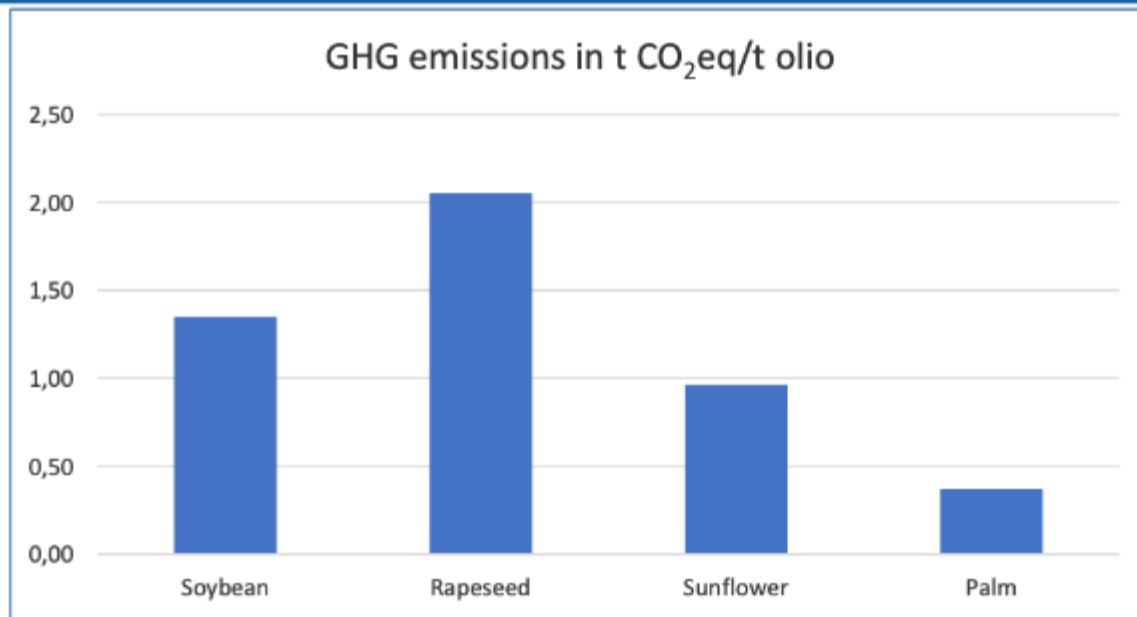
This helps places like Chester to become the first city in the world to only use 100% certified sustainable palm oil

UK's city of Chester becomes first sustainable palm oil city

by Palm Oil Health | Jul 22, 2021 | Forest Conservation, Sustainability



GHG emissions per ton of oil



Oil palm cultivation results in the **lowest** contributions to climate change-related GHG emissions out of the four major vegetable oil crops

Colombian palm oil is climate change friendly for GHG emissions, in addition to being forest and labour friendly etc

Colombia needs to be **smart** about seizing all available opportunities for its oil palm sector

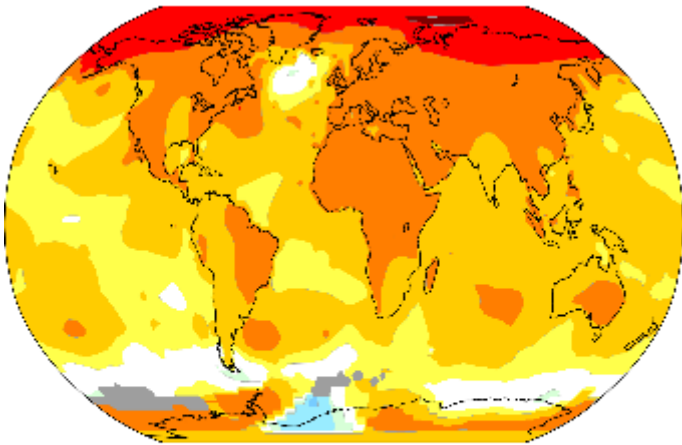
- The world can be like a **jungle** where the evolutionary scientist Charles Darwin tells us that only the **fittest** tend to survive
- But being fit is not necessarily about being the **biggest or strongest**
- More commonly it is the **smartest** that will eventually prevail
- **Smart branding** could enable Colombian palm oil to achieve market premiums over non-differentiated rivals and increase sales in regions such as EU where there are significant opportunities

**A possible target market for
Colombian palm oil products?**

**Sophisticated, climate-conscious,
environmentally aware younger
consumers**



Temperature change in the last 50 years



2011–2021 average vs 1956–1976 baseline

-1.0 -0.5 -0.2 +0.2 +0.5 +1.0 +2.0 +4.0 °C

-1.8 -0.9 -0.4 +0.4 +0.9 +1.8 +3.6 +7.2 °F



THE TRANSFORMATIVE
POWER OF OIL PALM

Thanks
¡Gracias!



Recent references from our team:

Murphy DJ, Goggin KA, Patterson RRM (2021) Oil palm crops in the 2020s and beyond: challenges and solutions, *CABI J Agriculture & Bioscience* 2, 39. <https://doi.org/10.1186/s43170-021-00058-3>

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