Droughts and Despair: An Innovative Tool for Policy-Makers to Assess Climate Change's Economic Impact on "Diseases of Despair" in Farming Communities

Proposal Summary

As climate change progresses, one of its most insidious impacts is a rise in 'diseases of despair' among farming communities, such as suicide and alcoholism. These are often a consequence of financial stress due to climate-related agricultural disruptions, such as increasingly severe droughts. This creates a dire need for evidence-based policy decisions to tackle the complex relationship between climate change, economic instability, and health outcomes in these vulnerable communities.

Our proposal - "Droughts and Despair" - aims to bridge this gap by developing an innovative tool that uses causal inference methods to assess the economic impacts of climate change on 'diseases of despair' in farming communities. The tool will integrate data on climate change, agricultural productivity, and health outcomes to provide a nuanced understanding of these interconnected issues. Our goal is to empower policymakers with precise insights that can lead to the formulation of impactful policies to mitigate this pressing issue.

We have successfully built a prototype model based on simulated data from India, establishing the feasibility of our concept. With the requested funding of £100K, we intend to broaden our tool's scope, including more countries and a diverse range of health outcomes and agricultural commodities, amplifying its relevance and impact globally.

Through our initiative, we anticipate contributing significantly to safeguarding health in farming communities worldwide in the face of an escalating climate crisis. The funding received will be instrumental in translating our ambitious vision into tangible action, delivering real-world impact in mitigating climate change's adverse health effects in vulnerable farming communities.

Prototype

Our prototype model, designed to support our funding proposal, measures the indirect health impacts of climate change amidst unseen influencing factors. It uses simulated data from India, including temperature, rice yield, and suicide rates among agricultural workers. Additionally, an interactive web application highlights the interconnected effects of climate change on health and the economy to inform policy decisions. This web application exemplifies our tool's potential to illuminate the complex interactions between climate change, economy, and health.

Climate change indirectly impacts health via economic effects, a relationship complicated by unseen factors that might skew our understanding, regardless of whether we use statistical models or machine learning. However, our preliminary research and model show that focusing on health issues not directly tied to climate change, like 'diseases of despair' in farming communities, provides a clearer picture. As these diseases are unlikely to be directly influenced by weather changes, it simplifies the complex subject, aiding our comprehension of the interconnectedness of climate change, economy, and health. (Figure 1).

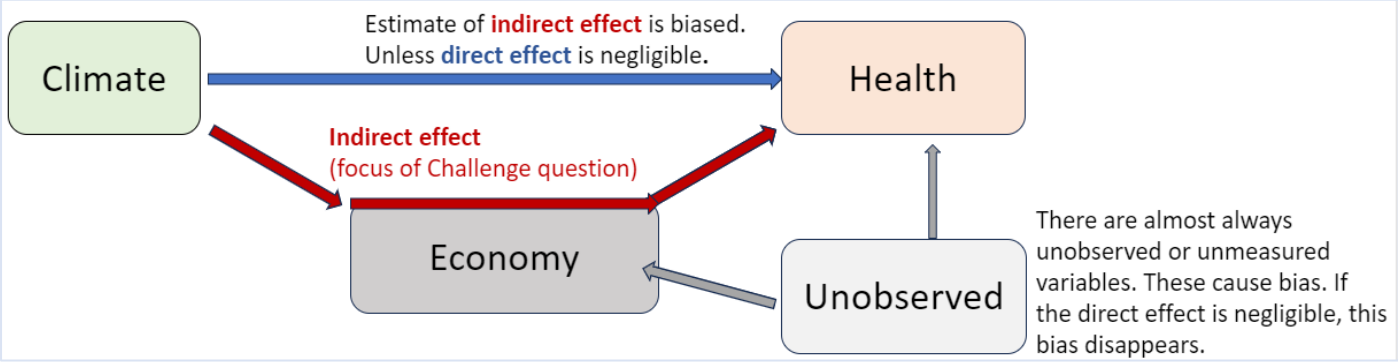

Figure 1. Our model illustrates the intricate relationship between climate change, economy, and health, focusing primarily on the indirect health effects via the economic impacts of climate change. While the direct impact of climate change on health is presumed to be minimal, unknown variables ("Unobserved factors") may influence these relationships. However, the bias they induce is less significant when direct effects are negligible, particularly in our study of 'diseases of despair' in farming communities.

Plans for future work

Project Overview and Objectives: Our project focuses on developing an innovative tool for policymakers to understand better policy impacts on climate change, agricultural economies, and health nexus, specifically 'diseases of despair' in farming communities. This tool integrates climate data, farm stats, and health indicators, offering a detailed picture of their interplay.

The tool will allow policymakers to simulate policy scenarios, like introducing drought-resistant crops to boost productivity and reduce despair-driven health issues or creating social safety nets to protect communities during climate-driven agricultural downturns.

Our goal is to offer a platform for policy decisions, helping alleviate climate change's indirect health effects on vulnerable groups. Using climate, agricultural, and health data from India, our prototype model and web application showcases our approach's feasibility.

Upon securing funding, we aim to extend our tool's coverage to more countries and a wider variety of health outcomes and agricultural products. Our professional networks in Kenya, Nigeria, Brazil, and the UK will broaden our tool's applicability and global impact. Under supervision from Principal Investigators and with an Advisory Group, a postdoctoral researcher will helm the project to ensure our tool's robustness and real-world impact.

Staffing and Roles: The primary role in this project will be taken up by a postdoctoral researcher, who will be responsible for executing the core elements of the project. They will develop sophisticated statistical models, establish and manage the Advisory Group, develop the online application, and actively participate in disseminating results. The Principal Investigators (with extensive experience in environmental, economic, and health metrics, statistical modelling and app development) will provide oversight and guidance to the postdoctoral researcher. Their advice will be instrumental in navigating the complexities of the project, ensuring the researcher's success in these critical areas and boosting their onwards career trajectory.

Advisory Group Formation and Management: We intend to create an Advisory Group of key stakeholders from diverse fields, including representatives from the United Nations Food and Agriculture Organisation and collaborators from research, policy, and industry circles in target countries, leveraging our professional networks. This group will ensure our tool is comprehensive and practical. The group will provide a platform for discussion, feedback, and review, contributing to the tool's development. Through quarterly online meetings, we'll ensure constant collaboration. The group's insights will aid in creating a technically sound, user-friendly tool aligned with research goals and policy needs, effective in real-world interventions.

Development of Statistical Models: The creation of our statistical models will be spearheaded by our postdoctoral researcher, under the guidance of the PIs and informed by the expertise within our Advisory Group. The postdoc will select suitable climate, economic, and health metrics that effectively represent the complex interactions we aim to explore. These choices will be made in collaboration with the PIs and validated by our Advisory Group, ensuring a comprehensive approach encompassing diverse perspectives and expert insights. The models will be developed within the R programming environment allowing us the flexibility and robustness necessary for the complex analysis required in our study. This process will guarantee the creation of rigorous, representative, and repeatable statistical models that will form the core of our tool. All analysis code will be hosted openly on GitHub and implemented into an R Package.

Shiny App Development: The development of our Shiny application, a web-based platform designed to present our findings visually, and to allow the exploration of policy impacts, will be an essential part of our project. The postdoctoral researcher will lead this task, consulting closely with the Advisory Group on its design and utility. This consultative approach will ensure that the end product is technically sound and user-friendly, accessible, and relevant to the needs of various stakeholders. The app will build upon the design and functionality of our initial prototype, incorporating enhancements and modifications suggested by the Advisory Group and any feedback received from our initial users. This iterative approach will ensure that our Shiny application is a dynamic, responsive tool that effectively communicates our complex data and statistical models to a broad audience.

Dissemination of Results: We aim to showcase our findings to a broad audience, including policymakers, health and climate professionals, the agricultural industry, and the general public. To this end, we will host an online webinar after the project to introduce and promote the Shiny app. We will invite a diverse range of stakeholders as our Advisory Group recommends, ensuring a broad representation of perspectives. This webinar will showcase our tool and its capabilities, encourage discussion, and foster an understanding of the complex interplay between climate change, the economy, and health. We will further disseminate our novel findings on the causal relationships between climate change, economy, and health, both in a published article and at relevant conferences, extending its reach within the academic community. We will maximise visibility by collaborating with the communications teams at the Wellcome Trust and our universities.

Project Timeline Summary: The project will be executed over 12 months. Month 1: hire a postdoctoral researcher and outline project goals and strategy. Month 2-3, form Advisory Group, data preparation for model development. Months 4-6, develop statistical models, engage with the Advisory Group and begin drafting the scientific paper. Month 7-8: Shiny app's initial development and design, refining the scientific article. Month 9-10: finalize the Shiny app and submit the scientific paper, initiate results dissemination plans. Month 11-12, conduct online webinar and collaborate with the communication teams to promote the article, reflect on the project, and prepare the final reports and outcomes for the Wellcome Trust.

Long-term Impact and Sustainability: By developing a robust, transparent, and accessible tool, we will empower decision-makers with the nuanced insights necessary to mitigate the adverse effects of climate change on human health via economic impacts. While the funding period is one year, the resulting tool ensures sustained utility and adaptability to evolving data and contexts. Our collaborative approach also fosters enduring relationships among scientists, policymakers, and other stakeholders, enhancing the capacity for evidence-based decision-making beyond the project's lifespan.

Research Environment: We will foster an environment that nurtures professional development, collaborative leadership, and reciprocally beneficial stakeholder engagement. As one of our first experiences co-leading a cross-institutional initiative, it offers a critical opportunity for us as early-career researchers to develop leadership skills. At the same time, the project serves as a dynamic platform for our postdoc's career advancement, providing hands-on experience in stakeholder engagement, climate, economic and health metrics, statistical modelling, app development, and academic writing. By cultivating a culture of reciprocity within our Advisory Group, we ensure our research outputs remain relevant to their needs thus creating a synergistic learning environment.

Equality, Diversity, and Inclusion (EDI): EDI is a core principle underpinning this project. The choice of study locations - India, potentially Kenya, Nigeria, Brazil, and the UK - reflects a commitment to inclusivity, capturing a diversity of socio-economic and climatic contexts. Furthermore, the Advisory Group's formation also aims to reflect diverse expertise, geographies, and perspectives. By embedding EDI into the project's heart, we ensure that the tool developed is comprehensive, relevant, and practical across various contexts, promoting equity in our collective response to climate change.

Conclusions

The "Droughts and Despair" proposal is at the frontier of innovative solutions to the compounding climate change crisis and health issues in farming communities. Our tool harnesses evidence-based science to forge an impactful policy-making guide. With the pledged £100K, we're expanding our tool's applicability and planting the seed for a global shift in addressing climate-induced challenges. Beyond creating a novel tool, we're forging a nexus of collaboration among scientists, policymakers, and stakeholders, fostering leadership and catalysing professional development. We envision a future where vulnerable communities are empowered to thrive amidst climate adversity. Together, we can forge a resilient, sustainable tomorrow.

Budget

Salaries

Name	Justification	Period on project	% time	Total
Postdoctoral researcher	Project lead	12 months	100	£60000
Olatunji Johnson	Co-PI – statistical analysis and online application expert	12 months	5	No cost
Alison Fairbrass	Co-PI – environmental and economic metrics expert	12 months	5	No cost
Tim Lucas	Co-PI – statistical analysis and health metrics expert	12 months	5	No cost

Materials and consumables

Description	Justification	Total
Computers	To enable our postdoc to conduct high-level computations efficiently, run complex simulations, and analyse extensive data sets integral to our project, we must invest in a high-specification computer, which is paramount for maintaining our research's pace, precision, and effectiveness.	£2000

Access charges

Description	Justification	Total
Cost of publishing the scientific paper (open access fees)	Covering the open access fees for a scientific article is critical as it ensures that our research is universally accessible, promoting widespread dissemination of our findings, enhancing its impact, and accelerating innovation and knowledge growth in the wider scientific community.	£3000

Travel and subsistence

Description	Justification	Total

Travel to meetings and conferences	The funds allocated for travel to meetings and conferences are essential, enabling us to share our project's findings with the broader scientific community and relevant stakeholders, fostering collaborative efforts, and maximising the impact of our research.	£5000

Miscellaneous

Description	**Justification**	**Total**
Public relations and marketing costs (working with communications teams, promotion materials, etc.)	The cost for public relations and marketing is justified as it helps in effectively communicating the value and impact of our research to the public, policymakers, and other stakeholders, thus facilitating a broader understanding, visibility, and impact of our work.	£4000
Online webinar hosting and promotional costs	The cost of online webinar hosting and promotional efforts, especially those concerning multilingual events, translation services, and accessibility measures like live subtitles, is crucial for fostering global participation, ensuring that our findings and discussions are accessible and inclusive to a broad international audience, thereby maximising the project's reach, engagement, and potential impact.	£2000
Contingency – unanticipated costs	The allocation of funds for contingency is necessary to effectively manage any unforeseen expenses that may arise during our project, thus ensuring its seamless operation and successful completion without financial interruptions or setbacks.	£5000
Postdoc training	Investing in postdoc training, specifically in causal inference statistical methods and building Shiny apps, is crucial to ensure they acquire the necessary skills and expertise for the project. This, in turn, will enhance the quality of our research and the robustness of the tool we aim to develop, thereby ensuring the successful execution and impact of our project.	£4000
Overheads	Covering the university overheads for the postdoc is essential as it supports the necessary administrative, technical, and infrastructural resources that enable the postdoc to carry out their research efficiently and effectively, thereby directly contributing to the success and impact of our project.	£15000

Summary of costs requested

Description	**Total**
Salaries	£60000
Materials and consumables	£2000
Equipment	£0
Access charges	£3000
Travel and subsistence	£5000
Miscellaneous	£30000
Grand total	**£100000**