Institution: University of Oxford		
Unit of Assessment: 14 – Geography and Environmental Studies		
Title of case study: Embedding Understanding and Governing Climate-related Risks at the Bank of England		
Period when the underpinning research was undertaken: 2013 – 2020		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s): Dr Ben Caldecott	**Role(s) (e.g. job title):** Director, Oxford Sustainable Finance Programme, Smith School of Enterprise and Environment	**Period(s) employed by submitting HEI:** April 2013 - present
Period when the claimed impact occurred: 1 August 2014 – 31 December 2020		
Is this case study continued from a case study submitted in 2014? N		

1. Summary of the impact (indicative maximum 100 words)

Aligning finance and the financial system with environmental sustainability is a necessary condition for meeting the Paris Agreement and the Sustainable Development Goals. Central bank action is a pre-requisite for this condition to be achieved. In 2012 there was no work on, or expertise in climate change at the Bank of England, or in fact any other major central bank. Caldecott's research on climate transition risks and stranded assets has substantially influenced the Bank of England's acknowledgement and subsequent governance of these risks since 2014, and informed the changing UK supervision of financial firms and investors. This has catalysed a global movement on climate change across financial institutions and financial supervision agencies (hereafter 'central banks'), which are now expected to disclose their climate-related risks.

2. Underpinning research (indicative maximum 500 words)

Caldecott's initial original insight was that climate-related risks can create significant 'stranded assets' that financial actors, such as investors and insurance firms, need to avoid. Stranded assets can arise as 'transition risks' in the move towards a low- or net-zero carbon economy, as assets experience unanticipated or premature write-downs, devaluations or conversion to liabilities [**R1**].

Caldecott and colleagues have developed a research programme on transition risks and stranded assets at the Smith School. They began to analyse the magnitude of both individual transition risks (such as fossil fuel divestment campaigns for fossil fuel firms and the investments of public pension funds, universities and other actors [**R2**]), and sets of transition risks for specific sectors (such as insurance and power) [**R3**, **R4, R5**]. As part of this, the underpinning research has identified different routes leading to stranded assets, including: environmental change; changes in the regulation, costs and availability of environmental resources; changes in technology; changes in social norms and consumer behaviour; or changes in statutory interpretation [**R2**]. In a report for Lloyd's of London [**R3**], they distinguish between upstream and downstream energy assets and liabilities, and also consider the implications for residential, commercial and shipping assets. Examples of upstream and downstream stranded energy assets are, respectively, the premature closure of coal power stations due to concerns about climate change and the fossil-fuel divestment campaign [**R2**], and impairment of the centralised electricity generation market if households use solar photovoltaics and electric vehicles to generate and store energy on a large scale. Upstream and downstream liabilities are exemplified by third-party liability claims to firms deemed responsible for climate change, and governments deciding to accelerate the phasing out of coal power plants and the internal combustion engine [**R2**]. Caldecott and colleagues have demonstrated the magnitude of future stranded assets, particularly in the power sector where more than half of the global electricity generation capital stock will need to be stranded if the world is to meet the climate goals laid down in the Paris Agreement [**R4**].

A second main area of research has been the identification of actions that institutional investors and central banks can take to identify and mitigate transition risks and pre-empt asset stranding [**R3**, **R5**, **R6**]. Individual investors can stress-test their portfolios for transition risks using scenario analysis, screen portfolios to exclude high-risk assets and include others, divest by removing assets from their portfolios, and engage more actively in the governance of the businesses in which they invest as a form of stewardship [**R3**]. At the collective level, investors and central banks can push for disclosure standards and greater transparency in the financial conduct of investee firms; collaborate and share knowledge with each other when targeting investees; and lobby authorities for involvement in prudential regulation, legislation and policymaking [**R3**].

3. References to the research (indicative maximum of six references)

R1: Caldecott, B. (2017) Introduction to special issue: stranded assets and the environment. *Journal of Sustainable Finance & Investment* 7(1), 1-13. https://doi.org/10.1080/20430795.2016.1266748 [output type: D]

R2: Ansar, A., Caldecott, B. and Tilbury, J. (October 2013), Stranded assets and the fossil fuel divestment campaign: what does divestment mean for the valuation of fossil fuel assets. Oxford: Stranded Assets Programme, University of Oxford, available at: http://www.fossilfuelsreview.ed.ac.uk/resources/Evidence%20-%20Investment,%20Financial,%20Behavioural/Smith%20School%20-%20Stranded%20Assets.pdf [output type: U]

R3: Caldecott, B.L., Dericks, G., Pfeiffer, A. and Astudillo, P. (2017) Emerging Risk Report 2017: stranded assets - the transition to a low carbon economy. Innovation Series: Society and Security. Lloyd's of London, London, UK. [peer-reviewed by Grantham Institute at Imperial College London], available at: https://www.lloyds.com/~/media/files/news-and-insight/risk-insight/2017/stranded-assets.pdf [output type: N]

R4: Pfeiffer, A., Hepburn, C., Vogt-Schilb, A., Caldecott, B. (2018) Committed emissions from existing and planned power plants and asset stranding required to meet the Paris Agreement. *Environmental Research Letters* 13, 054019. http://doi.org/10.1088/1748-9326/aabc5f [output type: D]

R5: Caldecott, B. and McDaniels, J. (2014) Financial Dynamics of the Environment: Risks, Impacts, and Barriers to Resilience. Working Paper for the UNEP Inquiry [peer-review led by OECD]. Oxford: Stranded Assets Programme, University of Oxford. https://www.smithschool.ox.ac.uk/research/sustainable-finance/publications/UNEP-SSEE-Working-Paper-Financial-Dynamics-of-the-Environment.pdf [output type: U]

R6: Kruitwagen, L., Madani, K., Caldecott, B., Workman, M.H.W. (2017) Game theory and corporate governance: conditions for effective stewardship of companies exposed to climate change risks. *Journal of Sustainable Finance & Investment*, 7(1), 14-36. http://doi.org/10.1080/20430795.2016.1188537 [output type: D]

Funding – The Stranded Assets Programme (now the Oxford Sustainable Finance Programme), led by Caldecott, has benefitted from a wide range of direct financial contributions. These include contributions from: World Wide Fund for Nature (WWF) (GBP20,000 – 2013, GBP29,629– 2014; GBP35,183 – 2016); Lloyds of London (GBP35,000 – 2015); City of London (GBP12,900 – 2016); HSBC (GBP15,000 – 2015; GBP20,000 - 2016-17; GBP50,000 - 2018-2021); NorgesBank (GBP184,500 – 2015-2017).

4. Details of the impact (indicative maximum 750 words)

This research has increased institutional awareness of climate-related risks and asset stranding within the Bank of England and influenced changes in how such risks are integrated into financial decision making, both in the UK and internationally.

Raising awareness of transition risk within the Bank of England and beyond

Caldecott was a key advisor to the Bank of England on its seminal report, *Impact of Climate Change on the UK Insurance Sector* [**E1**], published on 29 September 2015. The report and

accompanying speech on the same day by then Bank Governor Mark Carney [**E2**] constituted the first time a central bank called for consideration of transition risk and stranded assets in financial policy. The report also set out principles for how the Bank would approach climate change in future and confirmed that it considered managing climate risks to be part of its statutory mandate.

According to the Head of the Bank of England's Climate Hub (2013-18), Caldecott was chosen as part of the small team working to develop **E1** and **E2** due to his "deep expertise and research excellence on the financial relevance of climate and environmental factors" [**E3**]. His research is cited throughout **E1**, with particular use of **R2**, including how "changes in sentiment and financial innovation, such as the 'hedging' of carbon risk or fossil fuel divestment, can impact asset values", and how growing fossil fuel divestment campaigns "may have the potential to trigger changes in market norms" [**E1**]. **E1** also features two tables of potential individual and collective investor responses to climate transition risks, credited to co-produced research by Lloyd's of London (a major insurance company) and the University of Oxford. These potential responses were later published in revised form as **R3** and include most of the actions mentioned in Section 2 above, including stress-testing of investment portfolios, enhanced engagement with investee firms, greater disclosure of climate-related financial risks, and pledged involvement with investment frameworks.

The Head of the Climate Hub further commented that "the Smith School's research on stranded assets was influential in shaping Chapter 4 on transition risks… you [Caldecott and colleagues] were the most cited academics in the entire report" [**E3**]. Another senior advisor to the project within the Bank's Prudential Regulation Authority commented that "your research and expertise on stranded assets and views on how climate risk should be analysed were invaluable. At the time, the idea of stranded assets due to climate was novel. However, your work that went into our paper on this topic put this topic front and centre" [**E4**].

In the international context, **E1** also provides much of the intellectual foundation for the Task Force on Climate-related Financial Disclosures (TCFD). The TCFD was first proposed by Carney in the speech [**E2**] complementing the Bank of England report [**E1**] as an effective international response to dealing with the financial risks, including transition risks and the stranding of assets, that climate change is causing. Following its creation, Michael Bloomberg was appointed the Chair of TCFD. The TCFD develops voluntary, standardised *climate-related financial* risk *disclosures* for companies providing information to stakeholders. Its remit is therefore an elaboration of the recommendations about disclosure standards in **R3**. In October 2019 the TCFD was supported by institutions representing over USD120,000,000,000,000 of assets globally [**E5**], mainstreaming the integration of transition risks across the financial system and supporting many countries working towards mandatory climate disclosure, including the UK.

The report's influence on financial supervision, regulation and disclosure in the UK

After the publication of **E1** in late 2015, the Bank began to assess how and when changes should be made to micro- and macro-prudential supervision, financial conduct, and monetary policy. A subsequent report published in 2017 [**E6**] cited both **E1** and **R5** in a point of emphasis ("environmental factors are not fully integrated into financial and corporate decision making") which needed further action. Whilst **E1** had focused exclusively on insurance, **E6** deepened the Bank's activities in that area and began to develop recommendations for how broader banking supervision should address climate-related risks. These recommendations were in line with earlier approaches identified by Caldecott in **R2**, **R3** and **E1**, such as "[i]nsurance activities will build upon the PRA's 2015 report. This will involve more granular research into firm-level exposures to physical and transition risks. It will also include considering the relevance of climate-related factors to the PRA's existing approach to supervision, including stress-testing, business model analysis and other aspects of firm supervision" [**E6**]. The report also announced that a "review of the UK banking sector will follow a similar process to that already completed for insurance firms" [**E6**]. The Bank published a consultation paper in October 2018, building on the analysis in **E1** to propose specific changes to supervision for supervised banks and insurers. The proposals were adopted in April 2019 via the publication of formal regulatory notices [**E7a-b**] requiring boards and senior management of the 1,500 firms supervised by the Bank of England to have the data, scenario analysis, and management plans in place to measure, manage and disclose climate-related risks.

Following **E1** and **E6**, which asked how the Bank of England could regulate other financial actors' climate-related risks, its own practice also changed. For the first time, the Bank followed the TCFD requirements and disclosed its own climate-related risks in a report published in June 2020. In the foreword, the new Governor of the Bank stresses the importance of leading by example: "The Bank sits at the heart of the financial system and so it is important we hold ourselves to the same high standards as the firms we regulate" [**E8**].

Increased understanding of climate-related transition risks in UK policy

Because of his work on stranded assets and disclosure of transition risk disclosure, Caldecott was appointed as chair for the TCFD work stream within the Green Finance Taskforce (GFT). The GFT is an independent taskforce set up by the UK Government in November 2017 to advise the public and private sector on green finance and the low-carbon economy. While it does not directly cite academic publications, the GFT's *Accelerating Green Finance* [**E9**] report to the UK Government foregrounded the risk of stranded assets that Caldecott had been highlighting since 2012: "the TCFD project must be implemented globally; otherwise market failures will continue, with exposure to climate change risk and opportunity continually mispriced and capital misallocated as a result".

As a result of Caldecott's written evidence and witness testimony to the Environment Audit Committee's 'Green Finance' inquiry in 2017-18, the Committee's final report argues that the UK should fully implement TCFD recommendations. Citing Caldecott directly, the Committee says that "London's systemically important role in the global financial system, means that 'the UK Government has an opportunity to green finance in a way that no other government has', according to Dr Ben Caldecott of Oxford University's Sustainable Finance Programme" [**E10**]. In making its arguments, the Committee also cites Caldecott's observation that many businesses already use scenario planning to manage risks such that TFCD scenario planning would be an assimilable task [**E10**].

The Environment Audit Committee's final report also praises the international leadership the Bank of England and its Governor (both influenced by Caldecott via **E1**) had demonstrated in outlining the risks of climate change to financial stability and putting the issue on the agenda of the G20. The Committee concludes that the UK Government must do more to "ensur[e] that financial institutions, businesses and regulators factor long term environmental risks like climate change into financial decision making" [**E10**]. Recommending that the Government set a 2020 deadline to listed companies and large asset owners for reporting on climate-related risks and opportunities in line with TCFD guidelines, the Committee proposed that the "UK's existing framework of financial law and governance could and should be used to implement climate-related risk reporting as the Green Finance Taskforce has recommended" [**E10**].

The UK Government followed the Committee's recommendations, announcing in July 2019 that large asset owners and listed companies are expected to report climate change risks in line with the TCFD guidance from 2022. In 2020 the Government "introduced fully mandatory climate-related financial disclosure requirements across the UK economy by 2025, with a significant portion of mandatory requirements in place by 2023" and developed a roadmap to facilitate this process [**E11**]. While many factors and processes have driven these policy and regulatory changes, Caldecott's research and engagement have made an important contribution.

Influence on other central banks

The Bank of England's work on climate risk, to which Caldecott has contributed, has also catalysed a broader international movement across central banks internationally. The Bank of England co-founded the Central Bank and Supervisors Network for Greening the Financial System (NGFS) to enhance the work of central banks on climate change, and it now has almost 80 members and observers, including the International Monetary Fund [**E3**]. Members, including Malaysia and Singapore, have adopted the UK's regulatory frameworks, including **E6**, almost unaltered [**E4**]. According to the former Head of the Bank's Climate Hub [**E3**], **E1** triggered "a transformation in the work of Central Banks and Supervisors relating to climate change and green finance…your [i.e. Caldecott's] pioneering work on Stranded Assets has been hugely influential in shaping the mainstream, system-wide actions that are now taking place to better align private sector financial flows with the Paris Agreement." In a May 2020 report about how to manage climate-related financial risks, the NGFS recommends the Bank of England's expectations regarding governance,

scenario analysis and stress-testing by financial institutions detailed in **E6** as good practice that central banks across the world can follow [**E12**].

5. Sources to corroborate the impact (indicative maximum of 10 references)

E1: Report: Prudential Regulation Authority, Bank of England (2015) *Impact of Climate Change on the UK Insurance Sector.*

E2: Speech: Governor of the Bank of England (2014) *Breaking the Tragedy of the Horizon – climate change and financial stability.* [published in full on Bank website]

E3. Testimonial letter from former Head of Climate Hub, Bank of England

E4: Testimonial letter from Senior Advisor, Prudential Regulatory Authority, Bank of England

E5: Speech: Governor of the Bank of England (2019) *TCFD: Strengthening the Foundations of Sustainable Finance*. [published in full on Bank website]

E6 Report: Bank of England (2017) *The Bank's Response to Climate Change*.

E7a: Supervisory Statement 3/19. Prudential Regulatory Authority, Bank of England (2019), **E7b**: Bank of England (2019) Policy Statement 11/19.

E8: Report: Bank of England (2020) *The Bank of England's Climate-related Financial Disclosure 2020.*

E9: Report: Green Finance Taskforce (2018) *Accelerating Green Finance*.

E10: Report: House of Commons, Environmental Audit Committee (2018) *Greening Finance, Embedding Sustainability in Financial Decision Making.*

E11: Report: HM Treasury (2020) *Interim Report of the UK's Joint Government-Regulator TCFD Taskforce.*

E12*:* Report: Network for Greening the Financial System (2020) *Guide for Supervisors Integrating Climate-related and Environmental Risks into Prudential Supervision*.