

Data for Good
Insights Paper

Climate Change Reporting in the Australian Media

RMIT Innovation Catalyst



Introduction

What are the most important problems we are grappling with as a society and how are those challenges reflected in the media? That simple question was the starting point for this project.

“What are the most important problems we are grappling with as a society and how are those challenges reflected in the media?”

The RMIT Innovation Catalyst, we unite community groups, local industry and RMIT’s own research expertise in pursuit of innovative solutions. So, with our big question in mind, we sought out partners who could help us to define the problem and work on a solution. Climate change is one of the most important challenges we face, and we knew we could present a new angle on Australia’s climate change discourse. In conversation with RMIT’s Victorian Circular Activator and the Australian National University’s Global Institute for Women’s Leadership, we identified an opportunity to analyse Australia’s media reporting on climate change over the past three decades. As a group, we took up the challenge and formed an inter-disciplinary team to analyse an enormous dataset of text media.

We used a machine learning technique, called topic modelling, to take a different approach to answering our broad research question. We know that the scale of the problem requires innovating with new methods and materials, so we set out to explore the public conversation as it is represented in the mainstream news media.

Using the Factiva database, we accessed a data set of text media articles on the topic of environment and climate change going back to 1990. We have identified topics and trends in this enormous corpus of media data using cutting edge machine learning methods. Unparalleled access to a comprehensive set of published articles makes our findings more robust.

What follows is an introduction to our most interesting findings, leaving more to discover and more work to be done with the trove of information that we have. Despite the volume of scientific evidence that we are approaching critical tipping points, we need diverse ways to understand and communicate the impacts of climate change on society and community. We have plenty of new insights to share and we hope to provoke a new conversation about climate change; one that ultimately leads to more effective climate action.

Throughout this paper, we present some provocations. These are questions for further research and consideration. Perhaps you know the way to find some of the answers; please join this conversation with us, share your thoughts, come to one of our events at the Social Innovation Hub and help us to tackle our biggest challenges through innovation and collective action.

The research and writing for this project were undertaken by

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The authors would like to acknowledge the support of Dow Jones Factiva Analytics, The RACE Hub and the Victorian Department of Education’s VHESIF program which made this project possible.

The Critical Climate Decade: Importance and Impact

Reducing the harm caused by climate change cannot be addressed using a simple technical lens. It is a collective action problem that requires a community response. We know that along with finding solutions, we must also build the collective resolve to implement those solutions. Directing sufficient resources towards carbon abatement, renewable energy technology and promoting energy efficiency all require government action, commitment from the business sector, and community support.

The media shapes and informs our public conversations¹. That is why it has a central role to play in our collective resolve to tackle climate change². Indeed, news media can be the primary source of information on climate change for a broad audience and it can form the basis for the news that people see in their social media feeds³. The largest traditional media organisations can play an agenda-setting role that shapes the news^{4,5} and also shapes policy at all levels⁶. Smaller outlets add nuance and fill niches that mass media cannot reach.

These are not the only key media figures in the daily lives of citizens, even independent commentators and thought leaders are influenced by - and influence - our news feed. Australian research from 2022 found that almost one in five (18%) Australians do not pay attention to climate change news; but that 42% say they want news outlets to focus more on what governments and large companies can do about it⁷. Those who do engage with climate change news rely on reports that come from scientists, experts and academics, as well as documentaries and news outlets.

It is therefore vital to the quality of our public debate that all stakeholders, including media outlets, are aware of the patterns and trends in media reporting on climate change. As the news media landscape is threatened by the growing dominance of social media, demonstrating the impact of news media reporting also becomes part of a quest for media survival, determining who will provide the guiding narratives, sources and experts to help us solve our collective problems.

Our approach offers a birds-eye view of the Australian media landscape over the past 30 years that can reveal trends which individual reporters and publications might miss. We can reflect the work of the media back and share an aggregate view with the public. We hope this can be the starting point for a more intentional and informed discussion about climate change and broader environmental reporting in our public sphere.

This approach is made possible by big data analytics techniques that have emerged as part of artificial intelligence advances over recent years. Thanks to massive datasets, increased computing power, and machine learning tools we can delve into the entire corpus of news media reporting collected and digitised over decades. This amounts to hundreds of thousands of articles, written by thousands of journalists and published by all Australian media publishers. As a dataset, this offers stakeholders unprecedented access and insights into the topics.

Our data captures long-running newspapers and online media start-ups to highlight Australian's shifting media consumption habits. We can see a dramatic increase in the volume of text that is published over the past 15 years as online publishing has grown. At the same time, media consumption has become decentralised and fragmented over the past two decades and people increasingly access a stream of news content that is served up algorithmically via social media.

We hope that our work will also create more informed and critical media consumers who are conscious of the broader conversation in which they find themselves, in this critical decade of action on climate change.

In this insights paper, we show the way that specific sub-topics have moved in and out of favour, within the climate change coverage. Perhaps unsurprisingly, major news events, like natural disasters, influence the volume of coverage that climate change receives. But less obvious are the ways that gender plays a hidden role in climate reporting, and that the circular economy is an emerging sub-field within broader environmental responses that we explore in more detail. We present an exploratory data analysis, using one of the largest news media datasets that stretches over 30 years. We invite you to join the conversation as we consider how we can improve our public discussion about climate change.

What can topic modelling tell us?

At the humanities-science interface, topic modelling is used to analyse large volumes of raw text to find trends and common themes. Drawing on recent advances in AI and machine learning, it is a true collaboration between humans and machines. Computers use their remarkable pattern recognition abilities to process far more text than a team of researchers ever could. The computer algorithm finds clusters of words that are likely to appear together in a document. These word clusters must then be interpreted by a human research team with subject matter expertise. The researchers impose meaning on the patterns found by the computer. By reading a sample of articles and placing the word clusters in their proper context researchers can create semantically meaningful topics. The computer can then categorise all the documents in the dataset using these topics.

“We have analysed 184,401 articles, covering all material published in the Australian media about climate change and the environment personal and family finance since 1990”

The remarkable strength of the topic modelling approach is its ability to analyse a comprehensive set of documents, where there are thousands (or even millions) of documents in the dataset. It would never previously have been possible for a research team to analyse every single text article published in Australia on an enormous topic like climate change from since 1990 to 2022 (184,401 articles in all). But that is exactly what we have done. This gives us a sense of the changes in our public conversation across time. As society and the nature of media publishing has changed, we can also see changes in the topics we talk about. For policy makers and advocates alike, we have new insights into the topics the media is talking about, and those that are missing.

See Appendix 2 for a detailed methodology.

Climate change and the media: Key findings

Coverage of climate change has increased significantly over the past 30 years across all news media outlets. In the 1990s there were an average of 514 articles in our data set on climate change each year. In the 2010s that figure rose to 80,943. This increase was driven by the rapid growth of online publishing. There are now more articles published on every topic, compared with 30 years ago. However, we can also see that climate change has grown as a proportion of the Australian media discourse. Articles referring to climate change or environmental issues increased nearly ten-fold over the two decades from the 1990s to the 2010s. However, these articles only accounted for 0.027% of all articles published in the 1990s and 0.28% in the 2010s.

This is similar to previous research that focused only on two major dailies – *The Australian* and the *Sydney Morning Herald*, which showed that over the period 1997 to 2010, climate change coverage constituted 1.42% of all articles published in those newspapers. Drilling down still further, they found that climate change coverage increased to 3.61% of all articles between 2006 and 2009. Other studies using the same two major dailies found that climate change reporting constituted 1.08% of all reporting, but they found that reporting declined over the 2006-2018 period⁸.

Our research illustrates that climate reporting across a wide range of media is typically lower than the two major dailies. It also shows that it is important to consider the full range of news media outlets, regional and urban, and syndication, when understanding the climate change reporting landscape⁹.

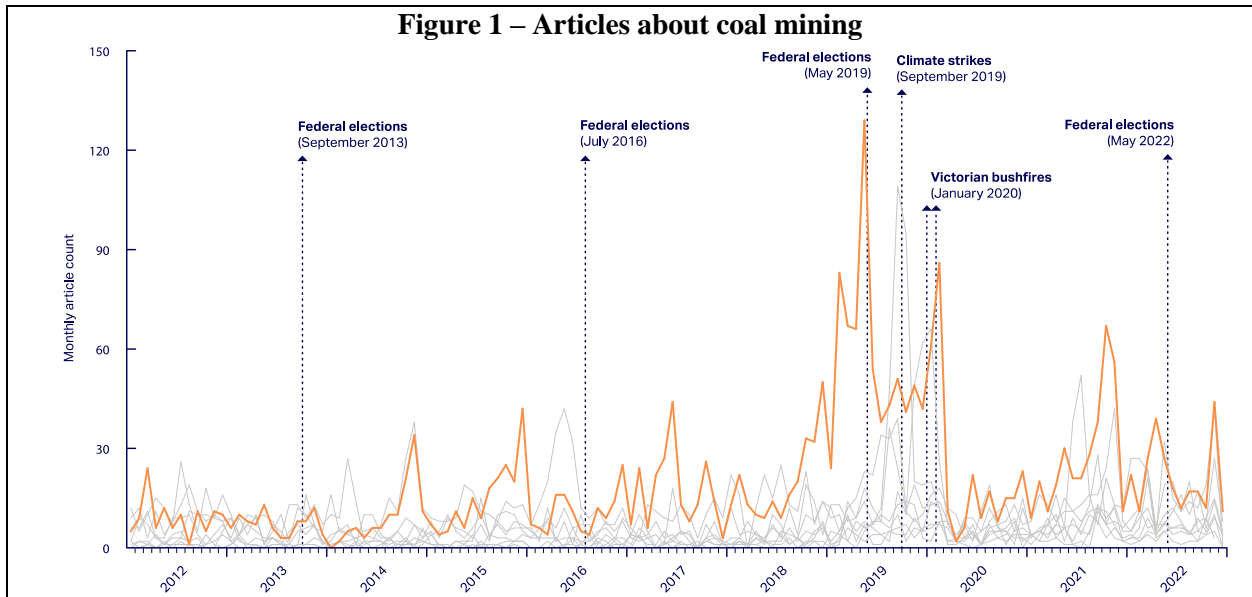
Within the climate change discourse, the mix of sub-topics has also evolved over time. Early reporting more commonly discussed temperature forecasts and predictions about climate change. Today people more often talk about climate change as a current and acute problem. Through our analysis we can see the forecasting topic losing its salience over time, perhaps as the time for forecasting passes, while other topics such as extreme weather events and recycling and circular economy are increasing.

In all time periods, political debates about climate policy and climate denialism can be observed to take up a significant part of the media discourse. From the very beginning the public conversation about climate change has been politicised. The media now tends to draw a closer link between natural disasters and climate change, putting more pressure on governments to take action that will mitigate climate change and its effects¹⁰.

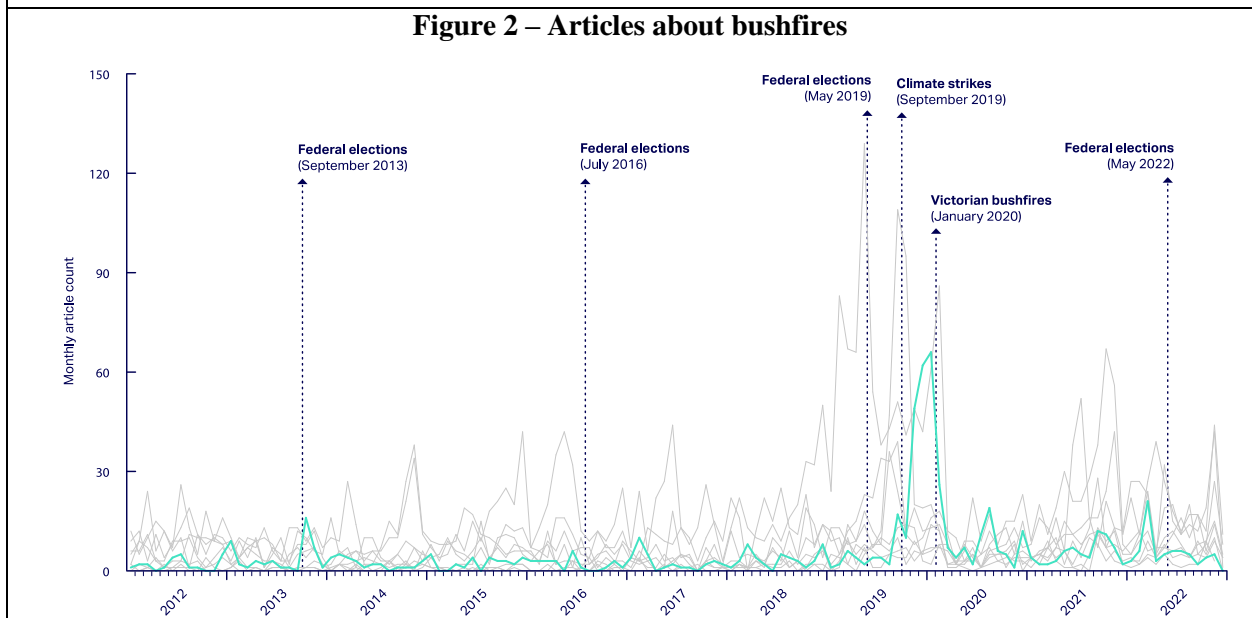
Our model contains 60 topics, of which, 48 were deemed to be relevant to the topic. However, in this report we take a closer look at only a segment of these topics. We are aiming to highlight the most important and interesting trends that we have found in our work so far.

Reporting at a time of crisis

Changes in media coverage driven by bushfires and other news media events



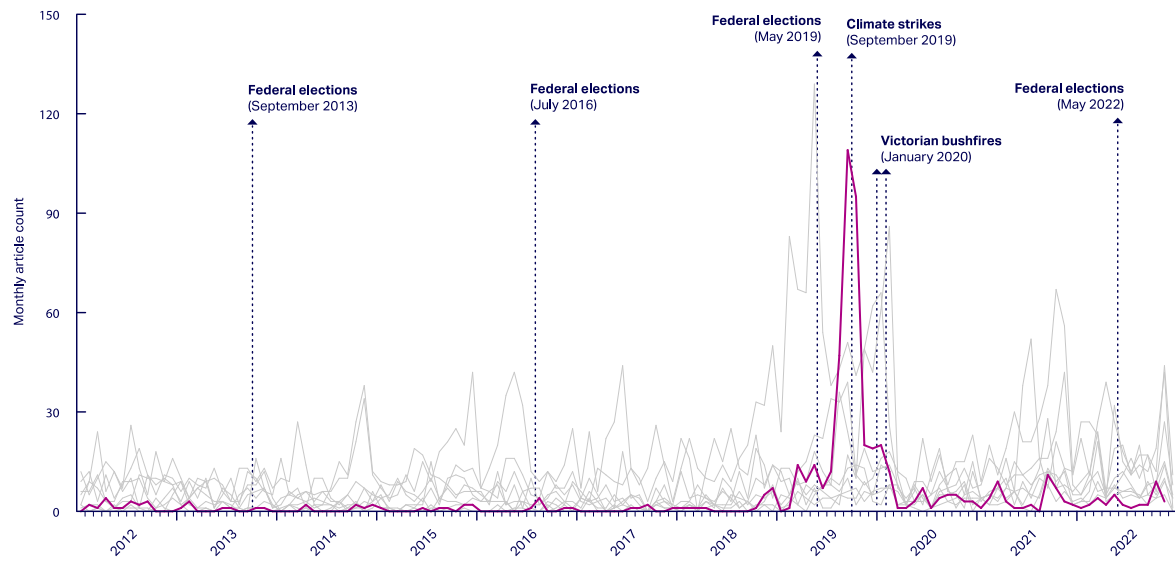
This chart shows the number of articles published in each month on the topic of coal mining that mention climate change. We see coverage of this politicised topic spiking in the lead up to federal elections.



This chart shows the number of articles published in each month on the topic of bushfires that mention climate change. Coverage of the major bushfires in Victoria in 2019 and 2020 included lots of discussion of climate change.

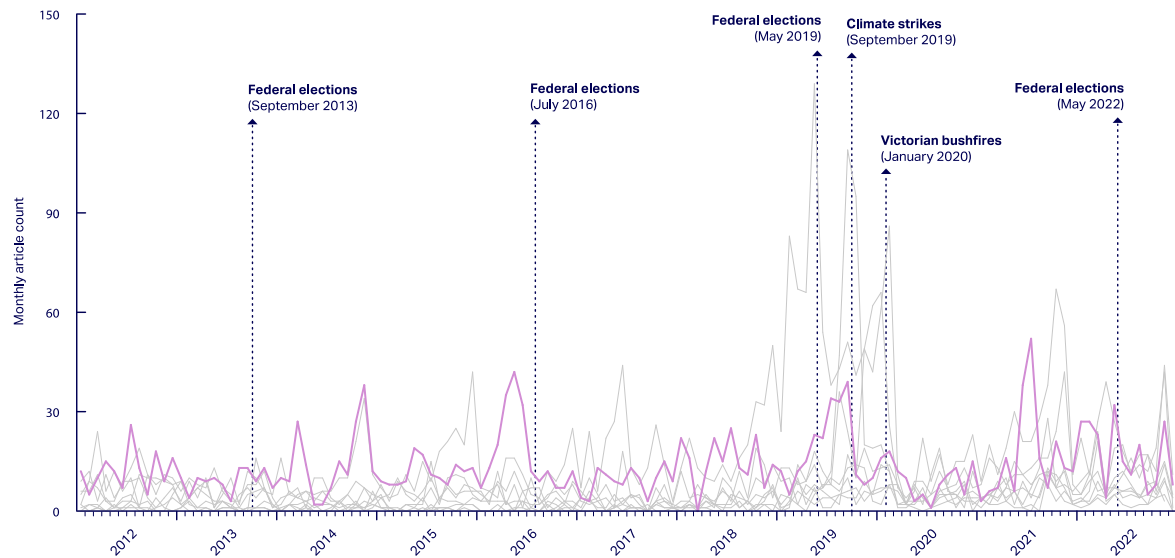
This is not true of major bushfires in the past, for example the 2009 Black Saturday fires

Figure 3 – Articles about climate activism and protests



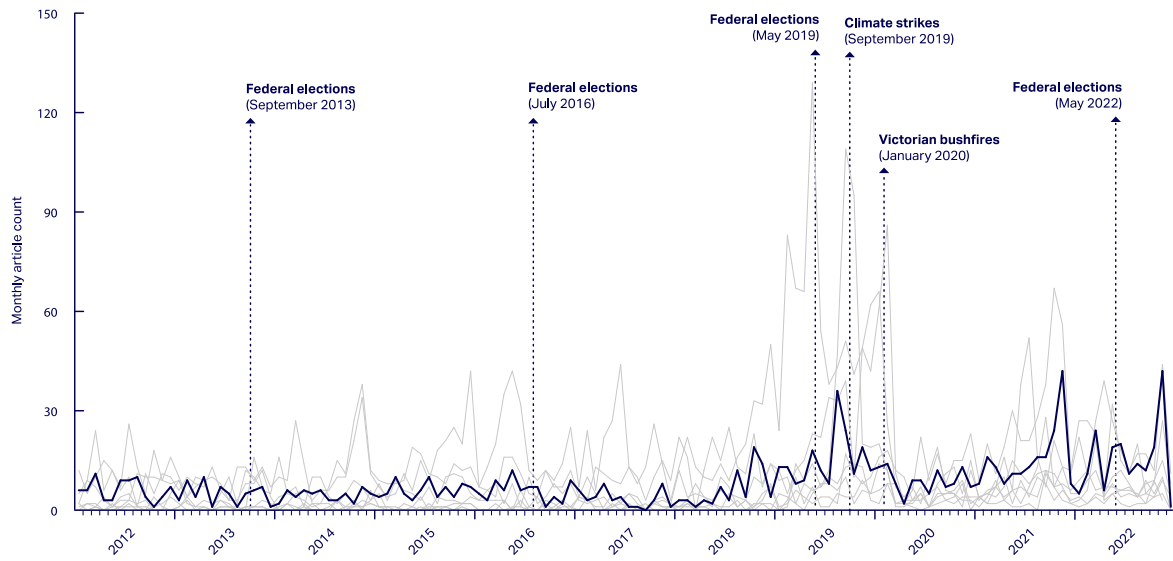
This chart shows the number of articles published in each month on the topic of climate activism and protests that mention climate change. The global climate strikes were successful in attracting a lot of media attention, although the effect seems to be short lived.

Figure 4 – Articles about coral reefs



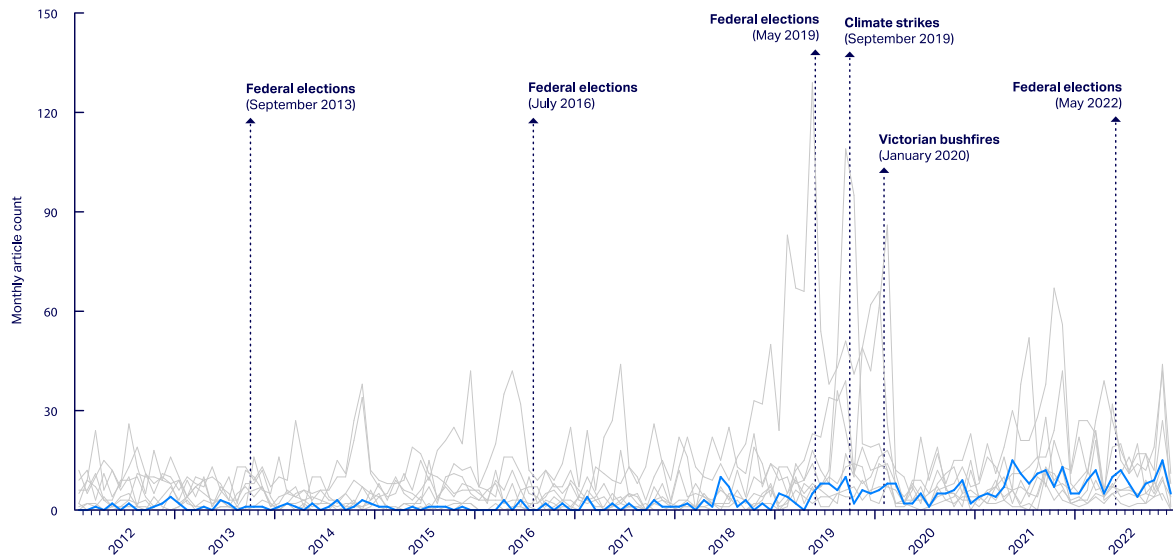
This chart shows the number of articles published in each month on the topic of coral reefs that mention climate change. Reefs are a major theme of Australian climate coverage because of the detrimental effect on the Great Barrier Reef.

Figure 5 – Articles about agriculture



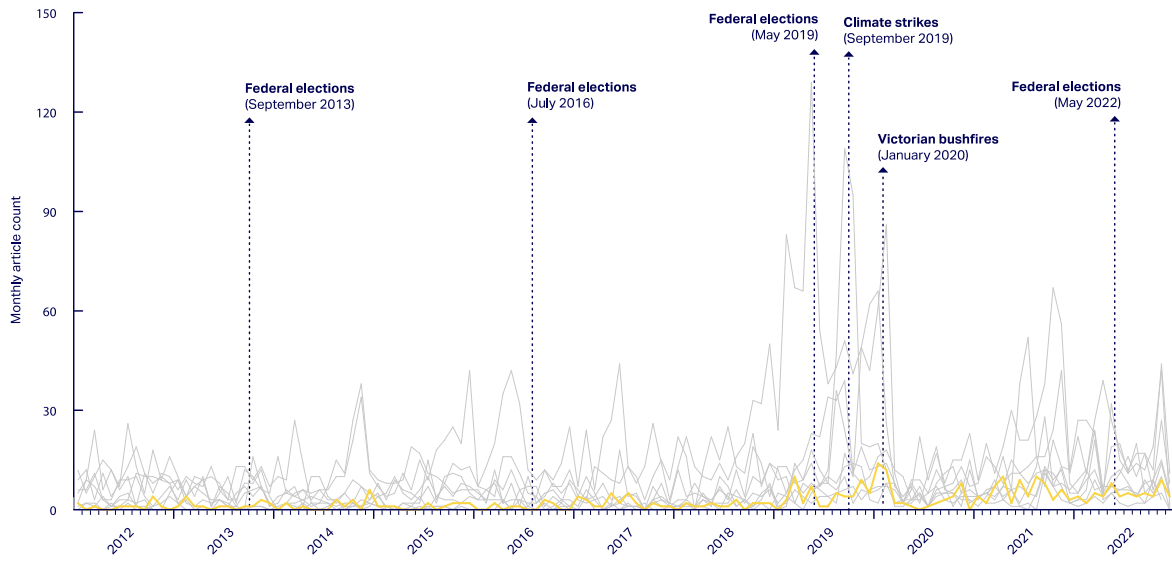
This chart shows the number of articles published in each month on the topic of agriculture that mention climate change. Agriculture as a component of the Australian climate discourse has increased in importance over time.

Figure 6 – Articles about recycling and circular economy



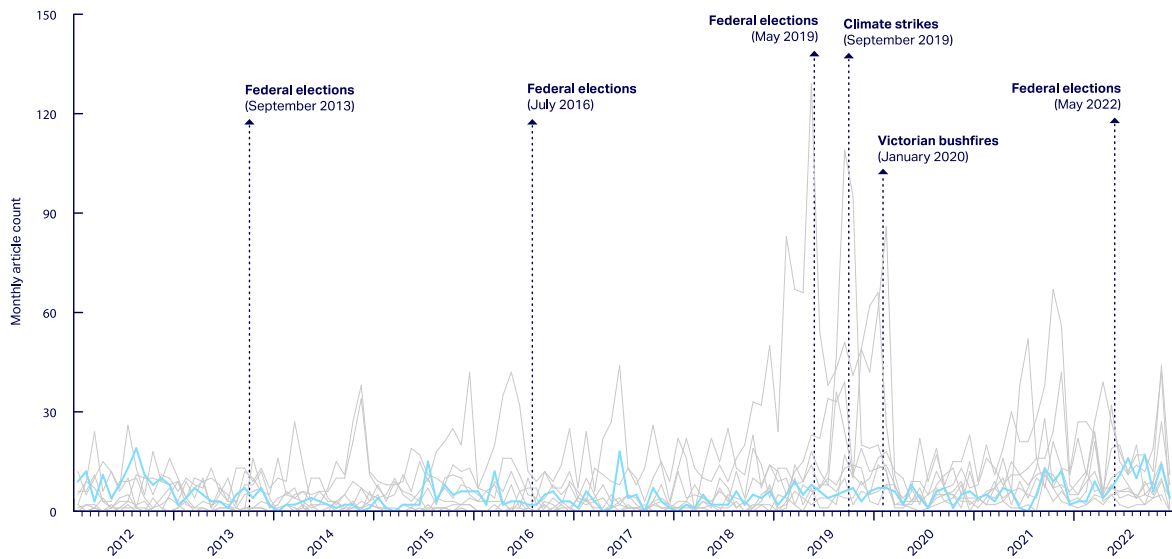
This chart shows the number of articles published in each month on the topic of recycling and circular economy that mention climate change. As a relatively new concept, circular economy has emerged as an important new approach to overcome broader sustainability and resource constraints.

Figure 7 – Articles about environmentally responsible investing



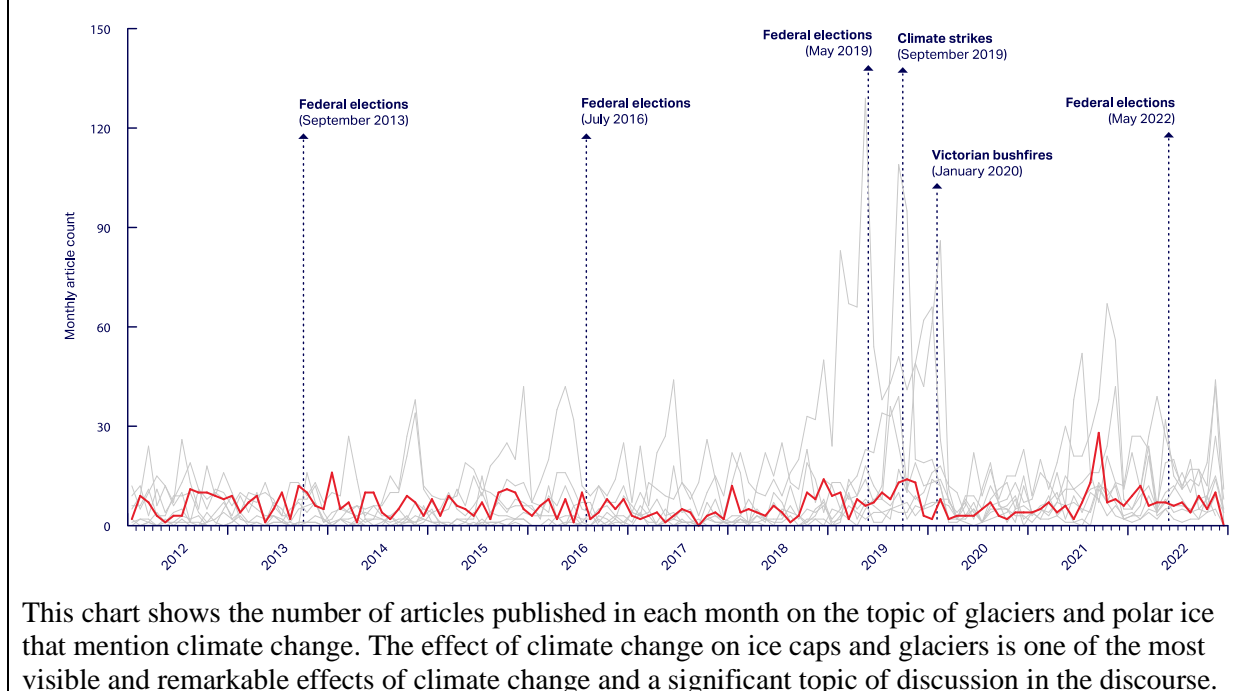
This chart shows the number of articles published in each month on the topic of environmentally responsible investing that mention climate change. Interest in the topic peaked in early 2020

Figure 8 – Articles about renewable energy



This chart shows the number of articles published in each month on the topic of renewable energy that mention climate change. Renewables have always been an important part of the discussion about climate change and climate action

Figure 9 – Articles about glaciers and polar ice



Explore more of our results using our interactive, online chart: <https://sairamdgitte.github.io/topic-wise-line-chart-cc/>

Bushfires and climate change coverage

One of the most important topics found in our analysis was the impact of bushfires on climate change reporting (see figure 2). Climate change reporting is driven by catastrophic and sensational events. We see significant changes in the volume and nature of coverage during major natural disasters, protests and similar events that attract news attention.

Taking the Black Summer bushfires in late 2019 and fires in early 2022 as an example, these periods produced spikes in reporting on bushfires, within the climate change coverage. Some stories at the time talked about the bushfires as a possible or definite result of climate change. Other research has shown that 49% of Black Summer newspaper coverage was about climate change, compared to only 5% in the Black Saturday reporting a decade earlier¹⁰.

Talking about present-day natural disasters as directly caused by climate change is a relatively recent phenomenon within news reporting. No previous major bushfires produced such a large spike in the climate change media. In fact, our chart shows only a small bump in articles about climate change and bushfires in February 2009, the time of the Black Saturday fires. While those fires were devastating and very extensively covered in the media, they were not linked to climate change in the way that the more recent fires were. Some of this could be attributed to sheer size and intensity. The 2009 bushfires burnt 450,000 hectares, whereas the 2019–20 bushfires consumed a massive 11 million hectares of bush across the country¹¹. The 2019 fires produced more than 65 articles about climate change in the month of January 2020 alone. By far the most climate change-related coverage of bushfires at any point in our data set.

We also see an increase in the prevalence of other climate change sub-topics around that time, including coal mining. This shows that the natural disasters coincided with more intense debates about climate change, and it's causes. Changing behaviours requires more than just attention, it also requires the capability and opportunity to drive change. Some bushfire narratives focus on 'the unstoppable power of nature' and 'failure of government planning' which may actually reduce audience feelings of capability and opportunity as readers feel overwhelmed by forces over which they feel they have no control.¹⁰ Media outlets that want to contribute to improving climate policy and discourse could consider narratives that promote feelings of autonomy and action during times of natural disaster, while they have the increased attention of readers.

The link to coal mining also shows that the fires touched off a wider conversation about climate change causes and mitigation. This does not mean that the added media attention is carrying the most important message to people. An Australian study investigated 512 media articles about bushfires and found that only 29% mentioned a link between bushfire risk and climate change. And very few (9%) described the health effects of bushfire smoke¹². Nevertheless, the finding aligns with studies that have been published overseas⁸, showing that people do pay more attention to the issue of climate change and climate action when major crises draw attention to the problem.

Provocation

The need for action on climate change gains most media attention during a time of crisis – which may or may not indicate openness to new solutions around these brief windows of media coverage. How can Media outlets help to build understanding and capacity to address climate change during times of natural disaster, while they have the increased attention of readers?

Clearly the public is paying more attention to climate change during a time of crisis – which may or may not indicate openness to new solutions around these brief windows of media coverage. Changing behaviours requires more than just attention, it also requires the capability and opportunity to drive change. Some bushfire narratives focus on 'the unstoppable power of nature' and 'failure of government planning' which may actually reduce audience feelings of capability and opportunity as readers feel overwhelmed by forces over which they feel they have no control¹⁰. Media outlets that want to contribute to improving climate policy and discourse could consider narratives that promote feelings of autonomy and action during times of natural disaster, while they have the increased attention of readers.

Climate Activism

We see in our data that activism can also drive coverage of climate change and its effects. Global and local activist movements are demanding intergenerational change to the crisis. Greta Thunberg's student climate strikes were an international phenomenon before Covid-19 put an end to their success. By November 2018, 42 countries were participating in the strikes, and within a year that number had risen to 183 countries¹³.

The protests were a globally coordinated week of strikes; Greta Thunberg's Fridays for Future protests. The protest was timed to coincide with the UN's climate summit in New York. It produced the highest single month peak for any topic in our data set, 140 articles were written about the protest in the month of September 2019 alone. There was a significant spike in reporting on climate activism around the time of the 2019 climate strike – which was an international protest. alone. At all other times, climate activism and protests typically generated fewer than 10 articles per month in the Australian media.

Fridays for Futures (FoF) is a youth-led and organised global movement inspired by climate activist Greta Thunberg to mobilise for social change with students taking direct action through school strikes or protests outside parliaments and city halls demanding change. As the FoF movement highlights: ‘Many question why millions of children and adults across the world are taking the time to strike: don’t they have school, work or other responsibilities?’ The answer they argue is simple, ‘We strike because we have no choice. We are fighting for our future and for our children’s future. We strike because there is still time to change, but time is of the essence. The sooner we act, the better our shared future will be’.

Students in Australia participated under the banner “School Strike for Climate”. A study of newspaper reporting on the school strike over 17 months argued that the reporting focussed on student’s emotions in a way that presented them as less rational¹⁴. One international study contrasted the way that climate activists express themselves on Twitter with the way that the same issues were talked about in mainstream newspapers. They found “News outlets tend to report on global politicians’ (in)action toward climate policy, the consequences of climate change, and industry’s response to the climate crisis. Differently, climate movement actors on Twitter advocate for political actions and policy changes as well as addressing the social justice issues surrounding climate change”¹⁵.

A similar study of climate change coverage in 10 different countries also found that protests and major climate summits do drive public attention to the problem of climate change⁸. This kind of activism might be able to create a shift in public sentiment or an opening for policy change. However, there are many more examples of well-organised protests that failed to cut through with media coverage or substantive policy change, yet little understanding as to why this is

Provocation

The news media can be a powerful source of support for climate activists, but social media offers more opportunities for self-expression. What elements of activism engage the news media, and how can media help to drive substantial and sustained action on change?

Mining and Energy Transition

One of the largest and most persistent topics in the Australian discourse about climate change is coal mining. It has such a powerful political and economic influence over some parts of Australia that the topic seems to rise and fall in line with national discussion about climate change. The importance of coal to our economy would seem to be a central reason for Australia’s resistance to decisive climate action. It is notable that the coal mining topic appears to peak in the lead up to each federal election in Australia.

A paper published in 2012 found that the benefits of coal mining to regional and remote communities are widely represented in the media¹⁶ but the harms and costs to the environment do not receive equal emphasis across the entire media. There is much more variation between papers in the extent to which the climate harms of coal mining are discussed within the context of high-profile mining controversies. The Adani (or Carmichael) mine controversy in Queensland for example was a proposal for one of the biggest new coalmines in the world and became a flashpoint for climate activists including Indigenous communities, environmental NGO’s and farmers against pro-mining interests including the state government and elements of the media. This controversy was a lightning rod for the Australian federal election in which the Adani mine won by the Coalition in 2019.

Elections highlight Australia’s division over these issues, not just between political coalitions but within them. Representatives of coal mining electorates have often advocated hard for ongoing coal mining, even in the face of strong opposition from their parliamentary colleagues. The May 2022 elections resulted in

the highest number of climate change articles; 1,328 in the month of May compared to just 259 articles in December of that year.

It seems that Australia's economic reliance on mining and energy exports (coal and gas) can be a major barrier for political leadership required for the transition to carbon neutrality and renewable energy. The role of mass media in lobbying strategies for mining companies is significant. Powerful coalitions between mass media, mining companies, and their shareholders help to promote pro-coal narratives that run counter to the climate science around strategies to achieve net zero futures through renewable energy sources.

Research demonstrates that coverage of the Adani mine controversy was pro-coal in mastheads like the *Courier-Mail in Queensland*, reflecting public-policy decisions taken in 2019, despite public opinion through social media such as Tweets largely promoting the need for greater action on climate change.

Critical minerals are at the core of Australia's transition to clean energy e.g. rechargeable batteries, electric vehicles, wind turbines and solar panels. This involves the reuse and recycling of materials to reduce the environmental impacts of mining and extend the life cycle of materials. However, the social and environmental impacts and opportunities of mining critical minerals such as lithium and copper are almost invisible in the media analysis compared to the debates around climate and coal.

The "umbilical" relationship between pro-coal interests and lobbyists and the mass media has been attributed as the reason why action on climate change has been stymied in contrast to other OECD nations who have adopted more ambitious carbon targets.

Provocation

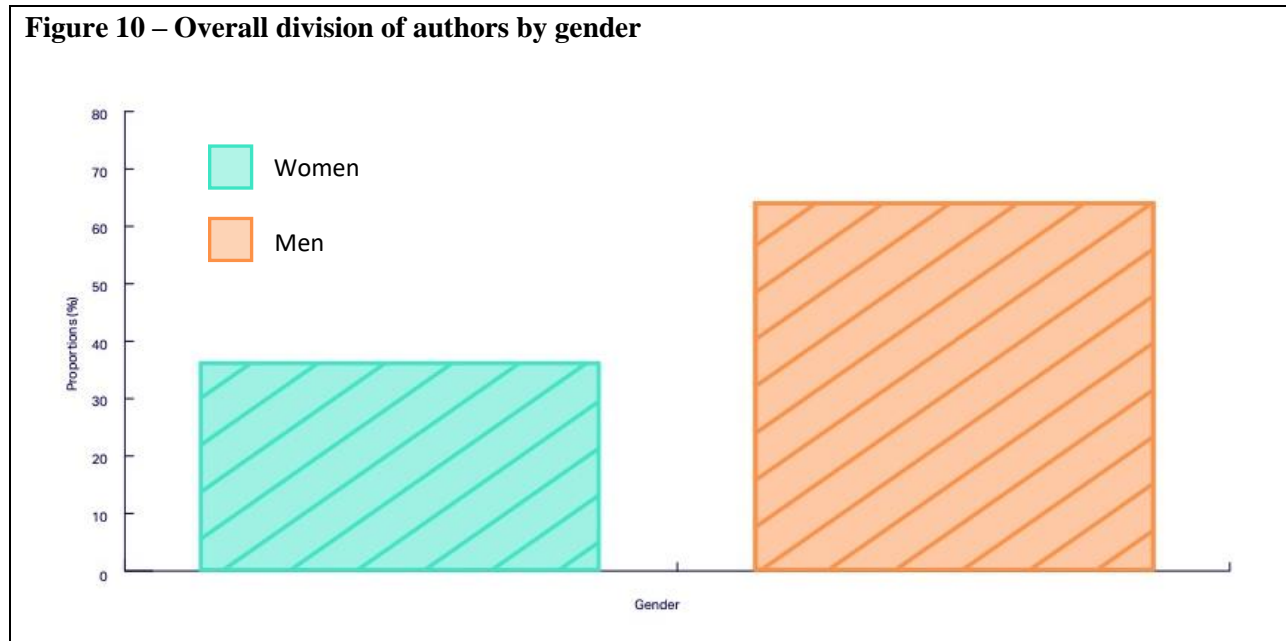
Fossil fuel mining is supported by powerful interests that influence elections How and in what ways can the role of the media better support and promote the transition to net zero and action on climate change? How can fake news or pro-coal PR be identified and called out in both traditional print and social media?

Gender and climate reporting

Climate change reporting may be considered gender neutral, but considerable research shows that gender plays a role in how climate change is reported and whose opinions and expertise is quoted.

Although the gender of the author is not provided in our raw data, one of the strengths of big data analytics is the ability to better understand underlying trends in the impact of journalist characteristics. We use author's names to predict their gender with about 90% accuracy.

Figure 10 – Overall division of authors by gender



There are almost twice as many articles about climate change authored by men as compared to women. This contrasts with the Australian journalism profession where women have outnumbered men since 2015¹⁷. While we do not have a complete picture of the structural dynamics that drive more men to write about climate change as compared with women, studies on gender, journalism and climate change do provide some insights.

The gendering of journalism generally can be viewed in two ways; the way that female journalists are assigned stories and expected to perform journalist roles, and the way that women are featured or not featured as sources.

Historically, women were typically assigned 'soft' stories relating to arts, culture, and family, whereas men routinely were assigned politics, business, and other 'hard' stories¹⁸. One study attributes this to three reasons: (1) a 'blokey' or hegemonically masculine newsroom culture which underpinned gender differences in story allocations; (2) 'hard' topics like sports reporting reviewed as "off limits" to women journalists; (3) stereotypical perceptions that women sought 'soft' news or were better suited to them than male reporters¹⁹.

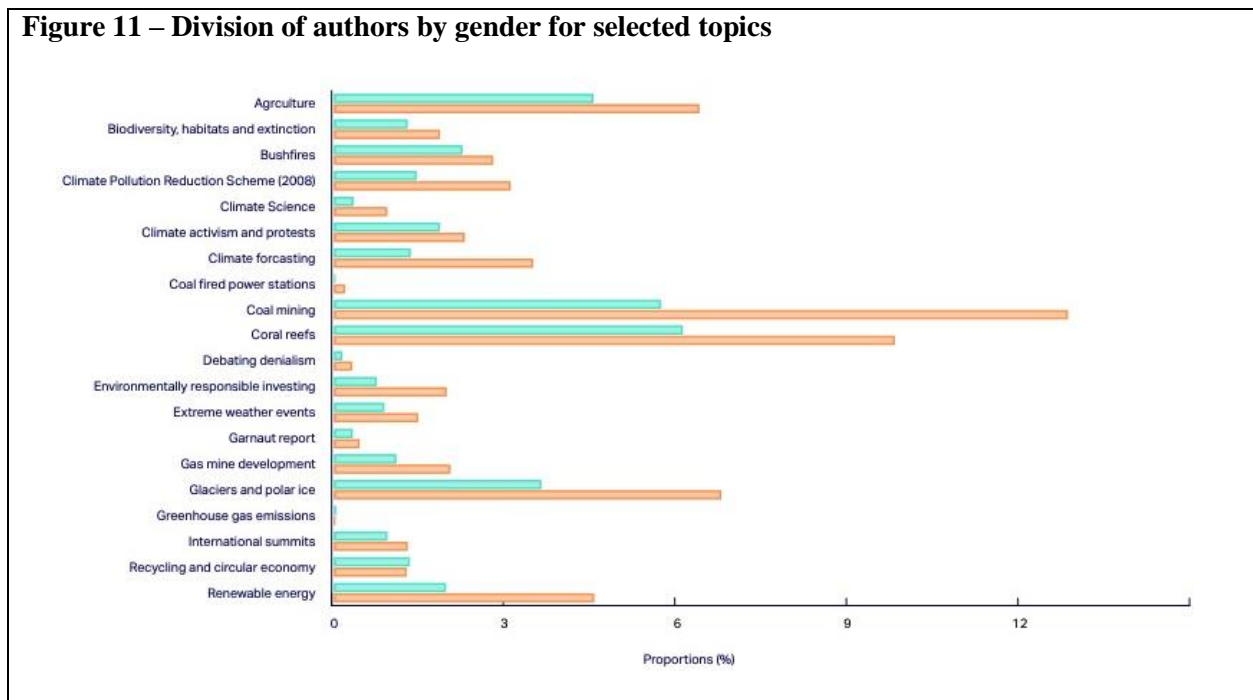
Secondly, elite and 'powerful' voices are the most preferred sources in climate change journalism. Implicitly, because of the patriarchal structure of Australia and many other English-speaking countries, men are often seen as those with the most authority on the issue of climate change. For instance, in one study of *Nature* magazine in 2018 using a Gender Gap Tracker, 71% of experts quoted in articles were

men and only 25% of sources and subjects were women. To contextualise these findings, the overall proportion of women in academic research in 2018 (as reported by UNESCO) was 33%, while more than half of Nature’s journalism team was female²⁰.

These same trends hold true in Australia, with the Women's Leadership Institute of Australia, Trawalla Foundation and GIWL’s 2021 *Women for Media Report*²¹ finding that 31% of quotes are attributed to women. Broken down, women are quoted 33% of the time for articles on the environment and disasters, 25% for those on science. The report also found that male journalists quote women less than female journalists do: men quoted women 37% of the time, as opposed to women who quoted women 50% of the time. In opinion pieces, women were much less likely to write about science (33%) or disasters (18%), as opposed to general news media where 39% of science bylines were by women and 55% of disaster bylines were by women.

Curtin University and GIWL’s 2023 *Going on the record: Gendered experiences of media engagement*²² further highlights women were just as willing as men to agree to an interview request, but worryingly, were more likely to receive sexist abuse. 38% of women respondents had experienced online trolling in response to appearing in the news. More generally, male journalists tend to be older, more senior and more highly paid, and women face glass ceilings, glass cliffs, pay inequity, work-life challenges, and more²¹.

Figure 11 – Division of authors by gender for selected topics



When we look at how climate topics are split by reporter gender, we see that the overall gender split is roughly reproduced in most of the topics.

Interestingly, there is only one topic in which women have a higher representation in contrast to male reporters: recycling and the circular economy. Women have been found to be more receptive to recycling and sustainable waste management practices, both at household and organisational levels. Women tend to participate more in home composting²³ and company boards with higher number of women tend to perform well on recycling indicators²⁴. While this may not have any direct correlation to their (slight)

over-representation in circular economy reporting, it may indicate that this is an area of environmental action more commonly occupied by women. Additionally, the circular economy is a more recent conceptualisation, largely popularised from 2015 onwards, which could be aligned with women's greater representation in journalism since this time.

Besides reporting on the circular economy, there are some additional topics where women come close to equal representation in reporting, including:

- Biodiversity;
- Habitats and extinction;
- Bushfires;
- Climate activism and protests.

In contrast, men are overrepresented, even compared to the baseline, when writing about coal mining, renewable energy, coral reefs, glaciers, and polar ice. While we are unable to draw direct links between why these areas are least reported by women compared to men, there are some hints in pre-existing research. Globally, the mining industry is noted as one of the most male-dominated industries, with women representing roughly 8-17% of workers²⁵. Renewable energy may be seen as a technology subject, which the Curtin University and GIWL report found was a male dominated area of reporting (with women representing only 28% of experts quoted)²².

While gender differences may be at least partly driven by the difference between the way that men and women are affected by climate change, it is also clear that more research is needed how and why these gendered differences play out, as well as to what effect. The ramifications of these findings are just beginning to be explored, including what impact gender has on climate change reporting. Yet, existing studies highlight that effective climate communication is critical in generating support for climate policy and action,²⁶ while there are gendered differences in motivation and preferences for adaptation²⁷.

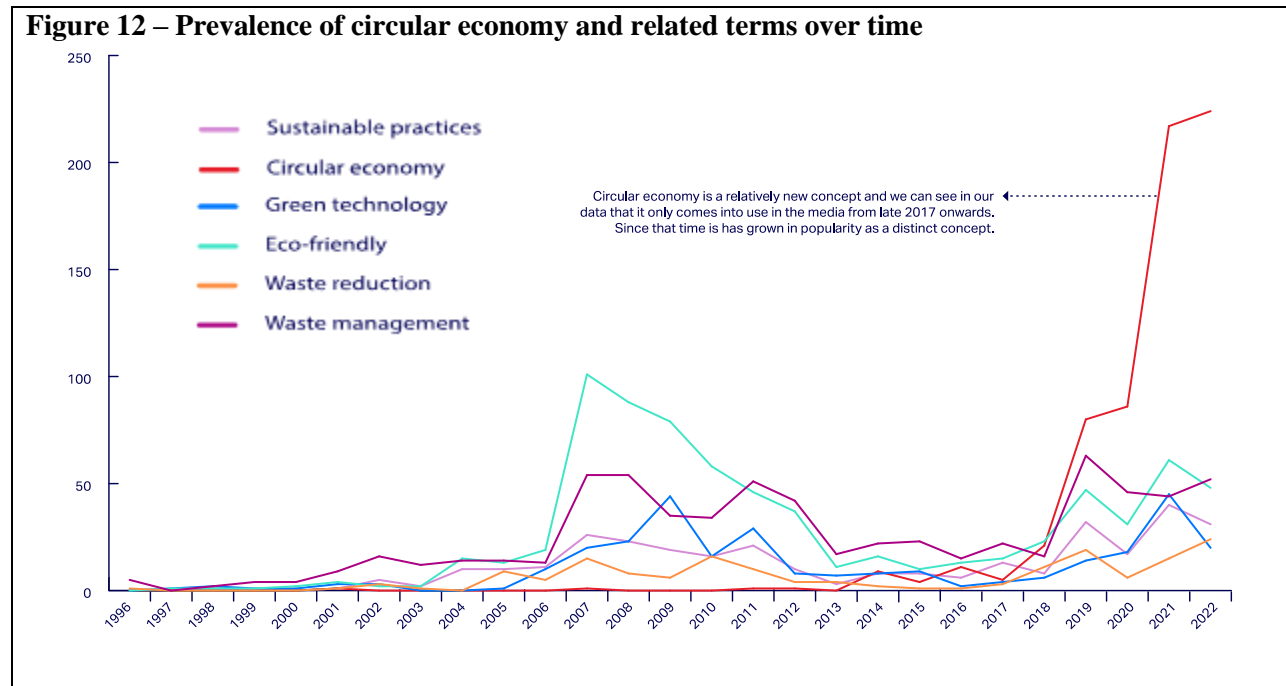
This infers that gender matters to climate change reporting. Indeed, it likely to have impacts on effective climate communication and communicating to a diverse audience, which may have second and third order effects on climate motivation and adaptation. Gender inequity in climate change reporting is also likely to be linked to women's wider status in journalism and how newsrooms allocate climate stories. Gender inequity in climate reporting has likely impacts on who gets quoted as experts on climate change, with women's perceived credibility and authority on climate issues, lesser, and women less quoted as experts by male reporters.

Additionally, the domination of male voices in climate change reporting indicates that climate change issues tend to be perceived more from masculine points of view. This kind of news coverage can result in a negligence toward the interests of women who are widely recognised as being more vulnerable to the effects of climate change and natural disasters²⁸. Indeed, gender inequality means that women often have fewer resources to deal with the fallout of climate change, while climate-induced stressors can impact on everything from access to education, to the labour market, agricultural adaptation resources and decision-making more generally.

Provocation

How can news reporting include more female voices and better reflect women's interests? What can be done to better support women who wish to engage with the media as experts in this area?

Reporting on circular economy in Australia



Another key topic that we found within the article corpus was around recycling and circular economy. The top 5 terms within this topic were recycl*, wast*, plastic, landfil* and circular_economi*. We observed a steady number of articles around recycling and circular economy over time until the late 2010s. However, the number of articles were a stark contrast to the articles on the topic of coal mining, which showed the highest number over the years. The average number of articles on recycling was about 2 per month until 2018, in contrast to around 15 articles per month on coal mining.

The topic trend over time shows that there are 2 periods, which result in a stepped increase in the average number of articles per month. The first increase is seen in 2018, which results in an increase in the number of articles to around 6 per month. 2018 saw Australia facing one of its major waste and recycling crises, as China imposed bans on importing recyclable waste. Unsurprisingly, we see a stepped increase in the number of articles during this period, as councils and waste collectors grappled with how to dispose of municipal solid waste. The narrative around the “waste crisis” on the one hand draws the public attention to a systemic failure within the Australian waste and recycling sector, which depended heavily on exporting waste to other poorer nations, but also has an unintended consequence of having a negative connotation on the need for separating recyclables. The increased awareness around the waste crisis led to a general belief that there was no need to separate recyclables, as all of it ended in landfill. This in turn exacerbated the problem for councils and material recovery facilities, by increasing contamination rates of recyclables, just as they were looking to adopt new processes and overcome the challenges.

Another stepped increase in articles on recycling and circular economy was seen after mid-2020. This increase in articles could be attributed to two distinct areas. On the one hand this increase could be due to circular economy being seen as a potential solution to the recycling and waste crisis. During this period State governments launched new recycling and circular economy policy frameworks²⁹ and public narrative on how a circular economy could be a solution for the crisis is seen. Another possible reason for

the increase in articles could be due to domestic crises within the recycling sector³⁰. The domestic issues during this time revolved around stock piling waste, fires inside recycling facilities, recyclers closing down and the collapse of the soft plastic recycling system.

The analysis of the recycling and circular economy topic shows that, like the bushfires and natural disasters topic, environmental crises tend to heighten media focus on these issues.

Provocation

Environmental problems require long-term solutions, not quick fixes. We see that media attention on environmental issues tend to intensify in times of major crises and then taper off. How can the media influence the sustained social change that is required for more holistic and systemic solutions to be adopted? Is there a role for Solutions or Constructive Journalism in covering this issue?

What's Next?

This project harnessed big data to show trends in media reporting of the big issue of our times; climate change. It showed how the media reporting is shifting as climate targets and timelines pass, moving from forecasts to disaster reporting. It showed how the Australian media grapples with the dependency on coal mining to our economy, while that dependency also generates climate impacts for future generations. And it showed how the media supports climate activism to try and bring about policy change now.

This analysis also exposed the emergence of circular economy responses in Australia. The circular economy response is where many Australians encounter climate change in their daily lives – as local council rate increases to cover the increasing cost of waste disposal or recycling facility fires in their neighbourhoods. The media is playing its part to expose the crises but we also need more sustained attention on waste and recycling.

The role of gender is perhaps the hidden factor in all these topics. That while we unconsciously accept climate reporting that is biased towards male authors, experts and topics published, we get a less effective media response. Just as companies that have more diverse Board representation perform better, so too may more gender-balanced media reporting help communicate and deliver better climate responses.

Climate change is a complex problem; it affects different parts of our society in different ways. It affects other deep social issues that we face in Australia, including gender equality and sustainability. At RMIT's Innovation Catalyst we are dedicated to testing new solutions to these challenges and we hope you will join us as we shape the Social Innovation Precinct in City North.

If you are inspired or provoked by this report, please reach out so that we can shape the next stage in this social innovation work together.

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Appendices

Appendix 1 – Full list of relevant topics from the topic model

Article Count	Topic Name (created by research team)
12	Greenhouse gas emissions
37	Coal fired power stations
83	Letters to the editor
123	Debating denialism
152	Earth hour
172	Effects on oceans and ozone layer
181	General construction and business
206	Garnaut report
229	Macroeconomics
256	Climate Science
349	Social security and welfare policy
425	Environmentally responsible investing
452	Extreme weather events
455	International summits
464	Community events
470	Biodiversity, habitats and extinction
497	Morrison Government
545	Recycling and circular economy
582	Gas mine development
600	Climate activism and protests
601	Technological innovation
619	Sustainable homes
774	Global poverty and conflict
821	Federal elections
912	Hydrogen power / carbon capture
913	Supporting regional communities
938	Bushfires
1063	Climate forecasting
1097	Climate Pollution Reduction Scheme (2008)
1185	Cars and trucks (including electrification)
1297	Renewable energy
1322	The news media
1335	Plants and gardening
1337	Air travel

1536	Business and investing
1633	Glaciers and polar ice
1836	Legal proceedings
1850	Agriculture
1913	Tasmania
2487	Tim Flannery
2630	Schooling and education
2639	Geopolitics
3017	Coral reefs
3204	Waterways management
3271	Biofuel
4063	Coal mining
4386	Industry
5555	Nuclear power
6308	Apocalyptic events
6364	Breaking temperature records

Appendix 2 – Data process and methodology

Data Cleaning

Before starting our analysis, we cleaned the data and organized it in a suitable format for our topic modelling algorithm. The data cleaning steps were:

1. Converting each article in the data set into an unstructured set of words. Each article simply becomes a list of all the words in that article with no word ordering, sentence structure or syntax.
2. Removing the most common and least common words. Words that are extremely frequent (mostly prepositions, pronouns etc...) are not useful in explaining the difference between articles and nor are words that appear in only a very small number of articles.
3. The remaining words are then lemmatized, a process which reduces them to their root. For example, lemmatization reduces “driving”, “driver” and “drives” to their root word “drive.” All these words will then be treated as the same word in the final analysis.

As well as individual words, ordered pairs of words (bi-grams) and ordered triplets (tri-grams) were also included in the model. For example the term “circular economy” is included in the model as the bi-gram “circular-economy”, which the algorithm treats in the same way as other words.

At the end of 2022, we used the Factiva Analytics service to download all the English language media coverage in their database referring to climate change or a range of other key words related to sustainability and the environment from 1990 to December 2022. This yielded 2,548,107 articles that. The data drawn from Factiva includes the heading and full text of each article, along with an assortment of metadata including publication date, author, publication name and much more.

Focussing on Australia, we created our final data set of 184,401 articles by removing material from other countries. We know that there is some error in the labelling of articles and some material in the dataset is not about climate change or the environment. However, having some irrelevant articles in the data set does not pose a major problem for the topic modelling methodology that we have used. Some topics produced by the model were irrelevant to climate change, but this does not hinder interpretation of the remaining topics.

Topic modelling

Having extracted the data and prepared it for analysis, we used a topic modelling approach called Latent Dirichlet Allocation (LDA)³¹ to identify latent topics in the corpus of text that is our data set. LDA is a commonly used natural language processing algorithm for identifying a set of meaningful topics within a large corpus of text. It finds words that frequently cluster together and creates topics out of them, modelling each document as a cluster of topics and each topic as a cluster of words.

In the exploratory phase of our research, we prepared topic models with 20, 40 and 60 topics. We found the topics in the 60-topic model to be more distinct and useful and the results from this model form the basis of our findings in this report.

Once the topics are identified the final step is to assign each article to a topic. A prediction algorithm is used to estimate the probability that an article belongs to a given topic, matching the words in the topic with those in an article. Each article is assigned to one topic, which the prediction algorithm gives the highest probability.

Interpretation

The output from this process was a set of key words and articles that best represented each topic. Labelling the topics required the research team to look at the words in the topic and review sample articles that had been assigned to that topic. This was an inherently subjective process that required the team to collaborate and build a consensus around the meaning of each topic. Our project team included subject matter experts on climate change, circular economy and journalism who helped to ensure that subtle meanings were not missed.

Predicting author gender

To shed light on the gendered dimension of climate reporting, we have used an algorithm to predict the gender of authors. The algorithm takes the author's first name as an input and predicts their gender accurately more than 90% of the time. This allows us to label each article with the gender of the lead author, and, subsequently, assess whether men and women authors are more likely to focus on different topics when discussing climate change. However, the algorithm is only capable of making a binary prediction about gender, either a man or a woman. Non-binary people are not represented in the predicted genders produced by the algorithm.