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Can Uruguay Have Its Steak and Eat it Too? "Greening" a Red Meat Economy

Michael Chepolis

CAN URUGUAY HAVE ITS STEAK AND EAT IT TOO?
"GREENING" A RED MEAT ECONOMY

By Michael A. Chepolis

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Approved:

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Advisor: Dr. Nora Tuulia Sylvander

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Reader: Dr. Marcus Mendoza

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Reader: Dr. Oliver Dinius

Abstract

The methane emissions produced by Uruguay's 12 million cattle drive the largest share of the country's total greenhouse gas emissions. Livestock farming is a driver of Uruguay's economy and an important part of their national identity and culture. Previous researchers have suggested that drastic changes to beef production and consumption habits are necessary to reduce the ecological impact of cattle ranching. This thesis investigates how Uruguay plans to deal with its reliance on beef production as it seeks to reduce its carbon emissions output. An analysis of Uruguay's development strategy plans reveals that while the country aims to reduce the relative methane emissions per pound of beef, their strategy is significantly stunted by an effort to grow beef production *and* reduce emissions per unit of beef. The country has been slow to implement measures to significantly reduce emissions; furthermore, environmental progress is stunted by the prioritization of industry growth and the expectation that technological advances are soon to be implemented.

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Chapter I: Introduction

In October of 2022, the New York Times Magazine published a story titled "What Does Sustainable Living Look Like? Maybe Like Uruguay." The magazine article praises Uruguay as a model for a society which supports a high quality of life while also managing to keep its carbon emissions low. The central claim to the article reads: "There are countries more prosperous, and countries with a smaller carbon footprint, but perhaps in none do the overlapping possibilities of living well and living without ruin show as much promise as in Uruguay." Uruguay is a small, diffusely populated country situated between Brazil and Argentina, best known for its relative political stability, its rich culture, and its high-quality meat. The country is also praised for the steps it has taken to decarbonize its energy sector, with aims to do the same for its public transportation (Sartori et al., 2022).

While Uruguay's achievements for renewable energy development outpace those of its neighbors, the country's largest barrier for sustainability is its agriculture. The agriculture sector contributes 75 percent of the country's greenhouse gas emissions (FAO & New Zealand Agricultural Greenhouse Gas Research Centre, 2017, 1). Most of these emissions come from methane, a heat-trapping gas produced by the digestive process of livestock known as "enteric fermentation." Cows outnumber people in Uruguay four-to-one; twenty percent of the country's exports are beef (Becoña et al, 2020). Uruguay intends to increase its beef production from 700,000 tons annually to more than 1,000,000 tons annually by 2030 (INAC Plan, 2021). The bovine hegemon is as much economical as it is cultural; in the aforementioned New York Times Magazine article, they interview a board member of the National Meat Institute (INAC) who has this to say about his country's relationship to meat:

> *"Uruguayans will never stop eating beef," Baethgen said. He disagreed with calls for a plant-based diet. From his perspective, the question of whether we should or*

> *shouldn't eat beef was irrelevant. "The goal shouldn't be carbon neutrality, but how to make it sustainable," he said. "The Serengeti in Africa — a grassland with large herbivores, like Uruguay — is that neutral? Probably not. But it's a sustainable ecosystem." He was quiet for a moment. "There are problems with cattle destroying ecosystems, problems with water quality, with animal welfare." He allowed that livestock systems based solely on feedlots and lands cleared from rainforests needed to end. "But is there a possibility that some systems continue to exist being very responsible in the midst of climate change?" he asked. "Yes, there is."*

Baethgen's comments towards his country, nature, and cows encapsulate an attitude present not only within Uruguay, but globally as well. For one, there is a refusal to change eating habits, even when they are detrimental to the environment. His rationalization is based on a pastoral idealization of his nation's natural landscape, shaped by the customs and traditions of his country. Finally, there is a belief that the agricultural system and our patterns of consumption can continue as long as some minor tweaks to livestock management are made. This framing of cattle ranching and its interaction with the environment does not necessitate a major systemic change, which is convenient for both producers and consumers. However, the necessity for major adjustments in the beef industry is urgent and unavoidable.

Baethgen's statements necessitate a reevaluation of the magazine article's central argument: *Is Uruguay an adequate model for sustainable living?* This thesis examines whether Uruguay's proposed ecological intensification plans for its cattle industry are enough to overcome the most damaging consequences of climate change. Examining the development plans that Uruguay has published reveals a strategy and language that are designed not with emissions reduction as a primary objective, but rather with the goal of allowing the country to continue to grow its beef consumption and exports.

I begin this thesis with a brief history of cows in Uruguay. This section introduces critical concepts relevant to the development of Uruguay as an agro-export economy. It also helps explain how cows became a key component to Uruguay's culture and traditions. The literature review section comprises other articles which contain relevant information to the topic. The section identifies a gap in the research, from which I derive the research question for the thesis. The theoretical framework introduces the central concepts integral to the research of the thesis. This section explains the theoretical concepts and theories of ecological intensification in cattle production, building on the work of Ormond's "Geoengineering super low carbon cows" (2020) and "Green rebranding: Regenerative agriculture, future- pasts, and the naturalisation of livestock" by Cusworth et al (2022) among other researchers. The methodology section details my use of thematic analysis to answer my research questions. Thematic analysis is useful because it allows me to categorize data and tease out patterns and common themes relevant to my study (Attride-Stirling, 2001).

The results are presented in two sections. The first section explains the most important details of Uruguay's sustainable development strategy. It differentiates the many political organizations at play, comparing the functions and priorities between them. The first section also observes the lack of action realized through these many plans to reduce carbon emissions per kilo of beef. The analysis indicates that while many promises have been made to reduce carbon emissions, very little progress has actually been made, and that it will be very difficult for Uruguay to meet its emissions reduction targets. The second section broadly considers the efficacy of Uruguay's plan regardless of whether or not they meet their emissions targets. I argue that the technological fix used by the country will be futile in long-term prevention of global

warming, and that changes from the consumer would be far more effective at lowering levels of carbon emissions.

Finally, the conclusion discusses the implications of the findings of this research. Briefly, it will suggest some alternatives for a "greener" Uruguay, ones that might require a rethinking of the cow's relationship with the country. I will also consider the limitations of my research, and offer suggestions for future investigators of this very fascinating topic.

A Brief Agrarian History of the Banda Oriental

A research project on Uruguay's cattle production would be incomplete without at minimum a cursory glance into the agrarian history of Uruguay. Luckily, there has been extensive research into the subject, with special attention given to the introduction and development of cows in the region. This brief overview into Uruguay's geographical history serves to familiarize readers with Uruguay's unique characteristics and to contextualize the findings and discussion of the later sections. Specifically, the introduction, diffusion and sale of cow products supplements much of the country's economic and social characteristics, from its liberal economy to its appetite for meat. The historical analysis relies upon the book *Peopling the Purple Land: A Historical Geography of Rural Uruguay, 1500-1915* by Jan M. G. Kleinpenning and supplemented by other geographers and historians.

In 1517 the Spanish set foot on the "Banda Oriental" for the first time, though they would to establish a permanent settlement until decades later (Kleinpenning, 1995, 13). A series of failed initiatives to occupy the land in the early years challenged Spain's conquest of the De La Plata region. The majority of Uruguay's soil is not suitable for cultivation. Its wide mouthed and shallow rivers made navigation difficult, along with an indigenous population who resisted the

Figure 1: Map of Río de la Plata and the Banda Oriental, late 18th century. The "Banda Oriental" (Eastern Bank) is the territory east of the Uruguay River and north of the Río de la Plata (Prado, 2015, 3).

occupation of their land. The Spanish initially labeled it *tierra sin ningún provecho* (land of no use), dissatisfied with the lack of precious metals and frustrated with an indigenous population which would not succumb to militants (Vidart, 1999). Until the twentieth century, although Spain claimed authority over the territory, they effectively ignored it. It was not until cattle were introduced and diffused throughout the *pampas* or "prairies" that Spanish colonization was incentivised to take control of the region (Kleinpenning, 1995, 16 & 20).

Cattle were introduced to the "pradera" (prairie) before settlements took shape. Although Uruguay's soil is not well suited for crop cultivation, the area seems as though it were destined for cattle ranching. The vegetation, climate, and low presence of natural predators was well suited for the newly introduced bovines, allowing the cattle population to multiply without human intervention (Kleinpenning, 1995, 20). By the end of the seventeenth century, a

considerable population of cattle spread across the country, leading to a renewed interest in the land once considered *sin ningún provecho*[1]. The production, collection and extraction of the cattle's newfound sanctuary was soon to begin.

Once Jesuits on the other side of the Río de la Plata thinned out the herds close to the settlements in Buenos Aires, they expanded their hunts across the Rio de la Plata to the Banda Oriental (Kleinpenning, 1995, 21). The beginnings of Uruguay's utility as a cow producer emerged during this time. Dozens of men would make expeditions to the Banda Oriental to herd upwards of tens of thousands of wild cows. These expeditions, called "vaquerias,"were initially used to replenish the dwindling herds around Buenos Aires. Soon after, however, "vaquerias de corambre" (expeditions to obtain hides) were held to harvest thousands of hides to be exported to Europe (Kleinpenning, 1995, 22-24; 39-41). Since they had no way of preserving the meat of the cattle, most of the time they only took the hide, leaving the remaining carcass to waste—sometimes operations sold hides, fat, and tallow on the black market. Everyone, from poor to rich, indigenous to European, participated in the open market of herding, slaughtering, and selling of cow hide (Sarreal, 2011, 521).

In very little time Uruguay has shifted from occidental irrelevance to a very high stature thanks to the introduction of cows. Demand for cow hide was so strong that the Banda Oriental was a partner in world trade before even a single city was established. Rich Spanish land-owners who often benefited from the lawlessness of the Banda Oriental soon realized that the over-exploitation of the wild cattle herds threatened their extinction, so they petitioned that the Spanish Crown increase military presence in the region to stave off criminal offenders (Sarreal, 2011).

[1] Kleinpenning estimates that a total of five million cows inhabited the southeastern region by the end of the seventeenth century (1995, 16).

The establishment of Montevideo in 1726 marked the beginning of the transition from wild cattle hunting to settled cattle ranching (Kleinpenning, 1995, 36). In an effort to colonize the Banda Oriental Region, the governor of Buenos Aires established Spanish militants to fend off indigenous groups and the Portuguese. The governor encouraged people to settle in Montevideo by offering free transport, land, cattle, horses, and a number of other inducements to willing families (Koebel, 1915).

Meanwhile, in the countryside, cattle resources were becoming scarce. The common practice moved away from the extraction of wild herds and toward "estancias." Estancias are permanent settlements which seldom had established boundaries. An owner and a small number of laborers cared for hundreds or even thousands of cattle. Few estancias were formally owned property; instead they operated as land-occupiers who claimed the land and, once they were settled for long enough, they became de-facto land owners. Indigenous tribes, neighboring estancias looking to expand their holdings, and Portuguese occupiers frequently challenged these informal claims to the land (Kleinpenning, 1995, 35-45). This constant threat forced Spain to develop a military presence, one which would eventually establish the Brazil/Uruguay border.

The process of colonization of the Banda Oriental was only made possible by cows. As the wild herds became scarce, the Spanish decided to settle cattle ranches in order to continue profiting from the production of hide. Peopling the pastures with European immigrants by way of estancias drove out native peoples and the emergence of differences in class between landowners and their workers. The early vaquería expeditions in Uruguay provide a classic example of a commons dilemma. This phenomenon occurs when a shared resource, in this case, the wild cow herds, is exploited by individuals who act in their own self-interest, leading to depletion and degradation of the resource (Hardin, 1968). The Spanish crown quickly established

authority over the common resource pool and privatized the modes of cattle production. Regulation and land-ownership laws were introduced to the cattle industry (mainly mandatory fencing and branding of cattle) which yielded much needed order to the trade but also begot a crisis for smaller farms who could not afford to implement the regulatory mandates. Crime dropped, but so too did the number of small family estancieros (Kleinpenning, 1995, 154). Ostrom (1999) found that in commons dilemmas, hegemonic control over the shared resource is a poor policy for protecting that resource; instead, community-based solutions reap the most benefits for everybody. The Spanish crown's decision to privatize the herds and exclude the local population from their use made it impossible for them to participate in their management. As a consequence, many people were forced away from their source of income and sustenance, leaving no option but to work for the larger estancieros (Kleinpenning, 1995, 151). Furthermore, the Spanish land reforms marginalized the indigenous groups who had adapted to the introduction of cattle (Kleinpenning, 1995, 101).

Uruguay became an independent state in the early nineteenth century. The independence attracted many European immigrants to Montevideo. These immigrants brought with them technology from the industrial revolution which were unavailable in the Rio de la Plata region at this point. The influx of immigrants contributed to the modernization period of Uruguay[2]. The modernizing process enabled the European entrepreneurial immigrants to stimulate the modernization process by introducing canning, live shipping and eventually refrigerated cargo to Uruguay (Kleinpenning, 1995, 166-168). Modernization shifted the social and demographic shape of the country's exterior. The fencing laws sedentarized much of the population (Kleinpenning, 1995, 138). The mass changes in infrastructure and technology enriched the

[2]Kleinpenning goes into much further detail on the topic of immigration in Chapter 9 of *Peopling the Purple Land* (1995, 219-266).

biggest landholders and made many of the laborers much worse off. What once took thirty men now took five, leaving many unskilled workers unemployed and unable to sustain a "traditional" lifestyle in rural Uruguay.

A unique culture and lifestyle emerged and evolved with the introduction of cattle, the vaquero expeditions, the establishment of estancias, and up to the period of modernization. The "gaucho," often likened to cowboys in North America, is a lifestyle which has inspired political and cultural identity for the Rioplatense region. "Gaucho was the name of the freedom-loving man on horseback who roamed the rolling, well-watered plains of Uruguay in the colonial period and into the latter half of the nineteenth century," writes Kleinpenning (1995, 44). Gauchos lived semi-nomadic lifestyles undertaking seasonal employment herding and harvesting cattle. Their diet primarily consisted of beef, as little else was available. The gaucho is a self-sustaining and anti-establishment figure whose mythos has inspired Rioplatense artworks, stories, politics, and even cuisine.

Uruguayan historians José Pedro Barrán and Benjamín Nahúm perfectly describe Uruguay's hidebound history from its founding to the beginning of the twentieth century as follows:

> *"When Uruguay is analyzed in a perspective of 200 years… its unaltered structural characteristics stand out more than do innovations. It could even be stated, with a slight degree of exaggeration, that in the last resort, changes actually served to maintain the cattle based establishment that was already defined by 1800. This deeply rooted conservatism of Uruguayan history could not help but be reflected in the total life of the nation, from its economy to its politics to its culture."* (1984, 656).

Cattle played their part in each of the most intense changes to the area. The animal's introduction and diffusion into the Banda Oriental fueled the people of the land. Cattle were foundationally deployed as tools for the settler-colonial project (Gillespie & Narayanan, 2020). Later, its hides and meat fueled lucrative exports, encouraging settlement into the land. Once herds became scarce, land management changed and led to the independence of Uruguay. All the while, a lifestyle formed around herding, raising, processing, and eating the animal.

Chapter II: Literature Review

For a country of such small size and population, Uruguay has taken considerable measures to reduce its carbon footprint. In 2017, Uruguay published its first Nationally Determined Contribution to the Paris Agreement (NDC), promising to decarbonize its industries by 2050 with special attention given to beef production. According to this agreement, Uruguay aims to increase beef production while decreasing the amount of greenhouse gas emissions generated per kilogram of beef (NDC, 2017).

China has become Uruguay's main buyer, comprising 69 percent of Uruguay's beef exports (Kenneth, 2022). Uruguay, while aiming to become more efficient in greenhouse gas output, still plans to expand its beef production tremendously. At this rate, can it achieve its carbon reduction goals outlined in the Paris Agreement? Can Uruguay's cattle production industry be considered sustainable?

The answer to the latter depends on how one defines "sustainability." The meat industry aims to balance economic sustainability and environmental sustainability. Other factors, like runoff production and habitat destruction, must also be considered. McManus (1996) offers various perspectives on sustainability in his article, as well as others. Sustainability efforts must take into account not only ecological conservation, but also the wants, needs, and limitations of different cultures— factors which determine what priorities are and where responsibilities lie (Scoones, 2016). Furthermore, structural makeup of food systems make some sustainability strategies more suitable than others. In Uruguay, five companies have 62 percent of the country's heads of livestock (Lopez, 2019). Community-led transformations might be more successful at reducing the footprint without bankrupting small farms.

Proponents of Uruguay's meat industry recognize that the meat we eat today is not the same beef the gauchos ate years past. "The beef that we sell today is not the same as it was 100 years ago because it has a lot of scientific work as well as producer and industry efforts behind it," said one INAC representative in an interview (Castrillón, 2021). While he does not give specific examples of the improvements of the quality of steak, one must assume he is referring to the developments in fodder, breeding, and animal health. Indeed, the institute has implemented certifications that all exporters must reach with other optional certifications of quality available. INAC has invested heavily in maintaining a standard caliber for all the meat exported from the country. In fact, Uruguay is the only country in the world in which buyers can trace each steak they buy down to the cow it came from . Uruguay hopes to enhance their traceability initiative by including the environmental impact of each meat product, though the upgrade has yet to be implemented.

Uruguay is aware of the rise of meat alternatives, but industry officials do not expect to be impacted by them within the near future. In a meeting held by the Ranching Agriculture and Fishery Ministry (MGAP), meat alternatives were among the topics discussed. Fernanda Maldonado, the general director of MGAP, claims that sustainable production should be what the cattle industry strives for. Cattle farmers are fearful of the rise of meat alternatives, yet they only expect to be impacted by these alternatives once they become more widely available and of better quality (El País, 2021).

It is both an advantage and a detriment to Uruguay that a single industry has such an overwhelming impact on the economy, culture, and carbon footprint. In some ways, it might simplify the efforts to attain carbon neutrality since it is such a dominating emitter. On the other hand, its hegemonic nature complicates any efforts to revolutionary changes. One must ask: how

did beef become so entrenched in Uruguayan identity and economy in the first place? As explained in the previous chapter, part of it has to do with the rural environment of Uruguay's exterior (Barran and Nahum, 1984). The expansive empty fields of Uruguay's exterior were poor conditions for dirt farming, but highly suitable for cattle raising. Furthermore, conservatism and a lack of state sovereignty strengthened the cattle-based establishment. By the 1800s beef was already ingrained into the identity and sustenance of *caudillos*. The advent of ships capable of transporting frozen beef to the United Kingdom and elsewhere further solidified beef's dominance. It is important to recognize the structural and historical background of cattle raising in order to conceptualize the difficulty in challenging the cattle production's dominance.

Chapter III: Theoretical Framework

Climate change has led to an increase in research to find development strategies which enable society to overcome changing environmental conditions. One mitigation strategy, the "technological fix," has been adapted by many industries and countries as a way to combat climate change without sacrificing the current market systems. Rather than targeting the root causes of carbon emissions, the technological fix aims to instead adapt to the effects of climate change. Technological fixes, sometimes called climate engineering methods, include afforestation, solar radiation management, and artificial upwelling. Technological fixes are not inherently corrupt adaptations to climate change, but proponents of technological fixes often exaggerate their effectiveness and/or come with severe side effects which cause more problems than they solve (Keller, Feng, and Osclies, 2014). Though their success in mitigating the effects of climate change may be limited, technocratic fixes are a popular means of adaptation because they promise economic opportunity alongside the environmental solution, associating businesses as part of the solution rather than the source of the problem.

The technological fix has even found its way into agriculture and livestock. Ruminant livestock account for approximately nine percent of global greenhouse gas emissions (Caro et al, 2014). To counteract their devastating toll on the warming of the atmosphere, the livestock sector has pushed to change the food, management, and genes of cows to mitigate methane emissions during their digestive process (Cooper, 2017). "Super low carbon cows," as Jim Ormond labels them, are representative of a larger effort by corporations to marketize the fight against climate change by implementing a carbon economy (2020).

Ormond theorizes two available responses to climate change: lower carbon emissions through changes in behavior and socio-political practices; or manipulate the earth's natural

systems to mitigate greenhouse gas (GHG) emissions. The former style of intervention is a more desirable approach from the perspective of the author because it addresses the *cause* of climate change (the burning of fossil fuels, deforestation, etc.) rather than the *consequences* of climate change. The approach tackles the causes of climate change head-on; the latter merely addresses the symptoms. Fallacies of the latter style notwithstanding, many policymakers have elected the 'geoengineering[3]' approach. The choice to pursue this fix to the climate crisis seems counterintuitive to most, but this solution benefits those who are already benefiting from the global cattle production system. "Geoengineering forms a part of the new corporate carbon economy defined as the techniques, practices and strategic capacities that private actors deploy to make GHG emissions thinkable and governable in the context of existing market, regulatory and supply chain models," Ormond explains (2020 138).

While critical responses have focused on the most radical examples of geoengineering (Keller et al, 2013) Ormond (2020) focuses on a far more 'mundane' example: cows. The ways cows are bred, raised, and fed have been optimized to produce as much dairy and beef and emit as little carbon atmospheric emissions as possible (Bojovic and McGregor, 2023). Producers frame this optimization in a way which promises to reduce carbon emissions overall, when often this is not the case. The language deceptively presents this effort to optimize beef production as a win-win for both the environment and for the economy— cows emit less carbon pollution, farmers more efficiently breed and feed their cows, and consumers no longer have to be asked to consume less beef.

In application, the results are not as beneficial for all parties. The global appetite for meat is growing as the world population rises and income levels increase in poorer countries (Godfray et. al, 2018). Growing demand, coupled with the promise that super low carbon cows are just on

[3] Another term used to describe the technological fix.

the horizon, justifies countries like Uruguay to *expand* their livestock production. As a result, while technocratic fixes have been developed to reduce emissions relative to pounds of meat, no progress is made in the effort to reduce absolute GHG emissions (McGregor et al, 2021, 1180). In fact, as Ormond points out, the geoengineered 'fixes' which purportedly reduce carbon emissions often fail to do so (2020, 148). Many of the adjustments he highlights in this paper are the same solutions advertised by Uruguay. The worry, therefore, is that super low carbon cows are further away than previously thought, and create as many problems as they solve.

Another point Ormond illustrates is that the discourse at the heart of the technocratic fix is fundamentally predicated on a best-case scenario outcome, where an improvement in management practices and a development in technology produces substantial results and has no unanticipated negative consequences. There are several categories that encompass the total progress to the super low carbon cow. Ormond describes three directions the meat industry has explored to reduce carbon emissions, including how to breed, what to feed, and how to care for the livestock (2020, 141-145). While many results show optimistic outcomes through small changes to the status quo, application has been a mixed bag. For one, lab studies find difficulty replicating in the real world (Ormond, 2020, 142). And while some solutions might reduce the methane emissions from cows, their downsides can include a decline in meat quality or animal welfare (Cooper, 2017, 822-823). Furthermore, some solutions seem so 'unnatural' to consumers that it might hurt the demand for the product, even if it comes with less carbon emissions baggage. This is all to say that even the ideal super low carbon cow is a flawed concept, and the exercised results are far from the overly-optimistic projected outcomes marketed to farmers and governments by corporations.

Continuing his analysis on the framing of the technocratic fix, Ormond observes that "The responsibilisation of the cow as a climate villain and then saviour offers a tangible example of how climate change policy has become predicated as a technocratic challenge" (2020, 148). The intense transformation of the cow also illuminates a change in humankind's relationship with the natural world.

Bioengineering moves livestock away from our notion of them as wild beasts and towards purely utilitarian machines in the global food chain. The technological fix intentionally detaches production from consumption, or rather, producers from consumers. By reforming the production side of the beef food system rather than the consumption side, consumers are not asked to buy less beef. Yet changes to food consumption, like dietary changes and minimizing food waste, would be far more effective mitigators of carbon emissions. "... changes in food production practices will only reduce the agricultural GHG by 10% by 2050, whereas changes in consumption practices (e.g. plant-based diets) could reduce emissions by up to 80%" (Ormond, 2020, 149).

Perhaps the most succinct critique of the technocratic fix, Ormond writes: "Human behaviours and market structures have become the dominating driver of change and in turn, the primary cause of the degradation of our earth systems. Yet the solutions put forward to mitigate this degradation fail to challenge human behaviours or market structures but rather, they seek to further change our earth systems" (Ormond, 2020, 137). Climate change will not be undone by the same forces which caused it in the first place, especially when it comes at cost to their market position. Ormond draws the conclusion that it is naive to rely upon technological fixes to solve climate change.

Many authors' arguments against ecological intensification stem from the political ecology literature sourced by Foucalt's governmentality approach (Ormond, 2020; Cusworth et al, 2022; Gillespie and Narayanan, 2020; McGregor et al, 2021). Relatedly, environmentality, defined by Agrawal as "When and for what reason socially situated actors come to care about, act in relation to, and think about their actions in terms of something they identify as 'the environment'" has been applied broadly to the field of political ecology (2005, 162). In other words, environmentality looks beyond how positions of power directly govern the environment. Environmentality includes how people's ideas and preconceptions about the environment are shaped by policy language and implementation.

Environmentality is a useful tool to be applied to the context of this thesis. When the technological fix is examined through this lens, one begins to understand how this tool enacts responsibility among producers and consumers. "Responsibilisation" is the way carbon reduction action is shared among actors (McGregor et al, 2021). Through a technological fix, consumers are not prompted to reevaluate their consumption habits; instead, producers —specifically in this case farmers— are the ones tasked with cleaning up their trade.

Environmentality can be understood as the ongoing effort to use climate science and biotechnology to govern the earth systems of livestock (McGregor et al, 2021, 1164). In the process, earth systems models from the molecular to the atmospheric scale are oversimplified into a measure of carbon in and carbon out. However, understanding and governing earth systems is an incredibly difficult task. As McGregor et al explain, "While [methane emissions] growth is driven by increases in the global herd as emissions intensities per animal have generally reduced, the methanogens, digestive tracts, genetics, herd dynamics and diverse farm-based biosocial collectives involved in generating global cattle methane have proved

difficult to govern, and their liveliness inhibits the standardisation, easy calculation and incorporation into the neoliberal governmentalities that pervade climate politics. Central to this resistance is the diversity and unpredictability of life" (2021, 1180). The "rendering technical" aspect of the technological fix allows organizations to frame a potential problem as technical to make it appear both intelligible and fixable (Paranage, 2018).

Stemming from environmentality, another concept emerges from the texts: naturalization. Naturalization is the way in which socially created subjects come to be theorized as eternal and immutable and often ignore the human connection with these processes (Attride-Stirling, 2001). Rosin (2013) applied the naturalization narrative to the realm of cows in New Zealand. As food commodity prices soared in the country, the pastoral farming sector framed their industry as necessary to feed the country's population; without them New Zealanders and other citizens of the word might starve. Environmentality is a dynamic which involves multiple parties, including the government, corporations, and the public.

A direction Ormond could have elaborated is the role of the government as it navigates the competing interests of corporations, consumers, producers, and the wellbeing of the environment. Political will tends to bend in the direction of corporations as they seek to reduce carbon emissions while still growing their markets. As with the case with Uruguay and its cattle farming, it is often difficult to decouple emissions from economic progress. At what point does a country look out for its own ecological welfare over the interests of a corporation? It is a battle between the short-term and long-term goals of a country. Export-oriented agrarian economies often lack another option.

The framework outlined here has not yet been applied to Uruguay's cattle ranching sector. This thesis introduces these ideas to the country, taking into account its unique

characteristics and the shortcomings of previous research when applied to this specific country. The case of Uruguay is an interesting one. While it is the most developed country on the South American continent, its economy is still heavily reliant on agro exports. The country is in the process of diversifying its industries, but this development is still in its early stages. In some ways Uruguay has no other option but to continue expanding its agricultural exports.

Asia and South America are experiencing record levels of growth in meat production and consumption. Whether Ormond deliberately chose to focus on English-speaking countries out of convenience or whether he simply lacked translation capabilities to properly research other countries is unclear. Nevertheless, it is important to recognize whose voices are heard and whose lack the accessibility and attention they deserve. It also exemplifies why interdisciplinary academics could benefit political ecology greatly— as the methodology section will demonstrate, this thesis would not be possible without Spanish linguistic skills to unravel the complicated development plans set out by Uruguay.

Chapter IV: Methodology

The objective of this research is to critically analyze Uruguay's ecological intensification strategy of cattle farming. It examines the efficacy and feasibility of the plan to increase beef production while decreasing the amount of carbon emissions. By unpacking the Uruguayan government development strategy and future plans documents, I question:

1. Is it feasible for Uruguay's cattle production industry to increase beef production while decreasing greenhouse gas emissions? What is the country's implementation strategy?
2. Is ecological intensification the best path forward for the country, and why have they chosen the route of ecological intensification?

With these research questions in mind, I settled on a thematic analysis as the best way to research these questions. I collected various documents published by governmental agencies in Uruguay or in conjunction with the United Nations. These documents include:

- The first and second nationally derived contribution (NDC) published by Uruguay in 2017 and 2022 accordingly.
- Uruguay's National Adaptation Plan for Agriculture published alongside the 2017 NDC.
- Contribution for a 2050 development strategy (Aportes para una estrategia de desarrollo 2050) published under the presidency of Tabaré Vasquez (2019).
- The Long Term Climate Strategy of Uruguay, published in between the two NDCs.
- National Meat Institute (INAC) Strategic Plan, 2021-2026
- "Low emissions development of the beef cattle sector in Uruguay," published by the Food and Agriculture Organization of the United Nations (FAO) (2017)

These documents were selected as they were all very relevant to the research questions at hand. Many of the documents contained the exact same information as the other documents, while others contained information outside of the scope of my research, so most of these documents were not read in their entirety, but rather selectively scanned for new and relevant information. After collecting these documents, I developed an in-vivo coding system (Given, 2008) which helped to organize relevant items within the literature. My coding system was derived from the thematic analysis style of qualitative research. Thematic analysis is an analytical tool which aims to understand the significance of an idea (Attride-Stirling, 2001). The method allowed me to refine my data, organize it using a coding strategy, and provide a reconstructed description of the data. I began this process by coding relevant information while reading from the texts. I developed basic themes from the various codes, and from these themes I was able to construct my organizing themes and make a map of these unifying themes. The systematization of this thematic analysis allowed me to maintain the clarity of my research topic and to unravel the information and thematic language these documents use.

Many of these documents are in Spanish, Uruguay's primary language. Therefore, careful translations of some quotes are present in my description and analysis. If readers would like to read the quote in its original Spanish language form, I provide the original text in the footnotes.

Chapter V: Description of Data

It is necessary to understand what these development documents describe before any analysis can take place. This section describes the data contained within the documents. It also notes any contradictions between documents; although they are all published by governmental organizations, their purposes, priorities and hence their strategies do sometimes contradict another. Along with the description of the data, this section describes the lack of action performed in order to reach the carbon emissions goals set forth by the document. Without a proper implementation strategy it is unlikely that any progress will be made to reduce carbon emissions.

Beef is one of Uruguay's top exported commodities, encompassing one fifth of total export value and four percent of the country's GDP (Becoña et al, 2020). Earlier sections have established that the livestock industry is deeply tied to Uruguay's economy, social development, and culture. It is also responsible for much of the country's carbon emissions. In 2019, ranching was responsible for 689,220,000 kilograms of methane emissions, equivalent to 1.4 billion kilograms of carbon dioxide in measures of heat retention capabilities (Ministerio de Ambiente, n.d.).

Since the country's agricultural sector produces the largest amount of its carbon emissions, Uruguay's NDC gives special attention to reducing methane emissions from cattle. In the first NDC of 2017, they presented a specific objective of reducing the methane emissions by a minimum of 32 percent for each kilogram of beef by 2025 (with an additional 5 percent if other conditions are met). The second NDC of 2022 raised this number to 35 (with another conditional 2 percent) by 2030. Given that Uruguay is a major player in the global beef market, a decrease in relative emissions was celebrated as a great achievement in the overall fight against climate

change. Ecological intensification is considered necessary to feed a growing population while also keeping environmental sustainability as a concern. The growth in global livestock food demand is expected to grow by 38 percent by 2050 (Komarek et al, 2050). Uruguay plans to proliferate cattle production as a response to this demand. They stress that they intend to "decarbonize" their economy "in a way that does not threaten food production" (NDC, 2017, 4 & 8). This specific phrasing in the NDC is used to justify Uruguay's commitment to only reduce carbon emissions *relative to pounds of beef* [4]. What they imply is that asking the country to reduce cattle production would threaten a nationwide starvation, which is simply not the case since three quarters of the beef produced is exported (INAC, 2020). This mirrors the discourse used by the pastoral farming sector in New Zealand, which naturalized the industry as necessary producers, thus justifying further accumulation of resources to continue producing cow meat and contesting regulations on the production process (Rosin, 2013).

Texts from different departments of Uruguay's government indicate varying levels of concern for the environment and sometimes even different expectations for the next decade's development. The National Meat Institute (INAC) gives a lot less attention to ecological concerns in their future development plans than the National Institute of Agriculture and Livestock Research (INIA). When comparing the two institutes' mission statements, this hierarchy of priorities is subtle but apparent.

Here is INIA's mission statement:

> [5]*"To generate and adapt knowledge and technologies in order to contribute to the sustainable development of the agricultural and livestock*

[4] "Given the relevance of emissions in beef production, as they are of biological origin, and as, under the Paris Agreement, Uruguay must mitigate climate change in a way that does not threaten food production, the national challenge focuses on reducing emission intensity per unit produced..." (NDC 2017, 8)

[5] Generar y adaptar conocimientos y tecnologías para contribuir al desarrollo sostenible del sector agropecuario y del país, teniendo en cuenta las políticas de Estado, la inclusión social y las demandas de los mercados y de los consumidores. (INIA, 2017, 41)

> *sector and of the country, taking into account the State's policies, social inclusion, and the demands of the market and consumers."*

Here is INAC's mission statement:

> *"To formulate, advise, and execute policies that promote the growth of the meat production chain, contributing to productive, economic, and environmental development for the benefit of society."*[6]

While the language of these two mission statements is similar, the primary and secondary objectives are diametrically opposed. In the former statement, INIA makes it clear that their focus is on sustainable development research, with "demands of the market and consumers" being "taken into account." The latter statement explicitly says that growth in the "meat production chain" is INAC's principal mission, while "environmental development" is a supplementary contribution. It is important to distinguish the missions of these two institutes because the purposes of these groups are often conflated. Since they both cover Uruguay's cattle production industry, it is easy to uncritically assume that they have the same goals and outlooks in mind, but this is not the case.

The National Climate Change Response System (SNRCCC) is another program that is concerned with Uruguay's path to sustainability. Their focus is more broad, but given that the cattle raising industry is responsible for 80 percent of the country's methane emissions, their publication "Long Term Climate Strategy 2020-2050" (Estrategia Climática a Largo Plazo 2020-2050) offers information for the cattle industry's future (2021, 65). Their objective for 2050 is to stabilize methane production at around 750,000 metric tons per year for 2030 onwards. They argue that stable methane emissions are an appropriate path forward because

[6] Formular, asesorar y ejecutar políticas que promuevan el crecimiento de la cadena cárnica, contribuyendo al desarrollo productivo, económico y ambiental en beneficio de la sociedad. (INAC, 2022, 1)

methane is a short-lived greenhouse gas, oxidizing naturally over 11 to 13 years (SNRCCC, 2021, 65). By decreasing the intensity of methane emissions per pound of beef, they predict that the industry will increase production by 149,500 tons of meat per year by 2050 while stabilizing their methane emissions (SNRCCC, 2021, 61).

The market growth forecast published by INAC is even more ambitious. They hope to increase meat production by 300,000 tons by 2030, an increase of 42 percent (INAC, 2022, 6). There is no mention of the ecological impact of this rapid growth, nor a plan to reduce relative emissions. Instead, this development is driven by a sharp spike in demand from China, who now import 69 percent of Uruguay's exports (Kenneth, 2022). From 2020 to 2021 alone meat exports to China grew 39.2 percent (Universidad Católica de Uruguay, 2021, 13). Needless to say, it is certainly possible that cattle production will outpace the SNRCCC prediction significantly if relations with China continue at the current rate.

Rapid market growth is not the only obstacle Uruguay faces to reach *at least* methane stabilization. While the country has proposed many scenarios which would hypothetically decrease methane emissions, slow implementation and a lack of enforcement plans has hindered their progress. It remains unclear exactly what facets of the meat production industry will be enhanced. Uruguay still seems to be on the research and planning stage, falling short of climate action. A recently published study titled "Studying beef production evolution to plan for ecological intensification of grazing ecosystems" (Caram et al, 2023) outlines management practices which show room for potential to reduce methane emissions, like adjusting land use and introducing legumes into natural pastures. Still, given how little progress has been made in the last half decade, it seems unlikely that Uruguay will reach its target of reducing methane emissions by 33 percent per pound of beef.

While this section analyzed the execution of Uruguay's plan as it stands today, the following section analyzes the country's strategy from a theoretical perspective. Hypothetically, if all goes well and Uruguay is able to reduce emissions by 35 percent per pound of beef, where does that leave them? Is this enough to reduce emissions to a sustainable level? Using the theoretical framework developed earlier in the paper, this next section analyzes Uruguay's ecological intensification strategy. It calls into question the effectiveness of the technological fix to mitigate the toll that the livestock sector has on the environment.

Chapter VI: The Big Question: Can Uruguay Cut Its Emissions While Producing More Beef?

Global warming is a grave concern for Uruguay, and they consider it a top priority of policy. In the 2050 Development Strategy published in 2019 by the office of Planning and Budgeting, they outline a specific definition for development:

> *"A developed society can be defined as one that is capable of applying and reproducing the best practices of a historical period, in the scientific and technological realm, in the economy, in forms of social organization, in management, in politics and democracy, in institutions and culture, in a general sense… But, in addition, for development to be sustainable, it must consider not only the well-being of current generations, but also that of future generations."*
>
> *(14)*

Sustainable development is at the heart of Uruguay's future plans. However, this definition put forth in this document exemplifies the difficulty for a developing country to balance sustainability concerns with those that are perhaps more short-term, like economic well-being. Sustainable development is often positioned as a sacrifice a state must make to the detriment of its economy, especially in countries like Uruguay where the primary export commodity has a direct impact on GHG emissions. Still, the country has committed itself to sustainable development in a strategy known as "ecological intensification" (Caram et al, 2023). This thesis understands ecological intensification to be the practice of obtaining more product from the same unit while reducing negative environmental impacts (Tittonell, 2014). In the case of cows, they are optimized through a series of modifications in order to produce fatter cows that take up less land and produce less methane. The ecological intensification of cattle is a type of technological fix in that it aims to eliminate concerns of the environmental impact of the production while yielding increases in productivity (Cooper, 2017, 819). The strategies which

Uruguay intends to implement are exclusively technological fixes: in the research project used to develop Uruguay's climate intervention agenda, it explicitly states that "Interventions had to have potential for improving productivity while at the same time reducing enteric CH_4 emissions per unit of output" (FAO & New Zealand Agricultural Greenhouse Gas Research Centre, 2017, vii).

The technological fix is not an intrinsically corrupt model for sustainability. In fact, Uruguay used this strategy to decarbonize 98 percent of their electrical energy grid (Sartori, 2021). However, the specific implementation of the technocratic fix will not be as effective for the cattle raising sector as it was for the energy sector. For one, carbon reduction technologies are not developed enough to substantially minimize the methane produced by the digestive systems of cows. Second, the strategies developed by Uruguay aim to reduce carbon emissions on the side of the producer and not of its consumers. While researchers have shown that changes in the consumption habits of consumers could reduce emissions better than changes in the management of production, the meat industry and the government benefit from production taking control of endeavors to decarbonise the cow (McGregor and Houston, 2017).

The proposed technological fixes in these documents show various levels of success in both mitigating methane production and optimizing beef production. Of the most promising options is adjusting the pastures of grazing cattle to include legumes. By sowing legumes into the pasture, cows are able to rear faster because they intake more nutrients, especially during winter when native forage is scarce (FAO & New Zealand Agricultural Greenhouse Gas Research Centre, 2017, 17-19). This strategy has been adopted elsewhere; but as Ormond (2018) points out, the process of transporting and sowing legumes counteract the gains made in methane reductions; furthermore, changes in the cattle's food might affect meat quality. Finally,

introducing new flora puts the pasture at risk— we still do not know how the introduction of certain legumes might affect biodiversity.

A less promising technological fix option that Uruguay has explored is carbon sequestration via afforestation (Bussoni et al, 2019). Specifically, silvopasture (an integrated forest-pasture environment) has been a favored proposition for Uruguay. Uruguay has committed to conserving all of its natural forest area. Silvopasture is an auspicious proposition for three reasons. For one, trees which are planted sequester carbon into the soil, leveraging the methane produced by cows; second, cows benefit from the shade provided by the canopy; third, foraged goods can supplement beef production revenue (Jose and Dollinger, 2019). While silvopasture possibilities remain optimistic, it is a relatively novel idea, and research is inconclusive on its effectiveness. In the first NDC published in 2017, Uruguay proposed to increase silvopasture land use by 25 percent by 2025; its second NDC changes this objective to a 10 percent growth by 2030. This indicates that it is a challenge to develop silvopasture in a short period of time. Uruguay is an especially challenging place to implement silvopasture because trees are not native to its grasslands (SNRCCC, 2020, 56).

Another promise Uruguay makes in their NDC is to improve the land management practices of their pastoral environments. By 2030 they hope to incorporate “good management practices" of the “campo natural” in 1.5 to 4 million hectares, or 10 to 30 percent of its pastoral land.[7] These efforts include ‘adjusting cattle fodder’ and ‘regenerative management practices’ which sought to reduce waste and contribute to carbon sequestration (2022, 16). It is difficult to understand what they mean by good management practices, and they do not explain it in greater detail though they claim it will make cattle production more sustainable.

[7] “Al 2030 se han incorporado buenas prácticas de manejo del campo natural y del rodeo de cría en establecimientos de producción ganadera en un área entre 1.500.000 y 4.000.000 ha, que conducen a reducir la vulnerabilidad a la variabilidad climática en sistemas de producción ganadera basados en campo natural.”

The narrative of environmentality helps explain why Uruguay has chosen to use technological fixes and why these technological fixes have not reduced emissions. Changes in the body of the cow and in the environment of the Uruguayan “pradera” (prairie) are attempts to govern the natural systems of the earth in order to mitigate the costs of human behaviors which cause damage to the environment. The idea is that humans can continue increasing cattle production if we adapt fixes to counteract the ecological toll of our consuming habits (McGregor et al, 2021). If the cattle sector can find a way to optimize beef production, they are able to accumulate more capital from cattle bodies. In spite of these researching endeavors, the earth systems are not entirely understood, and so they are unable to implement a strategy to counteract the ecological damage. However, proponents of technological fixes are able to promise that in the future they will come to understand these systems. This allows them to increase production before they are able to implement GHG emissions mitigation strategies. It is possible that researchers may never find a way to significantly reduce cattle methane emissions, but that won’t stop the meat sector from intensifying their operations.

It becomes very apparent that there is an ongoing effort to implicate a very specific image of ‘el campo natural,’ a phrase which in English which directly translates to “the natural countryside”. A better natural countryside should include altering biodiverse grasslands to better fit the dietary needs of cows; to plant trees in nutrient-poor and shallow soil; and most importantly, to base all land management practices to better suit a species introduced to the continent only a few centuries ago. The vague proposal to incorporate better management of the natural countryside invokes certain aspects of historical, current, and future states of cattle management. Reframing the perception of cattle farming towards this corporatist green style clashes with the marketing strategy that Uruguay uses. Uruguay relies on the grassfed “campo

natural" imagery which implies minimal interference with the cow's natural biological system; to replace this image with the bio-engineered conception might cost the meat its luxury status.

Uruguay's National Meat Institute (INAC) advertises the country's beef as such: "Uruguayan livestock are free-range, raised in natural conditions with a mild climate, fertile land, and plenty of water from the country's several rivers and streams, thus their welfare being ensured" (National Meat Institute (INAC), n.d.) They construct a nostalgic imagery of a product with an intimate connection to nature and minimal human interference. Uruguayan ranchers are prohibited from using growth hormones and antibiotics for the purpose of growth promotion by law. Sentimental idealization of pastoral land has been a useful message for an industry now under fire for its corruptive impact on the environment. INAC's "From Nature to Your Table" message is trying to overcome the negative association of meat for the environment. "The environmental control that meat still represents has taken on negative implications for many people today, superseding the predominantly positive meanings of the past," (Fiddes, 2004, 210). Since external consumers are now aware that the old ways of cattle production are ecologically damaging, proponents of cow meat and products have subtly reworked the pastoral narrative to characterize practices as working symbiotically through nature and technology. This green rebranding has been termed 'post-pastoral': a term used to describe framings which seek to retain the cultural allure of craft and a proximity to nature, while embracing the power of science and technology— and reasserting the place of capitalism (Cusworth et al, 2022).

Evidence suggests that post-pastoralism is a powerful legitimizer of beef production internally. In a recently published survey, Uruguayans were asked to perform a mental association with meat (Realini et al, 2022). As expected, associations with red meat were mostly positive; respondents characterized beef as a healthy source of nutrition, and many associated

beef with social and cultural aspects. Most interestingly, they showed little awareness of the environmental impact of beef. Those who recently started to consume less red meat did so because of the price and health concerns, and not because of altruistic motivating factors. This lack of awareness suggests two things: that efforts to green Uruguay's cattle production industry are driven by external bodies; and that domestic consumers might intentionally be left ignorant of the environmental cost of the beef they consume. This helps to explain why Uruguay is the second-highest consumer of beef per-capita globally. The results also forewarn a national identity crisis once people become aware that beef is not as healthy nor as eco-friendly as they once thought.

The point here is not to imply that the people of Uruguay are at fault for their nescience of the cow's ecological toll on their country. Uruguayans are known for their fervent political activity; furthermore, most efforts to reduce emissions are undertaken by the producers (ganaderos). It is convenient for the industry that the population remains unaware of these global concerns of the food's carbon footprint. The demand for beef persists since domestic consumers are not burdened with the knowledge that their eating habits are unhealthy both for their body and their land. Responsibilizing producers rather than consumers enables the beef industry to continue expanding, whereas shifting consumer practices would ultimately limit the market demand.

Perhaps Uruguay's post-pastoral solution is so successful precisely because consumers are not yet asking for more radical changes. So long as they implicate their will to abide by new bioengineering fixes they will convince the international markets that they are willing and able to play a part in the effort to reduce carbon emissions. Not only that, but because they are industry

leaders of the green cow movement, foreign consumers buy into the ethicality of Uruguay's steaks.

As it stands today, Uruguay's climate strategy fails to address the root cause of its emissions. While its efforts to offset GHG emissions theoretically relieve the gasses produced by its cattle, it is an imperfect correction. Without some way to cap the amount of cattle produced in Uruguay, these solutions will only grant farmers further expansion in the production of cow products. Failing to transform the cattle production *and consumption* patterns will only provide a temporary fix.

Chapter VII: Conclusion

The title of this thesis, *Can Uruguay Have Its Steak And Eat It Too*, references the common idiom of having your cake and eating it too. This admittedly nonsensical idiom is used in situations where someone wants two things that cannot be had together, or for when someone wants to act in some way without having to face the consequences (Merriam-Webster, n.d.). Through the implementation of ecological intensification, Uruguay wants to increase beef production while also wanting to make changes to achieve a more sustainable future. Achieving this goal through technological fixes is unlikely to result in the results they hope for.

The findings of this thesis are significant. Using a thematic network I was able to reduce and refine data, organize this data into several themes, and deconstruct the significance of the sustainable development plans. I described the data I find to be most important in the following section. Also in this section I noted contradictions between the many political organizations and institutions that deal with the cattle ranching sector and the environment. The data description includes my finding that implementation for Uruguay's emissions prevention strategies have been markedly slow.

The second analysis section answers the big question: Can Uruguay cut its emissions while producing more beef? Using the theoretical framework, I argued that Uruguay's strategy prioritizes market growth over reductions in global emissions. The “ecological intensification” approach that Uruguay takes is shown to be problematic, since it fails to implement any changes made to consumer habits. Furthermore, through the post-pastoral narrative the beef sector has entrenched their status in the country. Since Uruguayan beef consumers are not aware that they ought to consider the ecological toll that cattle ranching has on their own country and the world’s environment, they are not a driving force of actual changes to the meat sector.

Serious action needs to be taken within the near future to prevent the most catastrophic consequences of global warming. Uruguay needs to consider the need to reduce emissions as existential because agricultural industries are directly affected by climate change. As droughts increase in intensity and severity, challenges to continue feeding livestock and the people who live off of them will be compounded. Pragmatic solutions and alternatives are more difficult to find when time is not on one's side; therefore it is imperative that Uruguay begins now to drastically revolutionize its agriculture.

Critical environmental social scientists have highlighted that consumers must be involved in the process to reduce carbon emissions alongside producers by changing consumption habits and acting as logical consumers who consider the ecological impact of the products they buy (Ormond, 2020; Poore and Nemecek, 2018; McGregor et al, 2021). Governments could also aid in the transition away from cattle ranching by providing aid to those who must transition their careers away from cattle ranching.

As the results from one survey (Realini, 2022) indicate, most Uruguayans do not weigh the environmental impact of consuming red meat in their eating habits. Therefore, an important and obvious step to reducing the country's carbon footprint is to expand awareness of this issue. In fact, I began this research project intending to investigate how Uruguayan environmental movements approached beef's harmful impact on the planet, but I had to shift course because there was very little evidence they spoke of the topic at all. One should expect an awareness campaign to be met with significant backlash because of the cultural significance of beef to Uruguayans. All the same, this step is necessary to put pressure on the cattle industry's unchecked hold on the country's economy and society. It is not an easy sell to demand Uruguayans to eat less beef; certainly, it might even become an existential crisis once there is

significant discourse around the idea of a Uruguay without beef. Nevertheless, the environmental crisis will have far greater consequences.

Since it would be extremely difficult for Uruguay to stop producing and consuming meat altogether, there are more feasible solutions to actually reduce emissions while still producing meat at some rate. McGregor and Houston (2017) offer one proposition that brings producers and consumers closer together to bring benefits to cattle, people, and the environment. Here, consumers grow more conscious of cow production processes which offer lower quantity but higher quality meat products. Cattle also benefit from this proposition through more humane production practices. This would require great transparency from the producers, something which Uruguay is working towards through their traceable technologies (Castrillón, 2021).

While this study provides useful and practical information on the plan to reduce cow GHG emissions in Uruguay, it is important to acknowledge some limitations. For one, the study focussed entirely on the reduction of greenhouse gas emissions. While this is a significant contributor to the rising global temperature, climate change can come from a variety of different man-made causes. By framing the environmental impact of cattle production solely on the GHG emissions they produce, the study overlooks other effects the livestock can have on the land, such as reducing biodiversity. Significant trade-offs exist between carbon footprint and other relevant environmental variables (Picasso et al, 2014). A more holistic approach to sustainability would benefit the research greatly. An all-encompassing approach would include more localized impacts that beef has on the environment, such as soil erosion and contamination (Cisneros-Saguilán et al, 2015).

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