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Operating Carbon-Neutral Tourism: Systematic Review & Bibliometric Analysis

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Abstract
Purpose: The primary goal is to identify the existing knowledge on carbon-neutral tourism gained from 2005 to 2023.
Research Methodology: To accomplish the research purpose, a systematic literature review (SLR) approach and preferred reporting items for systematic reviews and Meta-analysis (PRISMA) guidelines were used to address the research objective. Through methodical literature research, bibliometric analysis, and the use of the VOS viewer software, all chosen papers were thoroughly reviewed, summarized, and synthesized.
Results: Combining The Google Scholar, Emerald Insight, and Lens.ORG databases resulted in 43 articles. An increasing variety of tourism destinations are planning to become "carbon neutral" as pressure on the tourism industry to reduce greenhouse gas emissions grows. This is because tourism is now widely acknowledged as a significant contributor to global climate change due to the significant greenhouse gas emissions associated with air travel. Overlay visualization shows that there has been a high demand for carbon-neutral tourism since 2021.
Contributions: They want to minimize their impact on global warming while simultaneously expanding their tourism industries by enhancing their reputation as green, environmentally conscious, and sustainable destinations.
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1. Introduction

1.1. The Concept of Carbon-Neutral Tourism

The tourism industry places considerable emphasis on sustainability. The invention of eco-certification schemes has been a crucial marketing approach for addressing the obstacles to sustainable tourism. The preservation of ecosystems requires enormous resources such as personal, financial, and infrastructure resources, which are becoming increasingly difficult to justify due to a lack of sustainability and use boundaries (Junior & Birolo, 2021). The global pandemic has had significant socioeconomic effects. This has also increased our knowledge of the significance of sustainability in economic decisions (Bitok, 2019). An imaging paradigm known as "carbon-neutral tourism" is centered on the reduction of emissions through tourism operations. Further broader values of adaptation, transitional, and behavioral changes. Tourism is now widely acknowledged as a substantial contribution to global climate change, particularly due to the large greenhouse gas emissions associated with air travel (Yangka, Rauland, & Newman, 2019). Tourism relies heavily on the environment and is particularly vulnerable to the effects of climate change and global warming. It is estimated to contribute to approximately 5% of the world's CO2 emissions (Scott et al., 2008). Natural changes have a significant impact on the urban atmosphere. However, it has a more severe impact on anthropoid welfare due to the loss and destruction of greenspace (ul Mustafa, Afzal, & Zahoor, 2020). Tourism is considered a highly climate-sensitive economic sector compared to other

industries because of its close relationship with the environment and climate change. Regional manifestations of climate change have a significant impact on tourism destinations and tourists, necessitating adaptation by all key tourism players. According to Bodansky (2013), climate change currently influences tourist decision-making. The globe and ecosystems have already sounded an alarm for humanity through the effects of greenhouse gases, particularly carbon dioxide. The earth's surface is naturally heated by greenhouse gases in the atmosphere and absorbs infrared energy. Emissions from sources, such as tourism and travel, have increased in the last few decades owing to the increase in human activities. Adding greenhouse gases to the atmosphere, warming the globe, and causing global climatic shifts around the world. Climate change is a major concern in sustainable tourism, both in terms of greenhouse gas emissions produced by the travel and tourism industry and the possible effects of climate change on regions that rely on tourism. A new paradigm known as "low-carbon tourism" focuses on how tourist businesses might reduce their emissions while also upholding larger ideals of adaptation, transition, and behavioral change (Baumber, Merson, & Lockhart Smith, 2021).

Destinations are claiming "Carbon neutrality," which indicates that they do not contribute to climate change. This is referred to as "carbon neutrality," "climate neutrality," "carbon-free," and "carbon clean." For instance, the term "climate neutral" refers to the emphasis placed on all greenhouse gas emissions, which is crucial given the radiative forcing generated by aircraft. "Carbon neutral" status can only be applied to CO2 (Sausen et al., 2005).

The term "neutral" in both circumstances is unbelievable because the greenhouse gas emissions associated with tourism can be offset by lowering emissions in non-tourism industries. Energy efficiency, as a renewable energy source, is a type of compensation project and forestry initiatives (afforestation, replanting, avoided deforestation, or forest conservation and management) are another type. There are questions about sinks' long-term viability and land availability, although one could argue that using the term "carbon neutral" is accurate if the quantity of CO2 equivalent to that generated by a particular tourism-related activity is stored in biomass, such as in a forestry project (Gössling & Higham, 2021). Low-carbon tourism is a new paradigm that was proposed in 2009 as a type of sustainable tourism that seeks to create an enhanced tourism experience with a novel process of travel for tourists and is expected to achieve improved social, economic, and environmental outcomes (Yangka et al., 2019).

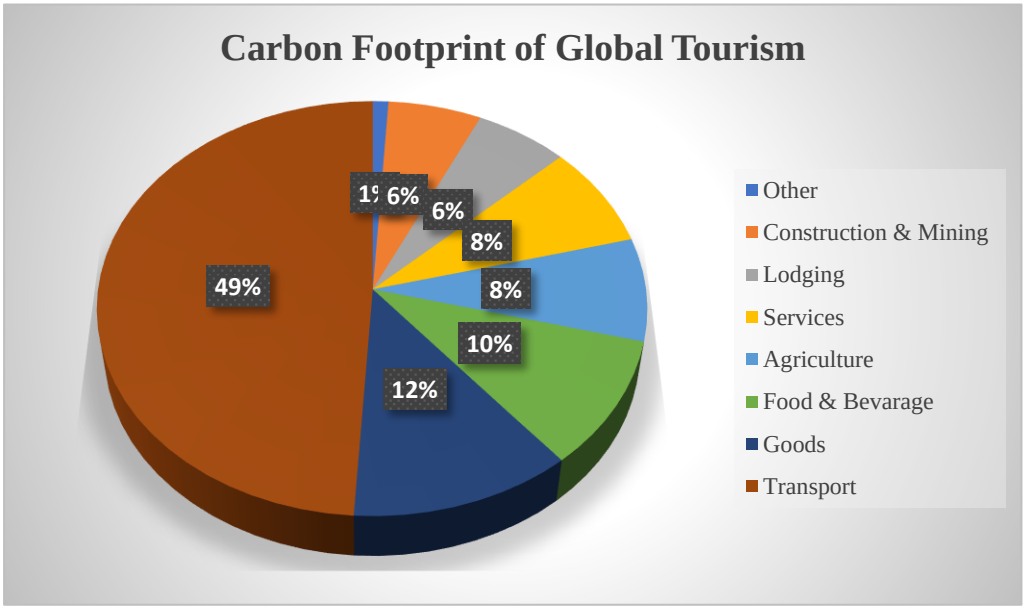

Figure 1: Carbon Footprint of Global Tourism
Source: Murphy et al. (2021)

The International Council of Clean Transportation (ICCT) has provided an in-depth analysis of airlines' CO2 emissions by route and airport. The top ten routes with the highest emissions were identified as Los Angeles International Airport (LAX) to Honolulu International Airport (HNL), Boston Logan International Airport (BOS) to San Francisco International Airport (SFO), LAX to Newark Liberty International Airport (EWR), LAX to John F. Kennedy International Airport (JFK), EWR to SFO, LAX to BOS, SFO to JFK, O'Hare International Airport (ORD) to SFO, Hartsfield-Jackson Atlanta International Airport (ATL), LAX, and LAX to ORD (Gössling & Higham, 2021).

1.2. Global Context of Carbon Neutral

The development of the greenhouse effect due to human actions has been blamed for trends in global warming since the middle of the 20th century. Carbon dioxide (CO2) is one of the gases in the greenhouse gas family that traps the most heat. Since the beginning of the industrial revolution 170 years ago, humanity has contributed to a 47% increase in atmospheric CO2 concentration. The greenhouse gases created by humans, notably carbon dioxide, methane, and nitrous oxide, are thought to be the cause of the rise in Earth's temperature. It is easy to establish whether the temperature has changed by calculating the monthly and yearly equivalent temperatures. Human activities, such as land use and deforestation, as well as climate change, affect greenhouse gas levels (Xinyu Chen et al., 2021).

Based on Xinyu Chen et al. (2021), China declares that it will be carbon-neutral by 2050, they will turn carbon-neutral based on the low carbon and climate resilience plan. China must transition to a sustainable economy as part of its efforts to combat climate change as well as to advance its social and economic development. By the end of 2020, China, the largest carbon emitter in the world, was responsible for 32% of all carbon emissions, making it impossible for China to achieve its objective of becoming carbon-neutral. The President of China stated that during the "14th Five-Year Plan" 2021, the objectives of carbon peaking and carbon neutrality will be incorporated into the broader framework of ecological civilization development. In addition, China has prioritized carbon neutrality in its national development strategy.

Along with a dramatic increase in the utilization of new energy vehicles, it has also been seen that energy conservation is managed by expanding key domains. The basis for China's eventual achievement of carbon neutrality was built by the country's pilot low-carbon and climate-adaptation regions and cities. China's 14th Five-Year Phase is necessary for the country to develop in a high-quality manner. Through carbon peaking and carbon neutrality action plans, Chinese provinces and cities are implementing the president's dual carbon targets (carbon peaking and carbon neutrality) (Wu, Tian, & Guo, 2022). Additionally, they are implementing policies in the areas of ecology, business, finance, tourism, buildings, and transportation. One of the several ministries and commissions within the State Council is the Ministry of Transport along with the Ministry of Housing and Urban-Rural Development and Ecology and Environment. The Sinopec Group, China National Petroleum Corporation, and China's five main power generation conglomerates are examples of state-owned businesses in China. Huawei was a private enterprise.

Japan has declared its intention to achieve carbon neutrality by 2050, following the Chinese goal. To achieve carbon neutrality, Japan would significantly alter its coal-power policies and push up research in essential technical fields, including renewable energy and carbon cycle technologies (Scott et al., 2008).

In 2018, the Danish government announced a plan to achieve a "carbon-neutral society" by 2050. This plan includes a restriction on the sale of new gasoline and diesel cars as well as support for the widespread use of electric vehicles. Furthermore, Copenhagen has encouraged a variety of low-carbon initiatives as a new paradigm to keep ahead of global carbon-neutral progress, including expanding efficient construction methods, creating energy-efficient buildings, increasing the use of solar cells, fostering technological advancement, and creating smart cities. By utilizing these strategies, green

travel was promoted in the transportation sector, including traveling by foot, bicycle, or bus, while using clean fuel. Additionally, they suggested using biomass energy and recycling trash into energy to increase manufacturing capacity.

In 2015, the United Kingdom displayed a high level of responsibility by signing "The Paris Agreement," which aims to limit global warming to 1.5°C over pre-industrial levels. In this effort, the United Kingdom joined 178 other countries. In June 2019, the UK made a clear commitment to its recently modified "Climate Change Act" to achieve carbon neutrality by 2050. The United Kingdom was the first developed nation to adopt carbon-neutral practices and incorporate a carbon-neutrality goal in legislation. The first carbon-neutral specification (PAS 2060) was released by the British Standards Institute. Additionally, the British civil aviation sector revealed the goal of becoming carbon-neutral by 2050. In November 2020, the UK released The Ten Point Plan for a Green Industrial Revolution. The policies of carbon neutrality are discussed in the table below.

Table 1. Low carbon initiatives in a few nations or regions from 2010 to early 2021

Country or region	National policies	Year
United States	Using modern technology while generating lots of emissions	2019
	Minimum cooling requirements for heating and cooling systems	2018
	projects carried out locally concerning alternative fuel cars	2017
	Standards for the fuel consumption and greenhouse gas emissions of medium- and heavy-duty engines and vehicles	2016
	300 renewable energy sources by 2020 is the statutory goal	2015
	attempt to preserve energy in rural areas	2013
	US Climate Action Plan; Loan Program for Energy Efficiency and Conservation	2012
	Energy grant program for high expenses	2011
	Enhance construction initiative	2010
United Kingdom	In the UK's 2020 budget, there is funding allocated for carbon capture and storage.	2020
	Residence-based electric vehicle charging	2019
	Action Plan for UK CCUS	2018
	industrial initiatives for clean growth, a UK-specific clean growth plan, and a program for ultra-low emission vehicles	2017
	Advanced carbon capture and storage (CCS) technology (ACT), workplace charging scheme (WCS), and home charging scheme for electric vehicles (EVHS)	2016
	Long-term investment in UK programs aimed at reducing vehicle emissions, such as the National Energy Efficiency Action Plan of	2015

	2014, the Energy Saving Opportunities Scheme (ESOS), and the Low Carbon Vehicle Innovation Platform (LCVIP)	
	National energy efficiency database, second national energy efficiency action plan, energy white paper from 2011	2011
	National Renewable Energy Action Plan (NREAP), and the Carbon Reduction Commitment Energy Efficiency Scheme (CRC)	2010
Germany	Actions taken by societal, cultural, and governmental entities to safeguard the environment; Initiative to boost energy efficiency and encourage the use of more renewable process heat in industry	2019
	Fostering electric vehicles in public transportation	2018
	Act of 2017 amending the renewable energy sources	2017
	Programs to promote energy efficiency, model local government climate mitigation efforts, community environmental protection activities, and heating system optimization	2016
	Networks for Energy Efficiency	2015
	NEEAP's third national action plan for energy efficiency	2014
	Support for energy management systems, the EnEV 2014 Energy and Electricity Tax Cap, and encouragement of environmentally and energy-conscious production methods	2013
	initiative to conserve electricity 2012 Energy and Climate Fund Law National Energy Action Plan (NREAP) 2011; Danish Climate Agreement for Energy and Industry, etc.	2012
	Climate protection initiatives in societal, cultural, and governmental entities; Program to encourage industry to use more renewable process heat and improve energy efficiency	2011
	Public transportation support for electric vehicles; the power grid action plan	2010
Denmark	Amendment to the Renewable Energy Sources Act of 2017	2020
	29 June 2018 Danish Energy Agreement (EE Dimension)	2018
	Green owner tax; Denmark car purchase tax rebate; EV registration tax decrease	2017
	Danish building standards for 2015 (BR15); voluntary energy-saving agreement for businesses that use a lot of electricity	2015
	Danish building regulations br10; energy strategy 2050	2011
	The Green Growth Agreement for 2010–2012, the Energy Saving	2010

	Council, and the Danish Energy Saving Trust	
Japan	A development plan for fuel cells and hydrogen, a roadmap for carbon recycling technology, and a roadmap for recycling carbon	2019
	A long-term objective and plan for Japan's auto industry for tackling climate change; a 2018 strategic energy plan; a law on the wise use of energy (a reform to the Energy Conservation Act); Taxation to encourage energy efficiency	2018
	The global warming strategy is a labeling system for energy efficiency, countermeasures, subsidies for commercial and residential building energy efficiency initiatives, and a building energy efficiency act	2016
	Realistic outlook for energy consumption and supply; subsidies for new energy-efficient vehicles	2015
	Strategic energy plan (2014)	2014
	Creation of advanced energy efficiency technological advances, feed-in tariffs for renewable energy resources, solar PV auctions, creative energy and environmental strategies, and the low carbon city act (Eco-City Act)	2012
	national action to save power	2011
	Promoting the construction of specified structures that are zero energy buildings (ZEB) and zero energy households (ZEH) (2010)	2010
Switzerland	energy law; premium on the market for massive amounts of hydropower	2018
	Standards for light-duty vehicle CO2 emissions under the Energy Strategy 2050	2017
	Action plan for coordinated Swiss energy research, the obligation for fuel importers to compensate for CO2 emissions, and technology fund for new technologies	2013
	CO2 emission standards for passenger vehicles	2012
	Program for renovating buildings; tenders for energy consumption that is efficient	2010
New Zealand	Standard cleanliness and a discount on car	2021
	Decarbonization program for the public sector	2020
	Warmer Kiwi dwellings; EVRoam	2018
	Access to designated lanes for special vehicles; an improved EECA (energy levies and energy innovation) (Electric Vehicles and Other	2017

	Matters) Amendment Act 2017 program; competition fund for low-emission vehicles)	
	Warm-up New Zealand: healthy homes extension for rentals program; electric vehicles program New Zealand	2016
	Updated policy recommendations for the carbon reduction program, air conditioners, and chillers	2014
	Warm-up New Zealand with the campaign to extend healthily	2013
	National policy declaration for the production of renewable electricity; New Zealand Energy Strategy (NZES); and New Zealand energy efficiency and conservation strategy	2012
	Emissions trading program and the 2010 Electricity Industry Act	2010

Source: Xinyu Chen et al. (2021)

1.3. Carbon-neutral destinations (countries)

Table 2. Carbon-neutral status of selected destinations

Country	Norway	Costa Rica	New Zealand	Scotland	Sri Lanka
Announcement	January 2007	February 2007	May 2007	July 2007	October 2007
Initiate by	Prime Minister	Ministry of Environment	Prime Minister	Tourism Innovation Group	Ministry of Tourism
Carbon-neutral by	2030	2021	No year, individual sectors between 2025 and 2040	Year not specified	Year not specified
Comprises (system boundary)	National emissions of GHG; international aviation not included, but possibly by 2012.	"Tourism and associated international air travel" and "certain industry sectors"	Not yet specified, starts with government agencies	"Tourism", including transport	". Tourism"
Strategy∗	Renewable Energy Energy efficiency Carbon Capture and	Forest conservation Forest Management Renewable Energy	Renewable Energy Energy efficiency Forest Management	Energy efficiency Renewable Energy Afforestation	Reforestation Biofuels

	Storage	Energy-efficiency	Afforestation		

Source: Gössling (2009)

1.4. Evolution of the "Carbon Neutral" Concept

Table 3. Evolution of the Carbon-Neutral Concept in the Globe

Author	**Year**	**Literature**
Wu et al. (2022)	1997	"Carbon neutrality" refers to the process of capturing storing, and converting carbon dioxide (CO2) to achieve "zero emission" of greenhouse gases over a specific period.
Sausen et al. (2005)	2005	Destinations have declared "carbon neutrality" aims, such as "carbon neutral," "climate neutral," "carbon-free," and "carbon clean." These terms appear to be interchangeable. The phrases, however, indicate distinct things from a definitional standpoint. "Climate-neutral," for example, would indicate that the focus is on all greenhouse gas emissions, which is especially significant in light of the radiative forcing caused by aviation, whereas "carbon neutral" would only include CO2.
Wu et al. (2022)	2013	By 2020, the aviation industry achieves carbon neutrality. The International Air Transport Association (2013) noted that this is the first time an explicit carbon neutrality aim has been put forth.
Wu et al. (2022)	2014	Suriname entered the era of carbon emission.
Bodansky (2013)	2015	The first global climate change agreement is announced by Paris Agreement in 2015. It includes policy responsibilities for all countries which attracted over 175 national pledges explaining a hybrid approach to global climate governance that incorporates both bottom-up and top-down tactics.
Wang, Huangfu, Dong, and Dong (2022)	2017	By the mid-twentieth century, 29

		countries signed the "Carbon-Neutral Alliance Statement" from "One Planet Summit" in December 2017 pledging to reach carbon neutrality. 66 countries formed the Climate Ambition Alliance during the United Nations Climate Action Summit in September 2019.
Yangka et al. (2019)	2018	Bhutan entered the era of carbon emission.
Emission Gap Report (2019) https://www.unep.org/resources/emissions-gap-report-2019	2019	According to the Emission Gap Report 2019, of UN Environment Programs (UNEP) there is a significant gap between existing countries' emission reduction intentions and the 1.5°C target required. Approximately two-thirds of the allocated funding for keeping the temperature rise below 2 degrees Celsius has been spent. Carbon dioxide emissions, as the most significant, show that world emissions must begin to fall immediately. A growing number of countries have intensified their emission reduction efforts by committing to climate policies like carbon neutrality to close the carbon emissions gap,
The European Union (EU)	2019	The European Union (EU) announced a new climate strategy called as "European Green Deal" on December 11, 2019, in Brussels, to achieve net zero greenhouse gas emissions. Further, decoupling of economic growth and resource use in Europe by 2050. This goal was also included in the European Climate Law draft.
Scott and Gössling (2021)	2021	The tourist sector has reaffirmed its commitment to a decade of climate action, to become "climate neutral" by 2050 (Glasgow Declaration, 2021). Although the stated objective is in line with net-zero emission targets and the Paris Climate Agreement it lacks specific steps that would enable such a transition.

1.5. Lessons from certified destinations

Bhutan is a tiny, underdeveloped Himalayan nation, with a population of less than 0.8 million. More than half of Bhutan's workers (Yangka et al., 2019). The vast majority of enterprises in the private sector are small. Bhutan's industrial base is also fairly small, but it is representative of many emerging nations that are working to balance and integrate many development agendas, including monetary opportunities, happiness, and environmental policy. As the first government to undertake such a program, it reaffirmed its commitment to achieving and maintaining eternal carbon neutrality. Bhutan has made various efforts to protect natural resources.

For instance, according to data from the Ministry of Agriculture and Forestry in 2017, the constitution of Bhutan mandates that at least 60% of the land must be covered by forests. Currently, forests cover 72% of Bhutan. The Bhutanese responded well to this tactic, in part by quickly planting new trees on their property. Bhutan has attained carbon neutrality because although emitting 1.1 million tons of CO2 annually, the country's forests have a much greater capacity to absorb CO2. However, the nation can teach us more than just how to preserve forests. Additional teachings included the use of hydroelectric power. Owing to the nation's abundance of swiftly moving waterways, it can produce a sizable amount of hydroelectricity (Wu et al., 2022). Bhutan intended to keep its carbon emissions within the capacity of its forest cover to absorb carbon, which has been quite simple to do so far. For example, Yangka et al. (2019), Bhutan was the source of 2.4 million tons of CO2 equivalent emissions in 2014. The Bhutan government has made efforts to improve hydroelectric electricity and reduce the country's reliance on fossil fuels. Bhutan exports some of its hydropower to India, which has aided it in being carbon-neutral. Bhutan also demonstrated the value of investing in new, cleaner, and more energy-efficient technologies. The Bhutanese government, as an illustration, subsidizes the costs of LED lighting and electricity public transit. Additionally, they encourage the sale of electric cars by cutting the prices for these purchases.

The Bhutanese government's strategy of giving the nation's rural population free electricity to decrease the need to burn wood for cooking has been another inducement they deploy to reduce environmental damage. A network of biological corridors connects more than half of the country, which has been designated as a national park, natural reserve, or wildlife refuge. The government also provides support to those who live close to environmentally vulnerable areas so that they can learn how to live in harmony with the environment and stop environmentally harmful behaviors, such as poaching, mining, and hunting.

The first foreign location to receive a carbon-neutral certification was Machu Picchu. The Green Initiative, a group that promotes eco-friendly and ethical travel, awarded the designation to the Historic and Natural Sanctuary of Machu Picchu. The Green Initiative has positioned Machu Picchu as a benchmark for sustainability worldwide. Well-known tourist attractions employ several strategies to overcome this distinction. The construction of Peru's only organic waste treatment facility, which converts trash into natural coal, as well as an oil transformation facility, which produces biodiesel and glycerin from vegetable oils wasted by locals and restaurants, were among the certifications granted to Machu Picchu (UNWTO, 2020). The amount of carbon that the Earth is capable of absorbing through its ecosystem must have been stopped from being released into the atmosphere globally. In addition to calculating and soon being certified for its water footprint, Valencia has made history as the first global destination to verify the calculation of its tourism-related carbon footprint. Every activity we perform, such as consuming food, buying, and traveling, contributes to the emission of greenhouse gases into the atmosphere, which affects the global climate. However, some activities have a much greater impact than others (Timperley, 2020). For a community to grow sustainably, all factors must be in harmony. The development of communities may be influenced by human emissions, which contribute to global warming and climate change. Global climate change is a top priority for both people and the environment worldwide.

1.6. The Sri Lankan Context of Carbon-Neutral Tourism Operations

Approximately 60% of Sri Lanka's tourist attractions are located near the coast, at elevations of less than two meters above sea level. Furthermore, there are significant and noticeable effects of climate change on natural resources that are dependent on tourism, such as inland water bodies, rivers, mountains, forests, and marine biodiversity, particularly coral reefs. Droughts that last for a long time affect the number of people visiting wildlife parks and forest reserves. Meanwhile, rising temperatures and heat stress may make this sector more vulnerable. Additionally, it will be more challenging to meet the water needs of tourism businesses in drier regions (north, northwest, and east). Landslides (Nuwara Eliya, Ratnapura, Kandy, Matale, and Badulla districts) and floods (Kalutara, Ratnapura, Kegalle, Batticaloa, and Ampara districts) potentially lead to greater insurance costs for businesses that provide tourism. Sri Lanka, one of the largest tea companies in the world, achieved carbon neutrality. At the end of 2018, a full line of carbon-neutral goods was launched by Dilmah Tea, a family-owned business with operations in over a hundred nations (Fernando, 2021). One of only six airlines in the world to do so, Sri Lankan Airlines, the nation's official airline, has also received approval for its "Flygreen" program. Sri Lanka has been permitted to display the QAS Carbon-Neutral Quality Mark, signifying that it is utilizing the world's best practices for carbon offsetting. The "Flygreen" Program actively solicits the participation of the airline's passengers, who are given the rare opportunity to voluntarily contribute a predetermined amount to offset the carbon footprint of their particular flight (www.srilankan.com/environment). Additionally, Aitken Spence Travels advocate adventures in nature and educate visitors on responsible tourism best practices, which may have an impact on the sector. At the United Nations International Energy Forum, which was held in New York on November 26, 2021, Sri Lanka further pledged to world leaders to restrict the production of coal power in the future to achieve net zero carbon emissions by 2050 (Fernando, 2021). Two mitigation strategies were put forth by the UNWTO to recognize the importance of tourism-related emissions on a global scale: encouraging travelers to select short-haul destinations with increased use of public transportation, less reliance on private transportation, and offering market-based incentives to tourism operators to increase their energy and carbon efficiency (Fernando, 2021).

1.7. Actions required for the growth of Carbon-neutral tourism

According to Gössling (2009), the travel and tourist sectors need to immediately reduce greenhouse gas emissions, especially from the operations of accommodation and transportation. The concept of " low-carbon tourism" is a new development. Sustainable practices include the adaptation of tourism-related businesses and destinations to shifting climatic circumstances, the use of new technology to improve energy efficiency, and the gathering of financial resources to support undeveloped regions and rebuild communities. Government and international organizations should collaborate on interactive strategic policies, measures, and plans to minimize greenhouse gas emissions from lodging, travel, and related tourism activities. Effective management and leadership are also required to implement pragmatic initiatives to lessen the impact of climate change.

The tourism industry is shifting to sustainable practices and renewable energy sources to reduce the carbon footprint of the entire industry by promoting and engaging in energy-efficient investing. Further research should be conducted to determine how the market responds to reduced environmental pollution (Gössling, 2009).

To reduce their carbon footprint, travelers should be encouraged to consider the climate, economic, sociological, and environmental repercussions of their decisions before selecting their destination. The investigation of communication networks is crucial. To close regional gaps, including those regarding the environment and climate, multidisciplinary research methodologies should be targeted. The "quadruple bottom line" (climate, environment, social, and economic issues) should be prioritized while promoting ethical travel that supports sustainable tourism.

In addition to calculating and certifying its water footprint, Valencia has become the first global destination to verify the calculation of the carbon footprint of its tourism activity. The carbon

footprint has been calculated in its three scopes, which include travel to and from the destination, as well as internal transportation, using robust big data technology. Indirect GHG emissions from energy use in tourism-related activities and associated indirect emissions, including lodging, tourist consumption, waste management, water management, and activities linked to culture, festivals, sports, and other events, as well as infrastructure for tourism provision. Tourism promoters can promote destinations that are closer to travelers while focusing on local markets, as long-haul tourists contribute the most to greenhouse gas emissions (Gössling & Higham, 2021). Important industry stakeholders include the UNWTO, the WTTC, destination marketing organizations, travel companies, local and national governments, and tourism promoters.

By developing alternative travel narratives, important travel stakeholders must support the company. Visit England launched a UK-wide effort to persuade people to take a domestic vacation during the fall and winter, working with tourist groups in London, Northern Ireland, Scotland, and Wales. Their main focus is domestic travel, and they use a new marketing approach to create and market new concepts and stories. The food and beverage business needs to focus more on experience-based cooking classes, vegetarian and fish-based cuisine, and a gradual decrease in meat consumption in the future (Wright, 2023). Meat consumption is a major contributor to global warming.

Discouraged by business travel, short to long flights should be avoided, especially when visiting foreign locations alone or in small groups. For such business meetings, technological and virtual reality chat rooms offer excellent substitutes for conventional meeting spaces. Business visits should be planned around personal vacations if they cannot be conducted through the Internet. Gap years should be advocated for people of all ages so that they can take their time traveling by land across numerous areas and continents to explore many sites (Wright, 2023). Regarding transportation, land-based choices should be fostered and supported. Travelers who want to travel locally, nationally, or regionally need more help from the industry. The industry needs to switch to renewable energy to sustain the tourism sector in the long run (Gössling & Higham, 2021).

There is a need for eco-friendly getaways that prioritize tree planting and environmental preservation. Emphasis on environmental education and giving back to the environment is essential because planting trees reduces carbon emissions (Wright, 2023).

3. Research Methodology

Table 4. Study Selection Process

Article selection method	PRISMA guidelines
Search strings	Carbon-Neutral Tourism
Inclusion criteria	1. Year range: 2005 -2023
	2. Subject area: All Subject areas
	3. Language of article: English
	4. Keywords: Carbon-Neutral Tourism

	5. Source type: Journals
	6. Type of Study: Empirical and meta-analysis
	7. Methodological quality: Articles that followed the Quantitative and Qualitative methodology (Mixed Methods)
Databases	Lens. Org, Emerald, Google Scholar
Analysis Method	Keyword Co-occurrence Analysis, PRISMA guidelines
Reporting structure	PRISMA guidelines

Source: Study Selection Process and Methods Source: Authors 'conception (2023)

As listed in Table 1, the PRISMA specifications, for which the PRISMA flow diagram was created, were employed when selecting the articles. Three phases are involved: "identification," "screening," and "included." These procedures were followed in this study (Figure 1). The search terms used for "identification" were "Responsible Tourism" and "Responsible Tourism Development." The researcher used both automated and manual screening of articles.

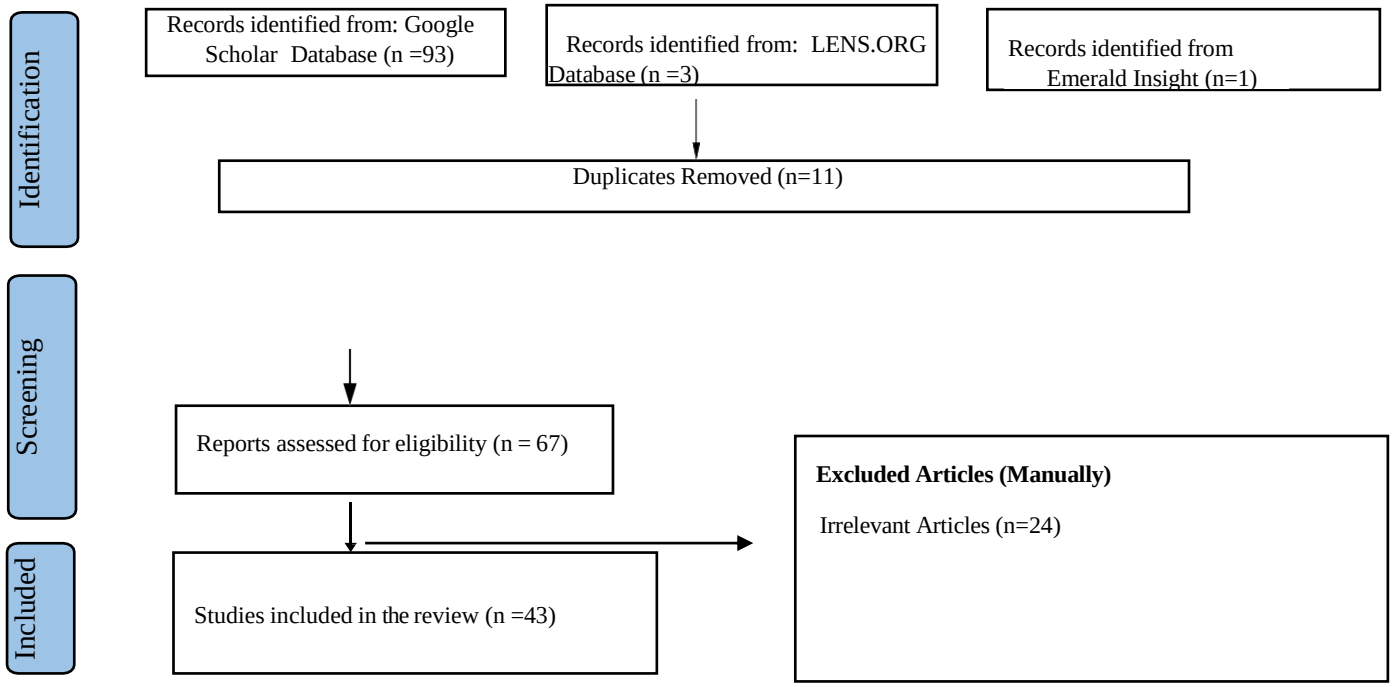

Figure 2. PRISMA article selection for the flow diagram.
Source: Authors creation based on the PRISMA flow diagram (2023)

3.1. The analysis methods

To examine the content and structure of an article, the researcher employed mathematical tools developed on the Biblioshiny and VOSviewer interfaces (Aparicio, Iturralde, & Maseda, 2019; Paule-Vianez, Gómez-Martínez, & Prado-Román, 2020; Van Eck & Waltman, 2014). As a result, the co-occurrence relationship of such terms in articles can be used to establish the links of such networks (Aparicio et al., 2019). According to Van Eck and Waltman (2014), VOSviewer shows them as "keyword co-occurrence network visualizations ". The substance of the keyword co-occurrence network visualization can be determined after relativizing the relationships between concepts (Cobo-Díaz, Baroncelli, Le Floch, & Picot, 2019; Priyashantha, De Alwis, & Welmilla, 2022). By normalizing the keyword co-occurrence network visualization, this process was carried out (Andrlić, Priyashantha, & De Alwis, 2023; Van Eck & Waltman, 2014). As a result, VOSviewer creates a network in a two-dimensional space using association strength standardization (Priyashantha et al., 2022; Van Eck & Waltman, 2014). In this area, networks representing substantially related terms are discovered closer to one another, while networks indicating less significant keywords are found further apart (Priyashantha et al., 2022; Van Eck & Waltman, 2014). After then, the links were split up into a network of clusters by the VOSviwer, with networks with a high degree of correlation being placed in the same cluster (Xiuwen Chen, Chen, Wu, Xie, & Li, 2016; Priyashantha, De Alwis, & Welmilla, 2021). The cluster associated with an instance is indicated by the color in the VOSviewer. Andrlić et al. (2023); Xiuwen Chen et al. (2016); Dogra and Parrey (2022); Van Eck and Waltman (2014), indicate that a cluster could represent an equivalent topic. As the objective was to determine the current body of knowledge on the evolution of carbon-neutral tourism from 2005 to 2023, a keyword co-occurrence analysis was performed. Each article's abstract and results section was examined to survey the findings associated with each clustered term.

Regions that are not frequently associated with carbon-neutral tourism were discovered using the density visualization map in the Vos viewer software. This explains why there were numerous keywords nearby. Blue represents less weight, green indicates average weighted keywords, and red depicts the most common areas (Andrlić et al., 2023; Xiuwen Chen et al., 2016; Van Eck & Waltman, 2014). Researchers may identify prospects for further investigation by employing density visualization maps.

Moreover, “overall information of the article set,” “annual article publication,” “average citation received,” and “source journals of articles,” were obtained using the software to elucidate the article's defined profile in the review. R-Biblioshiny was used to generate the first four outputs and the final output was generated using VOSviewer.

4. Results and Discussions

Using the PRISMA flow diagram during the initial stage (identification), the researcher found 97 articles were identified. The articles were located using information from Google Scholar, LENS.Org, and Emerald Insight publications, published between 2005 and 2023. Owing to redundancy, 11 items were ignored, and 14 articles were excluded based on the year they were published. Three papers were excluded because there were no journal articles, while two were excluded for linguistic reasons. 24 more articles were manually removed because they were not relevant to the subject of discussion. Further, there were a total of 43 articles that were considered for the review.

4.1. Main Information of article sets

This section focuses on outlining the features of the stored articles. The overall information of the articles is presented in Table 2.

Description	Results
MAIN INFORMATION ABOUT DATA	
Timespan	2008:2023
Sources (Journals, Books, etc)	16
Documents	43
Annual Growth Rate %	2.74
Document Average Age	3.81
Average citations per doc	0
References	147
DOCUMENT CONTENTS	
Keywords Plus (ID)	177
Author's Keywords (DE)	177
AUTHORS	
Authors	200
Authors of single-authored docs	4
AUTHORS COLLABORATION	
Single-authored docs	4
Co-Authors per Doc	4.81
International co-authorships %	0
DOCUMENT TYPES	
book chapter	1
journal article	4
journalarticle	38

Figure 3. Main information of the article set

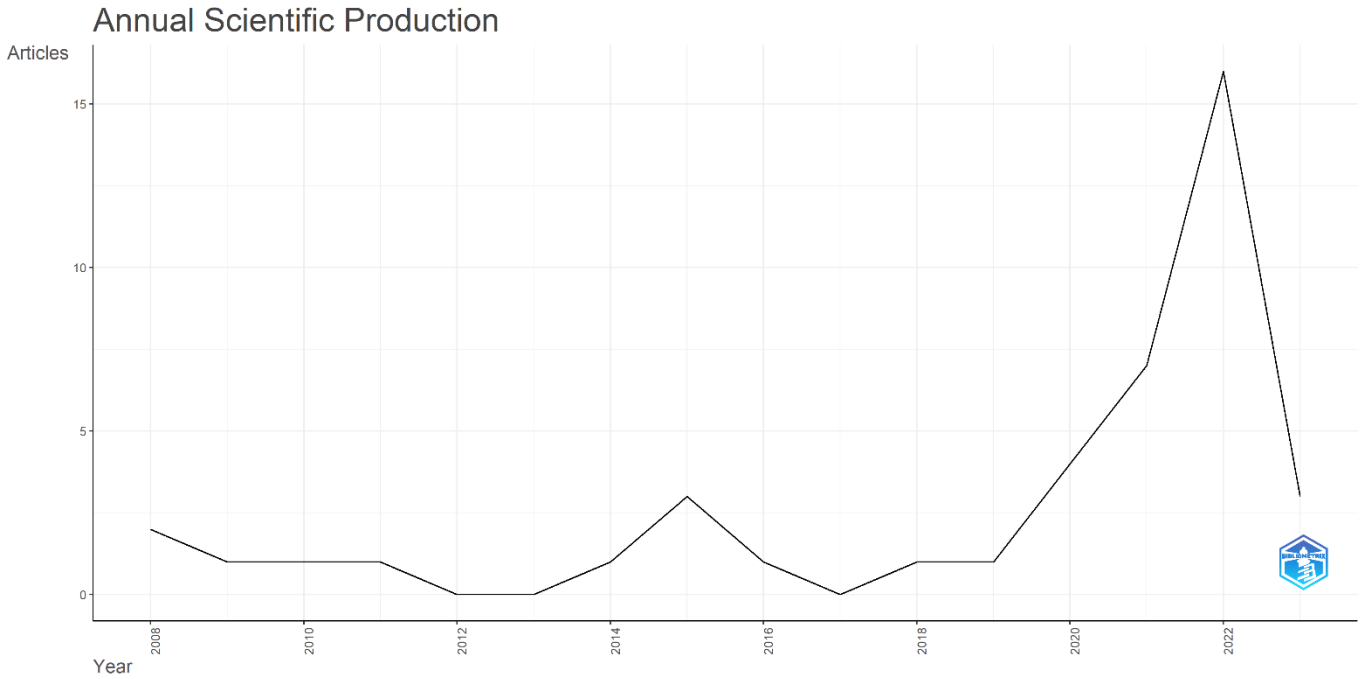

Figure 4. Annual Scientific Publication

Figure 4 illustrates the annual scientific publication process. According to the results illustrated by Rstudio software (Biblioshiny), the researcher can conclude that there is growing attention to

researching carbon-neutral tourism respectively from 2003-2023. In the initial stage, there was a slow upward slope, and after 2015, there was a steady increase in the attention paid to responsible tourism.

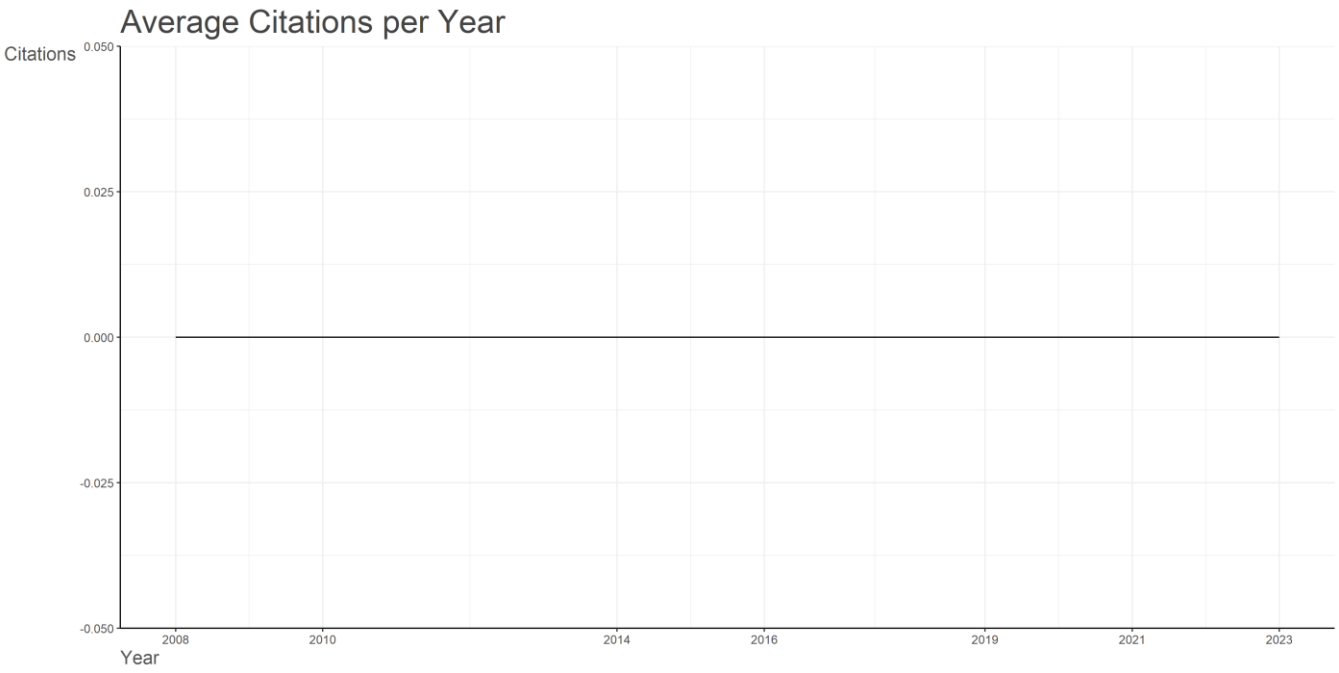

Figure 5. Average citation per year

According to the results illustrated by the R studio software, the average citation for carbon-neutral tourism-related articles is shown using a straight line.

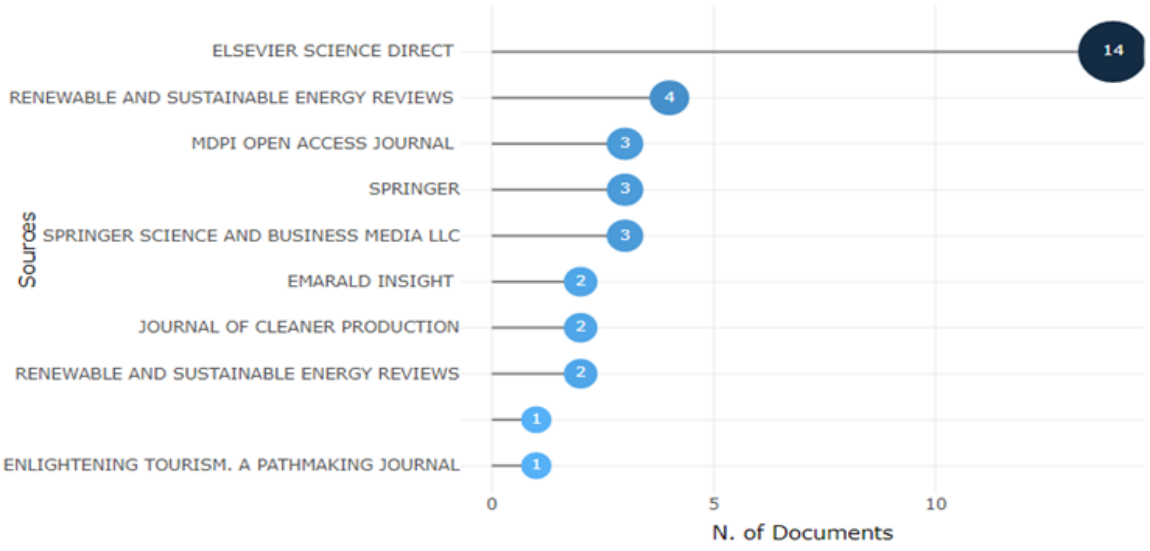

Figure 6. Most Relevant Sources

Figure 6 illustrates the most relevant sources of carbon-neutral tourism. Elsevier Science's direct publications in the Highest Level and Renewable and Sustainable Energy Reviews, MPDI Open Access Journal, and Springer are also relevant.

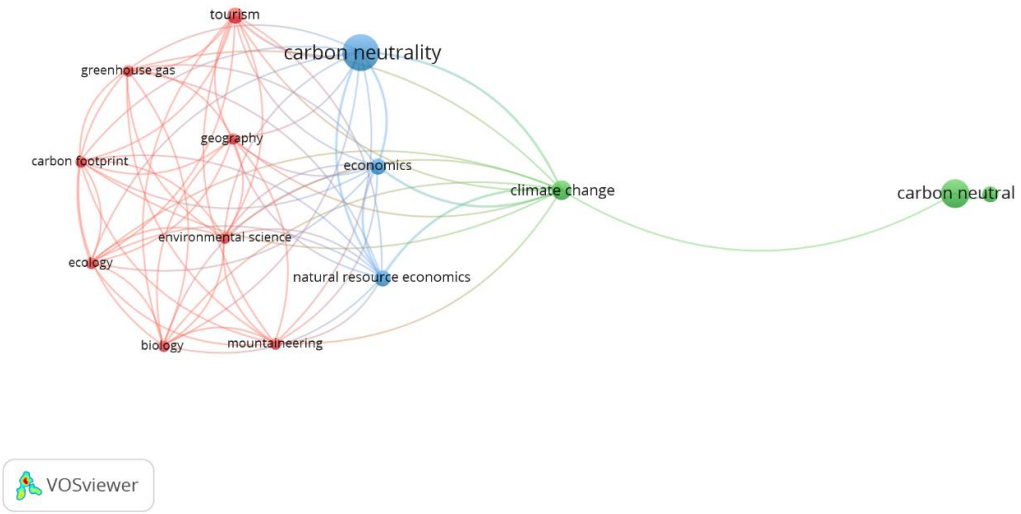

Figure 7. The keywords co-occurrence network visualization

The researcher used a co-citation network of 43 journal articles to demonstrate the network visualization. In network visualization, items are represented by their labels and, by default, by a circle. The weight of an item determines the size of the label and the circle surrounding it. The higher the weight of the term in the considered research, the greater the label and the circle. In contrast to this study's results, carbon neutrality has a stronger weight in this context. The cluster to which an item belongs determines the item's separate color. The links are represented by lines between terms. The red color appears in the voviwer output. Within this cluster are the terms of Tourism, Geography, environmental science, greenhouse gas, biology, mountaineering, and carbon footprint. Moreover, natural resource economics, economics, and carbon neutrality belong to another cluster with a blue color. Further, climate change and carbon-neutral belong to another cluster displaying green color. The keyword that appeared most frequently in the literature was carbon neutral.

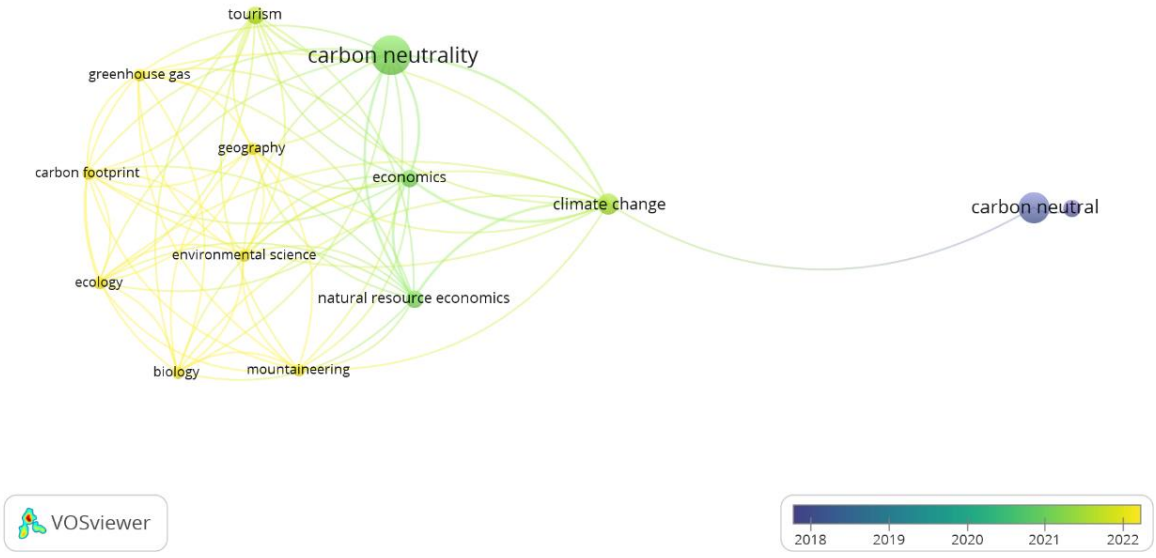

Figure 8. Overlay Visualization

In overlay visualization, the research components are colored differently. Where the colors range from blue (lowest score) to green (medium score) to yellow (highest score). In the bottom-right corner of the visualization, there is a color bar. This describes how the scores are assigned to colors. According to the Vosviwer output, blue color terms, such as carbon-neutral, have a high score from 2018 to 2020. Furthermore, from 2020 to 2021, there was a strong emphasis on carbon neutrality, economics, natural resource economics, and light attention on climate change, which is represented by the green color. From 2021 to the present, the new trend focuses on tourism, geography, greenhouse gases, environmental science, mountaineering, ecology, biology, and carbon footprint. Yellow emphasizes the aforementioned findings. Based on this, researchers can emphasize that society is now adhering to carbon neutrality over time.

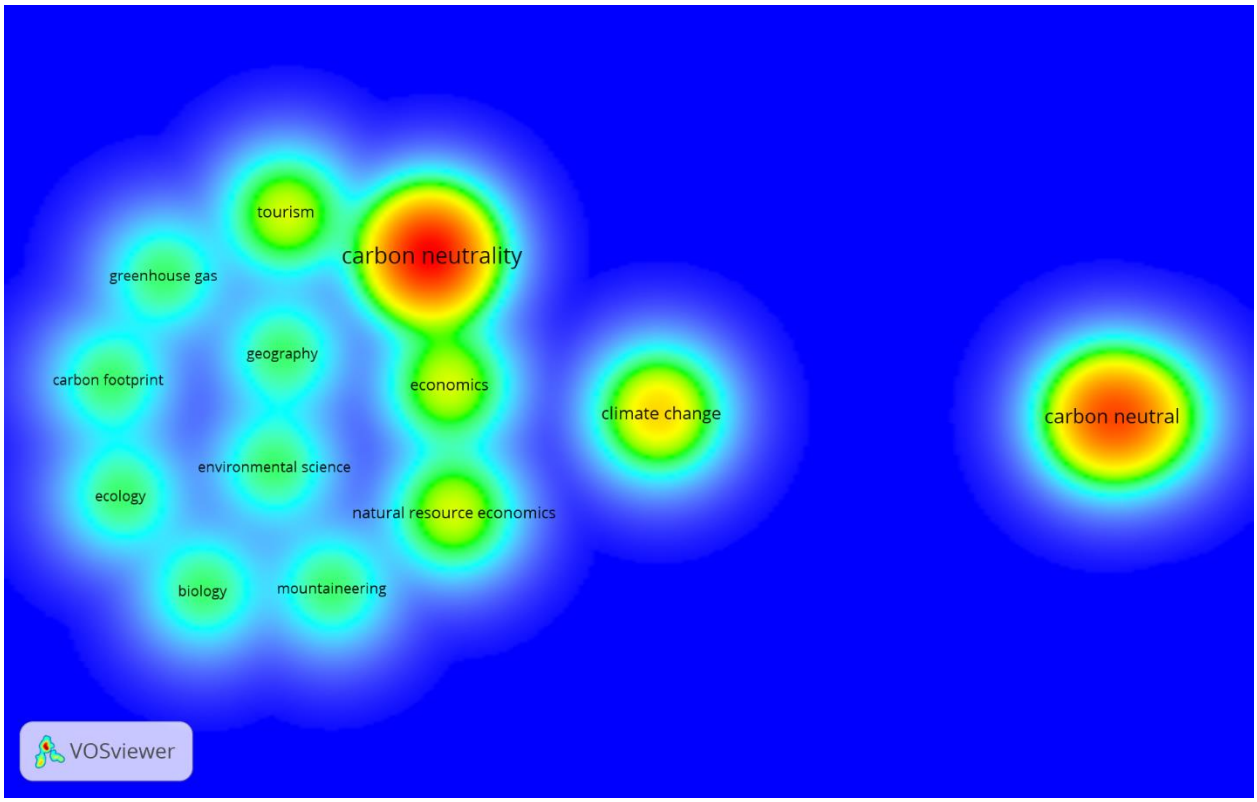

Figure 9. Density Visualization

In item density visualization, items are represented by different color codes. The colors ranged from blue to green to yellow. The greater the number of objects in a point's neighborhood and the greater the weights of nearby items, the closer the color of the point is to yellow. The opposite is true: the smaller the number of objects in a point's neighborhood and the lower the weights of the nearby items, the closer the color of the point is to blue. Carbon neutrality had the highest total bond strength.

5. Conclusion

This study contains an organized review of the literature on carbon-neutral tourism and how various countries are currently seeking to realize this concept, including or focusing on their tourism industries. However, bibliometric analysis that connects the carbon neutral and analytically and objectively identified emerging works, authors, and research groups has not been performed previously. The SLR, which aims to integrate research on carbon-neutral tourism practices published between 2005 and 2023, serves as the basis for the design of this study. It has emerged to identify the current knowledge concerning carbon-neutral tourism. We leveraged the Vos Viewer software and systematic reviews and meta-analysis (PRISMA) guidelines. Patterns discovered based on previous research. According to the output of RStudio software. Over the past decade, there has been an

increasing interest in research on carbon-neutral tourism and its carbon footprint. Hence, New tourism facilities planned, designed, and developed may be in line with the resulting Eco/zero-emission standard. Global industrialization and the over-exploitation of fossil fuels have resulted in the release of greenhouse gases, increasing global temperatures, and generating environmental problems. Therefore, reaching net zero carbon emissions is an urgent necessity (Xinyu Chen et al., 2021). Destination management companies can identify and introduce carbon-neutral destinations as an important new concept within the sustainable tourism paradigm, leading to significant reductions in greenhouse gas emissions. Furthermore, the review focuses on global activities, namely, laws or actions implemented by particular countries to attain net-zero carbon emissions.

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