9

Coral, Coal, and Cattle

Cumulative Impacts and the Great Barrier Reef

9.1 INTRODUCTION

Like other World Heritage–listed sites, superlatives feature prominently in official descriptions of Australia's Great Barrier Reef ("Reef"). The "outstanding universal values" of this, the world's "most extensive coral reef ecosystem," include both natural beauty, as "the most spectacular maritime scenery in the world" and "amazing" biodiversity as "one of the richest and most complex natural ecosystems on earth."[1] The Reef is also a vital part of Aboriginal and Torres Strait Islander Peoples' culture and heritage, with some seventy Traditional Owner groups having cultural authority in the Reef area.[2]

Since its World Heritage listing in 1981,[3] however, the Reef has experienced "a historical sequence of compounding pressures that are steadily escalating," involving polluted agricultural runoff, coastal development, the effects of climate change, and fishing.[4] Indeed, the Reef has become a flash point for the effects of climate change nationally and internationally. These cumulative impacts have triggered significant evolution in the Reef's "globally

[1] "Great Barrier Reef: Description" (*UNESCO*, n.d.) https://whc.unesco.org/en/list/154/, last accessed March 24, 2025.

[2] Great Barrier Reef Marine Park Authority, "Reef Traditional Owners" (2022) www2.gbrmpa.gov.au/learn/traditional-owners/reef-traditional-owners, archived at https://perma.cc/6VFS-TU79.

[3] World Heritage Committee, Decision 5 COM VIII.15, Report of the Fifth Session of the UNESCO World Heritage Committee, October 26–30, 1981, CC-81/CONF/003/6 (January 5, 1982) 5.

[4] Terry P. Hughes, Jon C. Day and Jon Brodie, "Securing the Future of the Great Barrier Reef" (2015) 5 *Nature Climate Change* 508–511, 509, 510.

iconic governance regime,"[5] administered jointly by Australia's national government (the "Commonwealth") and the adjoining state of Queensland (see Figure 1.2).

The Reef offers a critical case study of the problems and potential of key legal mechanisms for dealing with cumulative impacts. The problems are profound. The Reef is highly vulnerable to climate change.[6] Long-established legal silos divide the regulation of adverse effects along jurisdictional lines, and between impact types, such as water quality and climate change, and make it hard to see the big picture. But there is also potential: As World Heritage, the Reef has high political salience and the highest level of legal protection for ecosystems in Australia. Reef governance has produced a central strategic environmental assessment (SEA) – often argued to be the most appropriate way to assess and manage cumulative impacts.[7] It seems like one of the likeliest places to find successful regulation of cumulative impacts, at least for problems at this scale.

A decade on from the SEA, this chapter evaluates its legacy of influence on the regulatory landscape of mechanisms for undertaking two key functions that are critical to regulating cumulative environmental problems: producing information about cumulative impacts on the Reef and advancing regulatory intervention to address those impacts. These are two of the four key interlinking functions of the CIRCle Framework of functions that this book argues benefit from being based on formal rules to help address cumulative environmental problems.[8] This chapter shows how the SEA, an information tool, paved the way for regulatory interventions that are unlikely to have happened without it. Because there are so many diverse types of activities and impacts on the Reef, this chapter focuses on an important subset. It contrasts mechanisms that apply in relation to sediment pollution and climate change as contributed by two major sectors, cattle grazing and coal mining. This reveals the influence of the SEA on individual regulatory tool bundles that apply to these impacts. In addition, it shows the potential of the Reef SEA to integrate regulatory mechanisms between different types of impacts, and between the

[5] Tiffany H. Morrison, "Evolving Polycentric Governance of the Great Barrier Reef" (2017) 114 *Proceedings of the National Academy, USA* E3013–E3021, E3014.

[6] See generally, Terry P. Hughes and others, "Coral Reefs in the Anthropocene" (2017) 546 *Nature* 82–90.

[7] Morten Bidstrup, Lone Kørnøv and Maria Rosário Partidário, "Cumulative Effects in Strategic Environmental Assessment: The Influence of Plan Boundaries" (2016) 57 *Environmental Impact Assessment Review* 151–158, 151 (citing numerous studies that make this argument).

[8] See Section 2.4 for an introduction to the CIRCle Framework.

siloed cumulative environmental problems of climate change and the broader range of impacts to the Reef.

These forms of influence – integrating information and regulatory intervention, changing regulatory tool bundles, and forming links across regulatory silos – go beyond the common perception that SEA has a technical-informative role in assessing the impacts of a program at a point in time, often disconnected from decision-making.[9] Rather, this kind of influence aligns with a view of SEA as providing a strategic framework that influences decision-making broadly, even beyond the land use, development, and spatial planning contexts typically discussed in the international literature.[10]

Section 9.2 provides context, describing how coal mines and cattle grazing contribute to water and greenhouse pollution that impacts the Reef, and the challenges that arise in managing these cumulative impacts. Section 9.3 gives an overview of the regulatory landscape around the Reef SEA, and the scope of the SEA. Sections 9.4 and 9.5 analyze its influence on legal mechanisms dealing with the cumulative impacts of coal mining and cattle grazing from the perspective of information and intervention, respectively.

9.2 CONTEXT AND CHALLENGES

9.2.1 *Key Threats to the Reef: Climate Change and Water Pollution*

As I write, the Reef is undergoing its fifth mass coral bleaching event in a decade – an effect of stress caused by a marine heat wave.[11] The damage accumulates with harms from diverse other causes, from invasive species to water pollution to cyclones.[12] The health of the Reef has been a prominent issue in Australia, due at least in part to its implications for the Reef's significant tourism industry.[13]

[9] Victor Lobos and Maria Partidario, "Theory versus Practice in Strategic Environmental Assessment (SEA)" (2014) 48 *Environmental Impact Assessment Review* 34–46, 40, 45.

[10] See generally, Bram Noble and Kelechi Nwanekezie, "Conceptualizing Strategic Environmental Assessment: Principles, Approaches and Research Directions" (2017) 62 *Environmental Impact Assessment Review* 165–173.

[11] Great Barrier Reef Marine Park Authority (GBRMPA), *Aerial Surveys Confirm Widespread Bleaching across the Great Barrier Reef* (March 8, 2024) www2.gbrmpa.gov.au/news/aerial-surveys-confirm-widespread-bleaching-across-great-barrier-reef, archived at https://perma.cc/NFG3-5G25.

[12] GBRMPA, "Reef Snapshot: Summer 2022–2023" (2023) 4, https://hdl.handle.net/11017/4002.

[13] See GBRMPA, *Great Barrier Reef Region Strategic Assessment: Strategic Assessment Report* (GBRMPA 2014) 5-26 to 5-30, https://hdl.handle.net/11017/2861.

Climate change and fine sediment in catchment runoff ("sediment pollution") feature among the highest risk threats among the cumulative pressures on the Reef.[14] Climate change impacts are diverse: altered ocean currents affect the transport of coral eggs, more frequent and intense cyclones physically damage coral, ocean acidification compromises coral skeleton building, and higher sea temperatures cause heat stress and reduce available oxygen.[15] These effects are felt worldwide: Even if ambitious global targets of 1.5°C of global mean warming are met, over 90 percent of coral reefs are likely to be lost, increasing to 99.7 percent at 2.0°C.[16]

Sediment pollution reduces available light and affects how corals grow and reproduce, making it more difficult for them to recover from disturbances, and even smothering Reef organisms entirely.[17] Waterborne sediment increases turbidity, which also increases ocean temperatures and reduces oxygen levels for Reef organisms.[18]

These pressures have similarities and differences in the challenges they pose to regulating them as cumulative threats. They are similar in that legacies of greenhouse gases and sediment both continue to cause adverse effects for years after their emission.[19] This means that the benefits of contemporary interventions may take many years to be seen and addressing cumulative impacts means repairing historical damage. A key difference between these pressures is that while greenhouse gases emitted globally cause climate change that affects the Reef, sediment pollution is entirely sourced within Queensland's territory – from the thirty-five major river basins, together larger than the size of Japan,[20] which discharge to the Reef.

[14] Ibid 6–47 (with respect to impacts on coral habitats; noting that crown-of-thorns starfish and nutrients from catchment runoff also receive the same rating of "very high" effects). Note that risks from sediment were originally categorized as "catastrophic," later revised to "major": GBRMPA, *Great Barrier Reef Region Strategic Assessment: Supplementary Report* (2014) 70, https://hdl.handle.net/11017/2864.

[15] GBRMPA, *Reef Authority Strategic Assessment*, 6-10 to 6-15.

[16] Adele M. Dixon and others, "Future Loss of Local-Scale Thermal Refugia in Coral Reef Ecosystems" (2022) 1:e0000004 *PLOS Climate* 1–20, 5.

[17] GBRMPA, "Position Statement: Water Quality" (2020) https://hdl.handle.net/11017/3683; GBRMPA, *Reef Authority Strategic Assessment*, 6–22.

[18] Department of State Development Infrastructure and Planning (Queensland) (DSDIPQ), *Great Barrier Reef Coastal Zone Strategic Assessment Supplementary Report* (July 2014) 35, https://hdl.handle.net/11017/3166.

[19] GBRMPA, "Position Statement: Water Quality," 3 (citations omitted).

[20] Department of Environment and Science (Queensland) (DESQ), *Great Barrier Reef River Basins End-of-Basin Load Water Quality Objectives* (2019) 3, https://environment.des.qld.gov.au/__data/assets/pdf_file/0023/99320/gbr-river-basins-eob-load-wqos.pdf, archived at https://perma.cc/HVV5-J5UC.

Making the cumulative problem even more difficult, the pressures of climate change and sediment pollution interact. Climate change increases the likelihood of more intense rainfall events that cause soil erosion and sedimentation, making water quality management more challenging.[21] They also act together to exacerbate other effects: crown of thorns starfish, an invasive coral-eating species that also damages the Reef, benefits from turbid water and higher sea temperatures.[22]

9.2.2 *Coal and Cattle*

Cattle grazing and coal mining each emit greenhouse gas emissions that contribute to climate change and increase sediment in catchment runoff, which both affect the Reef. Both industries have characteristics that produce political, social, and economic challenges to intervention and concerns about regulatory burdens. Other agricultural enterprises, especially sugarcane growing, also contribute to water pollution via pesticides and nutrients[23] though those are not discussed further here.

As one of the world's largest exporters of coal,[24] Australian coal mines, most of which are in Queensland, contribute significantly to global greenhouse gas emissions.[25] They emit greenhouse pollution directly when the coal is mined, and indirectly, when it is burnt in Australia or overseas.[26] Mines contribute sediment-laden runoff to the Reef through earthworks and construction activities and rock blasting that result in dust deposition,[27] as well as a small amount of point-source pollution.[28] Multinational companies own most

[21] DESQ, *Reef 2050 Water Quality Improvement Plan 2017–2022* (2018) 14, www.reefplan.qld.gov.au/__data/assets/pdf_file/0017/46115/reef-2050-water-quality-improvement-plan-2017-22.pdf, archived at https://perma.cc/4VHM-TB4X ("*WQIP*").

[22] GBRMPA, *Great Barrier Reef Region Strategic Assessment: Supplementary Report*, 67.

[23] GBRMPA, "Position Statement: Water Quality," 2. See also n 40.

[24] Geoscience Australia, "Coal: Production," *Australia's Energy Commodity Resources 2023* (2023) www.ga.gov.au/digital-publication/aecr2023/coal, archived at https://perma.cc/42H2-TA7F.

[25] Jacqueline Peel, "The *Living Wonders* Case: A Backwards Step in Australian Climate Litigation on Coal Mines" (2024) 36 *Journal of Environmental Law* 125–132, 130.

[26] In relation to fugitive emissions, see Department of Climate Change, Energy, the Environment and Water (Australia) (DCCEEW), *Quarterly Update of Australia's National Greenhouse Gas Inventory: September 2024* (2025) 19–20, www.dcceew.gov.au/sites/default/files/documents/nggi-quarterly-update-september-2024.pdf, archived at https://perma.cc/493M-6VSJ.

[27] DSDIPQ, *Great Barrier Reef Coastal Zone Strategic Assessment Supplementary Report*, 35–37.

[28] DSDIPQ, *Great Barrier Reef Coastal Zone Strategic Assessment 2013: Strategic Assessment Report (Draft for Consultation)* (2013) 4-135, 5-165 to 5-166, https://hdl.handle.net/11017/3138.

Queensland coal mines,[29] and have recently earned "extraordinary revenue" due to high coal prices.[30] Coal mining also contributes significantly to state revenue and rural employment, which produces polarized political views about it in Australia.[31]

Australia is also among the world's largest beef exporters,[32] and cattle and calves are Queensland's largest agricultural export.[33] Queensland has Australia's largest cattle herd, with family-run operations dominating the industry.[34] Cattle grazing in northern Australia is large scale, with an average property size of 24,000 ha, and some properties over 1 million ha, but around half of grazing operations are not financially sustainable.[35] Sediment pollution of the Reef, which has more than quintupled since the 1850s, is driven largely by soil erosion associated with clearing native vegetation to establish pasture for grazing, and overgrazing.[36] Queensland has the highest rate of land clearing in Australia, and as of 2023, its rate of deforestation is significant worldwide.[37] Gully, streambank, and other forms of erosion caused by past land management practices continue

[29] Industry Queensland, "Coal Mines Qld" (n.d.) https://industryqld.com.au/coal-mines-qld/, archived at https://perma.cc/2TAP-F576.

[30] Queensland Treasury, *Queensland's Coal Industry and Long-Term Global Coal Demand* (2022) 9, https://s3.treasury.qld.gov.au/files/Queensland%E2%80%99s-Coal-Industry-and-Long-Term-Global-Coal-Demand_November-2022.pdf, archived at https://perma.cc/N4AQ-R5AF.

[31] See generally, Bruce Tranter and Kerry Foxwell-Norton, "Only in Queensland? Coal Mines and Voting in the 2019 Australian Federal Election" (2021) 7 *Environmental Sociology* 90–101.

[32] OECD and FAO, *Agricultural Outlook 2024–2033 Database* (2024), https://data-explorer.oecd.org (available under agricultural trade and markets, select all countries as "reference area," "beef and veal" as "commodity" and "exports" as "measure"), archived at https://perma.cc/87ZN-VWA9.

[33] Department of Agriculture and Fisheries (Queensland), "Primary Industries Data" (2025) www.daf.qld.gov.au/news-media/campaigns/data-farm/primary-industries, archived at https://perma.cc/7PNN-YYCT.

[34] Ernst & Young, *The Queensland Beef Supply Chain* (Queensland Department of Agriculture 2018) 13, www.publications.qld.gov.au/dataset/investment-outlook-for-the-queensland-beef-supply-chain, archived at https://perma.cc/63B2-ZVK5.

[35] Steven Bray and others, "Climate Clever Beef: Options to Improve Business Performance and Reduce Greenhouse Gas Emissions in Northern Australia" (2016) 38 *The Rangeland Journal* 207–218, 208.

[36] GBRMPA, *Reef Authority Strategic Assessment* 5-18 to 5-19 and 6-22; Fanny Douvere and Tim Badman, *Mission Report: Reactive Monitoring Mission to Great Barrier Reef (Australia), 6th to 14th March 2012* (UNESCO World Heritage Centre and IUCN June 2012) 26, https://whc.unesco.org/en/documents/117104.

[37] Environmental Defenders Office, *Analysis of Vegetation Management Regulatory Frameworks in Australia: WWF Trees Scorecard 2023: Evidence Collection* (July 2023) 117, www.edo.org.au/wp-content/uploads/2023/08/EDO-Report-Analysis-Vegetation-Management-Regulatory-Frameworks.pdf.

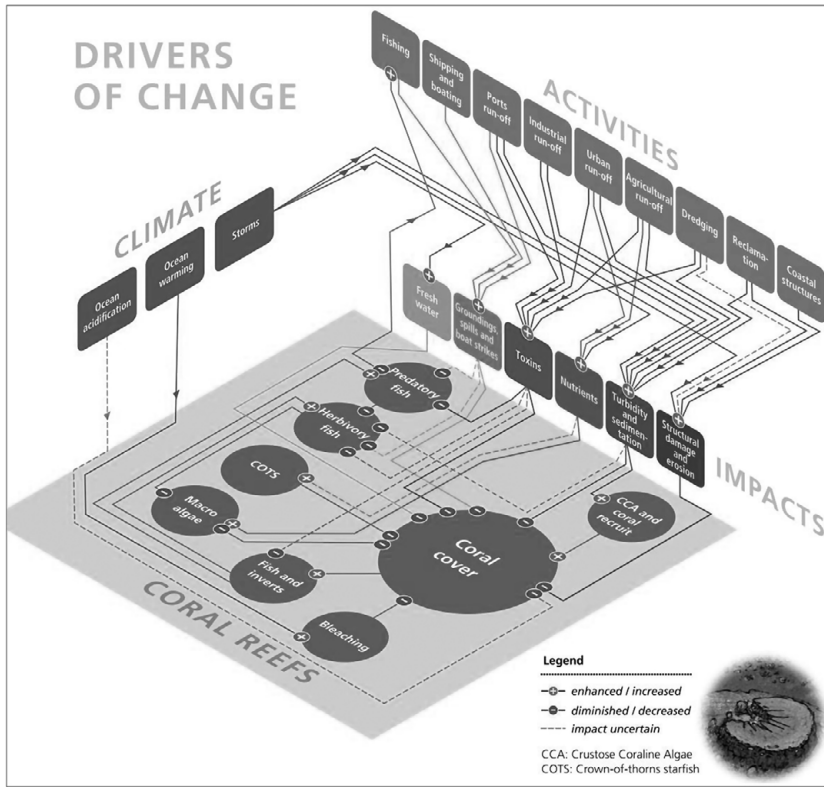

FIGURE 9.1 Qualitative model of cumulative impacts on coral, as assessed by the Reef SEA, omitting greenhouse gas emissions contributing to climate change
Source: © Commonwealth of Australia (GBRMPA, *Reef Authority Strategic Assessment*, 6–57), 2014

to contribute sediment to the Reef.[38] Cattle also contribute directly to greenhouse gas emissions through enteric fermentation and manure, and indirectly through other land management practices associated with cattle grazing, including savanna burning.[39]

Climate change and sediment pollution are an important subset of the pressures and impacts that accumulate to affect the Reef (Figure 9.1). Both cattle grazing and coal mining impact the Reef in other ways, and other activities and factors contribute to sediment pollution and climate change.[40]

[38] DSDIPQ, *GBR Coastal Zone Strategic Assessment Report*, 4-135.

[39] Bray and others, "Climate Clever Beef," 208. Note that when undertaken in specific ways, savanna burning is considered to reduce greenhouse gas emissions: see n 166 and accompanying text.

[40] E.g., waterborne nutrient pollution from sugarcane: see generally, Evan Hamman and Felicity Deane, "The Control of Nutrient Run-Off from Agricultural Areas: Insights into Governance from Australia's Sugarcane Industry and the Great Barrier Reef" (2018) 7 *Transnational Environmental Law* 451–468.

9.2.3 *Challenges: Information, Intervention, and Intersecting Problems*

Coal mines and cattle grazing, and their impacts, highlight the importance and challenges associated with two functions of regulation under the CIRCle Framework advanced by this book:[41] collecting, aggregating, and analyzing data and information about conditions of the Reef and threats to it; and intervening to change behavior to reduce cumulative harm. As shown by Chapters 5 and 6, respectively, diverse regulatory mechanisms can support these functions.

The large size of the Reef and its catchments, the dispersed nature of farming activities, and the difficulty of accessing parts of the Reef and its catchments and identifying species pose challenges in collecting data about its condition and relevant impacts.[42] It is also difficult to monitor sediment and greenhouse gas emissions and their effects, because they are diffuse (widely dispersed in space, rather than "point" sources) and because of legacy effects of past decades' and centuries' activities. So it is to gather information about regulatory interventions, compliance, and even government policies and programs in a complex regulatory landscape. Bringing all this information together when different laws address these issues is the overarching challenge. Section 9.4 takes up these information-related challenges.

Regulatory intervention is challenging when contributors to a cumulative environmental problem are politically or economically weighty, such as cattle grazing and coal mining, and known for a "culture of independence" and resentment of government restrictions.[43] In contrast to coal mining companies, graziers have more diverse financial positions and willingness to change practices.[44] This spotlights potential debates about approaches and strategies for intervention that reduce regulatory burden and increase social and political palatability, but that tend to reduce the reliability with which interventions pursue their objectives,[45] such as regulatory incentives ("carrots") and offset strategies. As discussed in Section 9.5, both carrots and

[41] See Section 2.4 for a brief description of the CIRCle Framework.

[42] E.g., A. J. Cheal and M. J. Emslie, *Supplementary Report to the Final Report of the Coral Reef Expert Group: S3. Synopsis of Current Coral Reef Monitoring on the Great Barrier Reef* (GBRMPA 2020) 18–19, https://hdl.handle.net/11017/3565 (hereafter "*Coral Monitoring Supplementary Report*").

[43] Neil Gunningham, Peter Grabosky and Darren Sinclair, *Smart Regulation: Designing Environmental Policy* (Clarendon Press, 1998) 289–290.

[44] Philippa England, "Leaders, Laggards and Blame Games: Responsive Regulation and Environmental Change in the Catchments of the GBR" (2021) unpublished manuscript, on file with author.

[45] Sections 6.2 to 6.4 of Chapter 6 ("Intervention") characterize different regulatory approaches and strategies in view of these aspects.

offsets appear in the regulatory landscape for the Reef. The diversity among graziers also raises questions about the fairness of the burdens imposed on different contributors across types of cumulative impact.[46]

A larger intervention-related challenge emerges in the intersection of two cumulative environmental problems. On one hand lies the aggregation of multiple types of impacts, including sediment pollution and climate change, on the Reef; and on the other hand is the cumulative impact of multiple types of activities that produce greenhouse gas emissions on the climate. This raises the challenge of dealing with greenhouse-polluting activities at the intersection of these problems: How might regulatory actors intervene in relation to activities undertaken in Queensland that produce greenhouse gases in the context of cumulative impacts on the Reef, given that others outside the jurisdiction and outside its control also contribute to this problem? Section 9.4 takes up these intervention-related challenges.

By contrast, the other two functions of regulation under the CIRCle Framework – conceptualization and coordination – are relatively less problematic in the Reef context, though not entirely straightforward. Conceptualizing the Reef as a matter of concern for regulatory purposes is largely settled due to its World Heritage listing, though some aspects are still variably implemented and contested.[47] Significant initiatives have developed a long-term vision for the Reef, expressing desired future conditions – a key component of conceptualization.[48] Similarly, while regulating pressures on the Reef is a multilevel governmental exercise, as discussed in Section 9.3, responsibilities and formal coordination structures are well studied[49] and well established, the product of a tumultuous history of federal-state conflict over the Reef.[50] Indeed, current approaches to regulating cumulative impacts on the Reef evolved significantly as a result of international action that coalesced in a multilevel (state/national) SEA, discussed next.

[46] England, "Leaders, Laggards and Blame Games."

[47] E.g., Douvere and Badman, *Mission Report: Reactive Monitoring Mission*, 35–36 (variable attention to outstanding universal values, as opposed to values generally). For a discussion on conceptualizing the matter of concern, see Chapter 4.

[48] See generally, Australian Government and Queensland Government, *Reef 2050 Long-Term Sustainability Plan 2021–2025* (2021) www.dcceew.gov.au/parks-heritage/great-barrier-reef/publications/reef-2050-long-term-sustainability-plan-2021-25, archived at https://perma.cc/8DWU-Y6YY. See Chapter 4 (Conceptualization).

[49] See, e.g., Pedro Fidelman and others, "Regulatory Implications of Coral Reef Restoration and Adaptation under a Changing Climate" (2019) 100 *Environmental Science and Policy* 221–229, 223; Morrison, "Evolving Polycentric Governance."

[50] For an overview of the early history, see Lorne K. Kriwoken, "Great Barrier Reef Marine Park: Intergovernmental Relations" (1991) 15 *Marine Policy* 349–362.

9.3 OVERVIEW OF THE REGULATORY LANDSCAPE AND THE REEF SEA

This section sets the scene for analyzing regulatory functions related to information and intervention and how the SEA influenced them. It explains how Australia distributes regulatory responsibility for environmental matters between states and the Commonwealth (Section 9.3.1), how international attention drove the Reef SEA that was developed cooperatively[51] between both levels (Section 9.3.2), and how the Reef SEA was scoped (Section 9.3.3).

9.3.1 *Setting the Scene: Regulatory Responsibilities and International Influence*

As a constitutional and practical matter, cumulative impacts on the Reef have long been managed by different levels of government, with overarching coordination. Australian states are primarily responsible for environmental matters, including pollution and land use planning; the federal Parliament may legislate to implement international treaties signed by the government.[52] These include the Climate Change Convention[53] and the World Heritage Convention,[54] which provides for listing and protecting areas that are "the priceless and irreplaceable assets, not only of each nation, but of humanity as a whole."[55] This international link grants the Commonwealth Parliament powers to regulate activities on the Reef itself (e.g., fishing, tourism), projects

[51] While regulatory mechanisms for coordination lie outside the scope of this chapter, note that the Reef SEA triggered extensive coordination mechanisms: Australian Government and Queensland Government, *Reef 2050 Long-Term Sustainability Plan* (Australian Government 2015) 49–50, https://hdl.handle.net/11017/2934; Australian National Audit Office, *Reef Trust – Design and Implementation* (2016) 32, www.anao.gov.au/sites/default/files/ANAO_Report_2016-2017_27.pdf, archived at https://perma.cc/H2MB-4JDY.

[52] For a discussion of the development of Australian federal and state legislative responsibilities in relation to the environment in the context of cumulative impact concerns, see Rebecca Nelson, "Breaking Backs and Boiling Frogs: Warnings from a Dialogue between Federal Water Law and Environmental Law" (2019) 42 *University of New South Wales Law Journal* 1179–1214, 1186–1191.

[53] United Nations Framework Convention on Climate Change (adopted May 9, 1992, entered into force March 21, 1994) 1771 U.N.T.S. 107. Note that while other treaties ratified by Australia are also relevant to the Great Barrier Reef, they are not discussed here for reasons of brevity and because they are less directly influential.

[54] Convention Concerning the Protection of the World Cultural and Natural Heritage (adopted November 16, 1972, Paris, entered into force December 17, 1975) 1037 U.N.T.S. 151.

[55] UNESCO, *Operational Guidelines for the Implementation of the World Heritage Convention* (WHC.21/01 edn, UNESCO 2021) 11. For a practical description of the operation of the World Heritage Convention, see ibid.

that may affect it, and climate change, while Queensland regulates land use and pollution produced in the Reef's catchments. The Commonwealth and Queensland governments coordinate under an intergovernmental agreement that expressly recognizes that climate change and catchment-sourced water pollution harm the Reef.[56]

In 2009, an international information mechanism jolted this system of shared responsibility, ultimately producing a key overarching legal mechanism for managing cumulative effects: the Reef SEA. The World Heritage Committee learned that – contrary to international guidelines[57] – Australia had failed to notify it that a large liquefied natural gas plant was being constructed on Curtis Island, inside the Reef World Heritage area.[58] This triggered formal discussions and a "reactive monitoring mission," both of which emphasized threats from diffuse water quality impacts, climate change, and cumulative impacts. The Committee urged Australia to undertake a strategic assessment of the Reef to formulate a long-term sustainability plan[59] and a framework for assessing development proposals in a way that considered cumulative impacts.[60]

The Committee backed these exhortations with indications it might list the Reef as "World Heritage in danger," a threat that continues even now.[61] Since such a listing would undermine tourism and damage Australia's international reputation, the threat worked to focus bureaucratic minds on the problem. Scholars consider that the SEA would likely never have happened without the Committee's request.[62] The Committee's involvement made mandating

[56] DSDIPQ, *Great Barrier Reef Coastal Zone Strategic Assessment: Program Report* (2014) 16, https://hdl.handle.net/11017/3165.

[57] UNESCO, *Operational Guidelines* [172].

[58] This omission was apparently caused by jurisdictional confusion about the boundaries of the WHA: Evan Vaughan Hamman, "The Role of Non-State Actors in Promoting Compliance with the World Heritage Convention: An Empirical Study of Australia's Great Barrier Reef" (Thesis, Doctor of Philosophy, Queensland University of Technology 2017) 35–36.

[59] World Heritage Committee, Decision 35 COM 7b.10 Great Barrier Reef (Australia) (N 154), Decisions Adopted by the World Heritage Committee at Its 35th Session, June 29–29, 2011, WHC-11/35COM/20 (July 7, 2011) 55; Douvere and Badman, *Mission Report: Reactive Monitoring Mission*, 7–8, 17–20, 23, 26, 31, 32, 45, 47, 49, 50 (esp. recommendations 2, 4, 7, 8). For a fuller description of the Reef SEA, see generally, Evan Hamman, Karen Vella and Umberto Baresi, "Cumulative Impacts and Strategic Environmental Assessment: Policy Development for Australia's Great Barrier Reef" in Jill A. E. Blakley and Daniel M. Franks (eds), *Handbook of Cumulative Impact Assessment* (Edward Elgar 2021) 123–139.

[60] Douvere and Badman, *Mission Report: Reactive Monitoring Mission*, 6–7 (recommendation 5).

[61] World Heritage Committee, "Great Barrier Reef (Australia) (N 154)" in UNESCO (ed), *State of Conservation of Properties Inscribed on the World Heritage List, WHC/24/46com/7badd* (2024) 59–64.

[62] Hamman, Vella and Baresi, "Cumulative Impacts and Strategic Environmental Assessment," 135.

agricultural pollution interventions "politically palatable,"[63] illustrating how involving more regulatory actors can change feasible interventions to address cumulative impacts.[64] The resulting assessment (2014) and its associated plans and policies (2015–2018) (together, the "Reef SEA") became the overarching mechanism for dealing with cumulative impacts on the Reef.

9.3.2 *Framework for the Reef SEA*

The Reef SEA was undertaken under discretionary provisions of Australia's national environmental legislation[65] that are used relatively rarely. These provisions are often criticized as too narrow, or merely a vehicle for bulk approval of projects.[66] Usefully, though, they can offer a two-part structure that directly links assessment (information) and regulatory intervention. The first component, a "strategic assessment report," is an information-focused assessment of environmental matters and the effectiveness of management arrangements. The second component is a "program report" that proposes improved management arrangements, possibly including mechanisms for information and intervention. The Commonwealth Environment Minister considers the program report for endorsement, which indicates that it adequately addresses impacts on relevant nationally protected matters (here, World Heritage values).[67] This raises the expectation that the formal commitments in the program, for example, information and intervention initiatives, are needed to address impacts on federally protected matters. While the program may not directly legally bind governments, arrangements that deviate significantly from it would raise the possibility of contravening federal legal protections.

While the Reef SEA is also not directly legally binding on coal or cattle proponents, it raised the potential to influence their activities in two ways: first, by connecting information about their impacts to existing laws that apply to their activities, changing how these laws are implemented; and, second, by

[63] Rowena Maguire, Evan Hamman and Justine Bell-James, *Environmental Planning and Climate Law in Queensland* (LexisNexis Butterworths 2020) 155, 230.

[64] See Section 2.2.4.1.

[65] Environment Protection and Biodiversity Conservation Act 1999 (Australia) pt 10 ("EPBC Act").

[66] This requires approving actions undertaken in accordance with an endorsed program, which is not what occurred here: ibid s 146B. See, e.g., Simon Marsden, "A Critique of Australian Law Reform for Strategic Environmental Assessment" (2013) 32 *University of Tasmania Law Review* 276, 280–281. For a recent summary of critiques of national SEA in Australia, see Tanya Burdett and Carolyn Cameron, "Strategic Environmental Assessment in Australia" in Thomas B. Fischer and Ainhoa González (eds), *Handbook on Strategic Environmental Assessment* (Edward Elgar 2021) 284–304, 292–294.

[67] EPBC Act s 146(2)(f).

triggering the formulation and adaptation of new and existing regulatory interventions, respectively, diversifying the regulatory mix. The degree to which the Reef SEA regime fulfilled this theoretical potential was influenced significantly by how it was scoped, discussed next.

9.3.3 *Scope of the Reef SEA*

The scope of a SEA in terms of sectors, space, and time, critically affects its analysis of cumulative impacts.[68] In this case, narrow and ambiguous language hampered the Reef SEA's potential comprehensively to gather information and influence regulatory interventions in relation to climate change and water pollution. This ultimately constrained its ability to connect the intersecting cumulative environmental problems of impacts on the Reef and climate change generally.

Without legislative criteria for adequacy, or detailed guidance from the World Heritage Committee,[69] formal terms of reference set the scope of the Reef SEA. Reflecting jurisdictional responsibilities, the Reef SEA was split in two. A Commonwealth agency, the Great Barrier Reef Marine Park Authority ("Reef Authority"), was to assess marine areas, with discretion to include other places if the Reef was "affected by actions in those places."[70] The Reef Authority was to assess (among other things) Reef conditions, cumulative impacts and "the likely impacts of climate change," and the effectiveness of management arrangements, including to "adapt to reasonable climate change scenarios."[71] But it was only to cover "management arrangements within the Authority's jurisdiction" and work jointly with Queensland in relation to water quality.[72] Queensland, on the other hand, was to assess "threats from both within and outside the strategic assessment area"[73] and the effectiveness of its management, planning and development framework in a 5-km wide, 2,300-km-long coastal strip, and catchment areas "to the extent that water quality management arrangements apply."[74]

[68] See generally, Bidstrup, Kørnøv and Partidário, "Cumulative Effects in Strategic Environmental Assessment."

[69] Hamman, Vella and Baresi, "Cumulative Impacts and Strategic Environmental Assessment," 132.

[70] GBRMPA, *Great Barrier Reef Region Strategic Assessment: Terms of Reference* (GBRMPA 2012) 1, 2, https://hdl.handle.net/11017/2859.

[71] Ibid 6, 7.

[72] Ibid 1, 2.

[73] Queensland Government, *Great Barrier Reef Coastal Zone Strategic Assessment: Background and Final Terms of Reference* (2012) 7, www.statedevelopment.qld.gov.au/__data/assets/pdf_file/0012/11316/great-barrier-tor.pdf, archived at https://perma.cc/2PZT-9FMD.

[74] Ibid 1–2.

The SEA terms of reference included catchment-sourced water pollution and adapting to climate change, but excluded climate mitigation. The Queensland government, which grants coal mining leases and associated environmental approvals,[75] assessed the impacts of mining that "directly affect the GBR coastal zone," including water quality impacts, but considered that "climate change cannot be addressed by the Program due to its global nature."[76] Commonwealth-level climate change regulators were not involved in the Reef SEA and the Reef Authority emphasized its lack of relevant "jurisdictional responsibility," and only briefly noted its potential role in advising other agencies about climate change mitigation.[77] Omitting climate mitigation caused public concern, especially given Queensland's fossil fuel sector.[78] Nevertheless, the impacts of climate change on the Reef were seen solely as a matter of adaptation.

9.4 REGULATORY MECHANISMS FOR INFORMATION AND THE REEF SEA

The mere fact that the Reef SEA provides information about the Reef's condition and threats does not break new ground. Rather, its function as an information mechanism is important because, together, the strategic assessment reports and program reports formalize nonstatutory information initiatives and expand them. Crucially, for cumulative environmental problems, they also bring information together and link it to intervention, incorporating design features that address challenges related to cost, sustainability, and legitimacy. These are key challenges for cumulative environmental problems generally.[79] After briefly reviewing historical arrangements for information about water quality and climate change, this section analyzes, in turn, how the strategic assessment reports and the program reports played an important information function in the context of impacts on the Reef as a cumulative environmental problem.

[75] Rebecca Nelson, "Regulating Hidden Risks to Conservation Lands in Resource Rich Areas" (2021) 40 *University of Queensland Law Journal* 491–530, 504–514.

[76] DSDIPQ, *GBR Coastal Zone Strategic Assessment Report*, 5-153.

[77] GBRMPA, *Reef Authority Strategic Assessment*, 8-15 to 8-16. Recent developments suggest the Reef Authority may act creatively on this front: see nn 168–172 and accompanying text.

[78] DSDIPQ, *Great Barrier Reef Coastal Zone Strategic Assessment Supplementary Report*, 144–145, 150–151.

[79] See Chapter 2.

Recall Chapter 5 (Information)

Key design features of regulatory mechanisms for information to address cumulative environmental problems include providing for gathering and sharing data and information from multiple government and nongovernment actors in a way that: **comprehensively** deals with conditions of the matter of concern (here, the Reef) over time and all important activities and impacts that contribute to the cumulative environmental problem; is **high quality**; is **easily shareable and interoperable; and manages cost**.

9.4.1 *A History of Regulating for Information*

Regulatory mechanisms for scientific expertise and information have long been central to Reef governance, beginning with the first Marine Park statute (1975) and intergovernmental agreement (1979),[80] the current version of which commits to coordinated monitoring of impacts on the Reef.[81] Since 2007, the Reef Authority has been required by statute to produce a five-yearly Reef "Outlook Report" that assesses the health and resilience of the Reef, risks to it, and measures to protect and manage it.[82] It expressly addresses indicators of water pollution and climate change threats.[83]

Numerous less formal, nonstatutory information programs have also arisen over time. Notably, since 2009, a nonstatutory annual Reef Report Card has tracked progress to water quality targets using a "Paddock to Reef" monitoring program.[84] The program assesses the adoption and effectiveness of management interventions, and both catchment and marine conditions.[85] It both

[80] Great Barrier Reef Marine Park Act 1975 (Australia) (as made) s 10(5); "Great Barrier Reef (Intergovernmental Agreement, Queensland and Commonwealth of Australia)" (1979) s 6 https://hdl.handle.net/11017/3367.

[81] "Great Barrier Reef (Intergovernmental Agreement, Commonwealth of Australia and Queensland)" (2009) 5, Sch D https://hdl.handle.net/11017/984.

[82] Great Barrier Reef Marine Park Act 1975 (Australia) s 54, introduced by Great Barrier Reef Marine Park Amendment Act 2007 (Australia) s 32.

[83] GBRMPA, *Great Barrier Reef Outlook Report 2019* (GBRMPA 2019) 161–167, 171–182, https://hdl.handle.net/11017/3474.

[84] DESQ, *WQIP*, 53; Department of Environment Science and Innovation (Queensland), "Reef Report Cards" (n.d.) www.reefplan.qld.gov.au/tracking-progress/reef-report-card, last accessed March 22, 2025, archived at https://perma.cc/69LA-NYA6.

[85] Jane Waterhouse, *Paddock to Reef Integrated Monitoring, Modelling and Reporting Program: Program Design 2018–2022* (Office of the Great Barrier Reef (Queensland) n.d.) 13–14, www.reefplan.qld.gov.au/__data/assets/pdf_file/0026/47249/paddock-to-reef-program-design.pdf, archived at https://perma.cc/6L9L-94ZM.

monitors and models pollution, since rivers have high flow variability and up to fifty-year time lags separate catchment interventions and monitorable changes to pollution.[86]

9.4.2 *The Reef SEA: Entrenching, Expanding, and Integrating Information Initiatives*

In line with their terms of reference, the strategic assessment reports used these existing and other sources to gather and assess information about the impacts on the Reef of climate change,[87] catchment-sourced sediment pollution,[88] other impacts, and cumulative impacts.[89] The cumulative impact assessment produced "cumulative exposure" maps showing how different areas of the Reef are exposed to multiple water quality impacts (sediment and other pollutants) and multiple key impacts (e.g., elevated temperatures, freshwater inflow, etc).[90] These are conceptually similar to California's cumulative environmental justice maps, discussed in the previous case study. These maps aggregate multiple sources of demographic and environmental risk experienced by human populations, and are used in California to prioritize some regulatory interventions.[91] The strategic assessment reports also noted key knowledge gaps regarding cumulative impact assessment, including relationships between the Great Barrier Reef (GBR) catchments and coastal zone.[92]

The endorsed program reports committed to ongoing information initiatives and linked them to planning future management. This provided for enduring influence in relation to information, thus addressing a frequent criticism of SEA as often limited to a "point in time" assessment.[93] The endorsed programs entrench and expand existing water quality monitoring through an expanded Paddock to Reef program intended to inform adaptive management of water quality interventions,[94] and introduce regular reporting of climate change indicators.[95]

[86] Ibid 9.
[87] GBRMPA, *Reef Authority Strategic Assessment*, 5-4 to 5-8, 6-10 to 6-15.
[88] Ibid 5-18 to 5-19 and 6-22.
[89] Ibid 6-55 to 6-67.
[90] Ibid 6-58 to 6-65.
[91] See Table 6.5, row 1.
[92] DSDIPQ, *GBR Coastal Zone Strategic Assessment Report*, 5-192.
[93] See n 9 and accompanying text.
[94] DESQ, *WQIP*, 52; Department of State Development Infrastructure and Planning (Queensland), *Great Barrier Reef Coastal Program Report*, 77.
[95] GBRMPA, *Great Barrier Reef Region Strategic Assessment: Supplementary Report*, 129.

The program reports also commit to a new integrated platform that reflects a cumulative impacts mindset of aggregating interoperable information.[96] A consolidated "Reef 2050 Integrated Monitoring and Reporting Program" (RIMReP) aims to integrate Reef-related monitoring undertaken by governments and other organizations,[97] including data on catchments, water quality, and climate indicators.[98] The RIMReP aims to provide interoperable data to guide management actions, including to understand the cumulative impact of pressures and interventions.[99]

RIMReP generally aligns well with a cumulative impact approach, but an important omission relating to activity-level information about impacts mars its comprehensiveness. There is no apparent link to government- or proponent-sourced data on the project-level (as opposed to catchment-level) impacts of regulated activities, for example, from environmental impact statements and compliance programs. This mirrors long-running criticism that Australia's national environmental law does not support aggregating environmental data produced by project proponents.[100] A Cumulative Impacts Policy linked to the SEA simply advises decision-makers to hold information about "current and reasonably foreseeable projects" to "allow stakeholders to accurately assess other sources."[101] Relatedly, Reef information programs apparently do not integrate data on compliance and enforcement of relevant activities, which might have been linked to a requirement to adapt interventions or their implementation. These are striking omissions given a history of concern about widespread noncompliance and minimal enforcement of

[96] See Sections 5.3.1 and 5.3.3.

[97] Australian Government and Queensland Government, *Reef 2050 Long-Term Sustainability Plan*, 65–66.

[98] James Udy, *Identifying Management Needs: Informing the Program Design of the Reef 2050 Integrated Monitoring and Reporting Program* (GBRMPA 2018) 11, 12, https://hdl.handle.net/11017/3426; GBRMPA, *Great Barrier Reef Region Strategic Assessment: Supplementary Report*, 129. Also see generally Australian Government and Queensland Government, *Reef 2050 Integrated Monitoring and Reporting Program Business Strategy 2020–25* (GBRMPA 2022) https://hdl.handle.net/11017/3918.

[99] Udy, *Identifying Management Needs: Program Design of RIMREP*, 11, 12. Also see generally, Australian Government and Queensland Government, *RIMREP Business Strategy*.

[100] House of Representatives Standing Committee on the Environment (Australia), *Streamlining Environmental Legislation: Inquiry into Streamlining Environmental Regulation, "Green Tape," and One Stop Shops* (2014) 79–81, www.aph.gov.au/Parliamentary_Business/Committees/House/Environment/Green_Tape/Report, archived at https://perma.cc/9SMM-UA2Z.

[101] GBRMPA, *Reef 2050 Plan: Cumulative Impact Management Policy* (GBRMPA 2018) 35, https://hdl.handle.net/11017/3389.

agricultural water quality requirements,[102] and about the transparency of compliance and monitoring data for mining projects.[103]

Information aspects of the SEA also demonstrate design features that address challenges related to cost and legitimacy of information.[104] Information initiatives manage the costs of monitoring in a large and challenging environment by including technologically driven approaches such as remotely sensed data.[105] RIMReP both manages cost and buttresses its legitimacy by including data from nongovernment sources, including the preexisting citizen science "Eye on the Reef" programs for assessing Reef conditions.[106] Formally requiring an independent review of the Reef SEA[107] also supports legitimacy, and mirrors statutory requirements of the Outlook report[108] and previous use of independent scientific "consensus statements" on water pollution, which have driven new interventions.[109] Independent reviewers complimented the reports' technical accuracy, but criticized proposed management of water quality and climate change issues as unlikely to be effective.[110]

Without more, gathering and sharing data and information about cumulative impacts simply shines a brighter light on decline: It is the regulatory links between information and intervention that enable information to influence cumulative impacts. The Reef SEA shows several types of these regulatory links in a way that seems relatively uncommon. The Reef SEA itself was spurred by an international regulatory mechanism for informing the World Heritage Committee about a major project on the Reef.[111] The endorsed program committed to an overarching "outcomes-based framework"[112] – the *Reef 2050 Long-Term Sustainability Plan* ("Reef 2050 Plan") – for improving the Reef to meet targets that would be "monitored, reported and adapted over time," fed by the program's information

[102] Evan Hamman and others, "Regulating Land Use in the Catchment of the Great Barrier Reef" (2022) 115:106001 *Land Use Policy* 1–15, 9.
[103] Productivity Commission (Australia), *Resources Sector Regulation* (2020) 202–205, www.pc.gov.au/inquiries/completed/resources/report/resources.pdf, arhived at https://perma.cc/9Q7C-32YL.
[104] See Section 5.3.
[105] Udy, *Identifying Management Needs: Program Design of RIMREP*, 19–22.
[106] Cheal and Emslie, *Coral Monitoring Supplementary Report*, 22–23.
[107] GBRMPA, *Great Barrier Reef Region Strategic Assessment: Terms of Reference*, 4.
[108] Great Barrier Reef Marine Park Act 1975 (Australia) s 54(4).
[109] Hamman and others, "Regulating Land Use," 9.
[110] GBRMPA, *Great Barrier Reef Region Strategic Assessment: Supplementary Report*, 11.
[111] See notes 57 to 60 and accompanying text.
[112] DSDIPQ, *Reef Coastal Program Report*, 74.

initiatives and revised every five years. The Reef 2050 Plan planned to deliver these targets in part by influencing other laws and management arrangements, facilitated by a policy to guide decision-makers on how to consider the Plan in "relevant decision making", and an initiative to collect information *about* intervention using a register of management plans.[113] As already discussed, though, information from project-level assessments and compliance and enforcement were blind spots. Now, a decade on from these commitments and aspirations, we can assess how these pathways for informing intervention have turned information into regulatory action.

9.5 REGULATORY MECHANISMS FOR INTERVENTION AND THE REEF SEA

This section analyzes how the Reef SEA influenced rules for interventions to address cumulative impacts on the Reef of greenhouse and sediment pollution from coal mining and cattle grazing. It shows that the Reef SEA increased the comprehensiveness of the overall regulatory regime – an important regulatory design feature for cumulative environmental problems.[114] It influenced and adapted existing water quality interventions and also drove the introduction of new interventions related to water quality. The Reef SEA also enhanced the diversity of regulatory approaches and strategies used in interventions (see text box).[115] Greenhouse gas emissions, though, lay beyond its reach. Australian climate law has advanced significantly since the Reef SEA, but it remains disconnected from the Reef context, with just a hint that this may change. This shows the barriers to SEA connecting decision-making across regulatory silos, and between intersecting local and global cumulative environmental problems,[116] especially in an unfavorable political context.

[113] Australian Government and Queensland Government, *Reef 2050 Long-Term Sustainability Plan*, 53 (action GA7).

[114] See Section 6.5.2.

[115] A single intervention may pursue multiple approaches or strategies (e.g., a "stick" mandate to obtain an environmental approval, which may have conditions attached to both reduce and offset harm; or an extension program [sermon] that uses incentives [carrot] to increase participation). A legally binding mechanism is categorized as only harm-reducing unless there is specific mention of offsetting or adapting in legislation, regulation or associated policy.

[116] See Section 9.2.3.

Recall from Chapter 6: Intervention

Key design features of regulatory mechanisms for intervention to address cumulative environmental problems include connecting decision-making about impacts that accumulate, intervening comprehensively across impact types and activities, intervening adaptively, and using diverse *regulatory approaches* and *strategies*. Regarding **regulatory approaches**, *sticks* refer to mandates about the carrying out of an activity that causes harm; *carrots* influence an activity through incentives and disincentives that apply to an activity in the absence of a mandate (e.g., a monetary incentive or tax); *sermons* influence the activity using information; and *state rescue* involves the state directly addressing harm rather than trying to change the behavior of contributors to the harm. Regarding **regulatory strategies**, *harm reducing* means changing an activity so that it causes less harm; *harm offsetting* means undertaking a second beneficial activity to counteract the negative effects of a first activity; *restoring* means undertaking a beneficial activity to counteract legacy harms that may have been caused by others; and *coping* refers to facilitating the matter of concern (here, the Reef) adapting to impacts so that harm decreases, even if impacts do not.

Table 9.1 summarizes the influences of the Reef SEA on national- and state-level regulatory interventions dealing with coal mining and cattle grazing, and the regulatory approaches and strategies of those interventions. Sections 9.5.1 to 9.5.3 and the notes to the table discuss these in more detail. Table 9.1 shows only formal rules[117] that expressly relate to water pollution or greenhouse gas emissions (either on their own terms or as explained through formal policy documents). An intervention is classified as applying to coal mining or cattle grazing based on the language of the rule, and, where necessary, evidence about whether the rule applies in practice to that activity. "Not routinely used" indicates an intervention that is not routinely applied to coal mining or cattle grazing, but in theory could be to some degree. Shaded rows show how the Reef SEA produces and influences relevant mechanisms for regulatory intervention, with darker shading indicating the strongest influence, where the SEA provided for creating a mechanism that is new or

[117] This necessarily omits other forms of influence, including non-state initiatives and state policies that are not reflected in formal rules. Rules are current to March 2024. This does not include legislative proposals in relation to climate-related financial disclosures and "nature repair," for which bills had not been introduced at the time of writing.

TABLE 9.1 *Major Australian federal (A) and Queensland (Q) regulatory interventions to address Reef-impacting greenhouse gas emissions (GHG) and water-borne sediment pollution (H_2O) from coal mines and cattle grazing, showing influences of the Reef SEA*

		Regulatory approach				Regulatory strategy				GHG		H_2O	
Australia/ Queensland	Legal mechanism (mechanism contained in a law or a document or plan for which a law provides)	Stick	Carrot	Sermon	State rescue	Harm-reducing	Harm-offsetting	Restoring	Coping	Coal	Cattle	Coal	Cattle
	(a) Mechanisms focused on the Reef as the matter of concern												
A	SEA, including endorsed program[i]	*Not specified*				*Not specified*						✓	✓
	EIA, approvals for actions[ii]	✓				✓	✓		✓			✓	✓
	Marine Park pollution regulation[iii]	✓				✓				*Not routinely used*			
A & Q	Reef catchment restoration[iv]		✓					✓					✓
	Extension and education for land managers[v]		✓			✓		✓					✓
	Voluntary Reef Credit Scheme[vi]		✓			✓		✓					✓
Q	Human rights to life, culture, property, etc[vii]	✓				✓				*Not routinely used*			
	(b) Mechanisms focused on a specific impact (H_2O or GHG emissions)												
A	GHG reporting mandate[viii]			✓		✓				✓			
	Emissions reduction transparency initiative[ix]			✓		✓				*Not routinely used*			
	Cap on GHG emissions[x]	✓				✓	✓			✓			
	Carbon credit scheme[xi]		✓				✓	✓		✓	✓		
	Clean energy loans and grants[xii]		✓			✓		✓			✓		
Q	Minimum land management standards[xiii]	✓				✓		✓					✓
	Point source pollution approvals[xiv]	✓				✓	✓					✓	

TABLE 9.1 (*continued*)

Australia/ Queensland	Legal mechanism (mechanism contained in a law or a document or plan for which a law provides)	Regulatory approach: Stick	Carrot	Sermon	State rescue	Regulatory strategy: Harm-reducing	Harm-offsetting	Restoring	Coping	GHG: Coal	Cattle	H_2O: Coal	Cattle
	General environmental duty[xv]	✓				✓				*Not routinely used*			
	Vegetation clearing restrictions, approvals[xvi]	✓					✓						✓
	(c) Mechanisms focused on specific activities												
A	Regional development loans and grants[xvii]		✓			✓				*Not routinely used*			
Q	EIA for "coordinated projects"[xviii]	✓				✓	✓	✓		✓		✓	
	Land development assessment, approvals[xix]	✓				✓				*Not routinely used*			
	Mining lease conditions[xx]	✓				✓				*Not routinely used*			
	Pastoral lease conditions relating to conserving soil[xxi]	✓				✓				*Not routinely used*			

NB: EIA, environmental impact assessment; SEA, strategic environmental assessment.

Key	Mechanism proposed by Reef SEA - either new or substantially modified	Existing mechanism directly influenced by Reef SEA	Mechanism under law influenced by Reef 2050 Cumulative Impacts Management Policy

References and provisions re regulatory strategies and approaches and GHG/H_2O focus

i SEA, including endorsed program (applies to "matters of national environmental significance"): EPBC Act (Australia) s 146 (noting that provisions for approving actions taken in accordance with the endorsed program in ss 146A–146M, a regulatory stick, were not used in the case of the Reef SEA)

ii EIA, approvals for actions (requires assessment and approval with binding conditions, i.e., harm-reducing regulatory stick, for any action likely to have a significant impact on a "matter of national environmental significance", but with no legal requirement to consider greenhouse gas emissions): EPBC Act (Australia) pts 7–9; Department of the Environment (Australia), *Significant Impact Guidelines 1.1: Matters of National Environmental Significance* (2013) www.dcceew.gov.au/sites/default/files/documents/nes-guidelines_1.pdf, archived at https://perma.cc/P4NR-YHXE; Department of the Environment (Australia),

TABLE 9.1 (*continued*)

Significant Impact Guidelines 1.3: Coal Seam Gas and Large Coal Mining Developments – Impacts on Water Resources (2022) www.dcceew.gov.au/sites/default/files/documents/significant-impact-guidelines-1-3.pdf, archived at https://perma.cc/WUQ3-3KDZ; Department of Sustainability Environment Water Population and Communities (Australia), *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy* (2012) 9 (offsets applying via approval conditions, noting that "other compensatory measures" could include regulatory coping initiatives) www.dcceew.gov.au/sites/default/files/documents/offsets-policy_2.pdf, archived at https://perma.cc/EE73-7RZP; Wendy Craik, *Independent Review of Interactions between the EPBC Act and the Agriculture Sector: Independent Report Prepared for the Commonwealth Department of the Environment and Energy* (Aither 2018) www.dcceew.gov.au/sites/default/files/documents/review-interactions-epbc-act-agriculture-final-report.pdf, archived at https://perma.cc/4TNX-8V3C; Department of the Environment (Australia), *EPBC Act Referral Guidelines for the Outstanding Universal Value of the Great Barrier Reef World Heritage Area* (2014) www.dcceew.gov.au/sites/default/files/documents/referral-guidelines-great-barrier-reef_0.pdf, archived at https://perma.cc/Y5EV-9MH7.

iii Marine Park pollution regulation: Great Barrier Reef Marine Park Act 1975 (Australia) s 66(2)(e) ("regulating or prohibiting acts [whether in the Marine Park or elsewhere] that may pollute water in a manner harmful to animals and plants in the Marine Park")

iv Reef catchment restoration: Reef 2050 WQIP, 34, 36 (targeted catchment repair projects through incentives to landholders e.g., riparian revegetation, gully repair, streambank stabilization; carbon sequestration noted as an additional benefit, but this is noted only tangentially); not categorized as a state rescue approach since it lacks a clear focus on public land

v Extension and education for land managers: Reef 2050 WQIP, 31 ("Deliver extension and education targeted at adoption of improved practices . . . through the Reef Water Quality Program and Reef Trust projects, e.g., BMP extension and education, Project Pioneer – Innovation in Grazing Management, and Reef Alliance – Growing a Great Barrier Reef"); Project Pioneer, www.projectpioneer.com.au (n.d.).

vi Voluntary Reef Credit Scheme: Reef 2050 WQIP, 30, 44, EcoMarkets Australia, *Reef Credit Guide V. 2.1* (2024) https://eco-markets.org.au/rules-and-requirements, archived at https://perma.cc/5ZUL-FXK7. NB: both harm-offsetting and restoring projects seem theoretically permissible under this incentive scheme.

vii Human rights to life, culture, property, etc: Human Rights Act 2019 (Queensland) ss 8, 13, 15(2), 16, 24(2), 25(a), 26(2), 28, 58 (prohibition on unjustifiably limiting human rights, assumed generally to be harm-reducing); *Waratah Coal Pty Ltd v Youth Verdict Ltd* (No 6) [2022] QLC 21, [1297]–[1694].

viii GHG reporting mandate: National Greenhouse and Energy Reporting Act 2007 (Australia) s 7 and pts 3, 3H, National Greenhouse and Energy Reporting (Measurement) Determination 2008 (Australia) ch 3 (applies GHG reporting requirements to companies that exceed scope 1 or 2 GHG emissions thresholds, with presumed harm-reducing strategy through public pressure; agricultural activities excluded because reporting requirements only apply where the Minister has determined approved measurement approaches: methods apply to coal mine emissions, but not agriculture)

ix Corporate emissions reduction transparency initiative: Clean Energy Regulator (Australia), "Corporate Emissions Reduction Transparency (CERT) Report Guidelines FY2022–23 and CY2023, Version 1.2" (2024) https://cer.gov.au/markets/reports-and-data/corporate-emissions-reduction-transparency-report/participating-corporate, archived at https://perma.cc/8HNN-L7QA (opt-in standardized reporting scheme for broad climate-related commitments that covers entities that are covered by the statutory GHG reporting mandate, with presumed harm-reducing strategy through public pressure; formal guidelines apply to

TABLE 9.1 (*continued*)

participants). As at July 2024, no coal mining or pastoral grazing companies had submitted a relevant report under this initiative: Clean Energy Regulator (Australia), "Corporate Emissions Reduction Transparency Report 2023," https://cer.gov.au/markets/reports-and-data/corporate-emissions-reduction-transparency-report/corporate-emissions-0, archived at https://perma.cc/RW3N-UM5J.

x Cap on GHG emissions: National Greenhouse and Energy Reporting Act 2007 (Australia) pt 3H; National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015 (Australia) (requiring covered facilities to either reduce their emissions to meet a declining baseline or surrender credits to offset excess emissions). Some coal mines, but apparently no cattle grazing operations are presently covered: Clean Energy Regulator, "2022–23 Safeguard Facility Data" (2024) https://cer.gov.au/document/safeguard-facilities-data-2022-23-excel (listing data for 2022–2023), last accessed March 22, 2025, archived at https://perma.cc/5LD4-3J5Q.

xi Carbon credit scheme: Carbon Credits (Carbon Farming Initiative) Act 2011 (Australia); provides market incentives to engage in approved credit generation methods, including some that expressly target both the cattle and coal sectors, including flaring or converting methane from underground coal mines, managing beef cattle using specified practices and reducing methane by feeding nitrate to cattle (some now closed to new projects): Clean Energy Regulator (Australia), "ACCU Scheme Methods" (n.d.), https://cer.gov.au/schemes/australian-carbon-credit-unit-scheme/accu-scheme-methods, last accessed March 22, 2025, archived at https://perma.cc/M99E-GER6, Clean Energy Regulator (Australia), "Closed Methods" (n.d.), https://cer.gov.au/schemes/australian-carbon-credit-unit-scheme/accu-scheme-methods/closed-methods, last accessed March 22, 2025, archived at https://perma.cc/9ZAZ-TPWW.

xii Clean energy loans and grants: Clean Energy Finance Corporation Act 2012 (Australia) ss 58, 60; Clean Energy Finance Corporation (Australia), "Investment Priorities" (n.d.) www.cefc.com.au/about-us/who-we-are/investment-priorities/, last accessed March 22, 2025, archived at https://perma.cc/N4G6-FXHF (prioritizes investing in agricultural "natural capital" and carbon sequestration and technology to encourage emissions reductions, i.e. incentives to reduce harm or restore); Clean Energy Finance Corporation (Australia), "New Capital, New Ambition: Annual Report 2022–2023" (2024) 37, www.cefc.com.au/media/l4igzbpf/cefc_ar23_web_sml.pdf, archived at https://perma.cc/M4LR-JDQ2 (projects include "sustainable grazing" to generate carbon credits). No coal mine-related projects were noted in the 2022–2023 annual report, nor in the 2021–2022 annual report.

xiii Minimum land management standards: Environmental Protection Act 1994 (Queensland) ("EP Act") ss 18(a), 79(1) (cattle grazing in a Reef catchment is an agricultural "environmentally relevant activity" or "ERA"), 81 (binding agricultural ERA standards, i.e. regulatory stick), 426(2)(a) (environmental authority not required for agricultural ERA that is not a prescribed ERA); *Agricultural ERA Standard for Beef Cattle Grazing*, v2 (2022) www.des.qld.gov.au/policies?a=272936:policy_registry/pr-es-grazing.pdf, archived at https://perma.cc/8KEP-YV76, e.g., maintain land in good condition (SC1), implement measures to improve condition of land in poor condition (SC2), i.e. harm reducing and restoring.

xiv Point source pollution approvals ("environmental authorities"): EP Act ss 18 (resource activity is an ERA), 77 (environmental protection policy for reduced contaminant loads to Reef), 88 (Reef water quality offsets under *Environmental Offsets Act 2014* (Queensland)), 107 (mining activity is a resource activity), 209 (offset conditions), 426(1) (requirement for environmental authority for ERA), Environmental Protection Regulation 2019 (Queensland) ("EP Regulation") s 41AA(3) (prohibition on approving release of sediment to Reef without offset); Department of Environment and Science (Queensland), *Point Source Water Quality Offsets Policy* (2019) https://environment.des.qld.gov.au/__data/assets/pdf_file/0033/97845/point-source-wq-offsets-policy-2019.pdf, archived at https://perma.

TABLE 9.1 (*continued*)

cc/RXR7-JQNL; Department of Environment and Science (Queensland), *Guideline: Model Mining Conditions Version 6.03* ESR/2016/1936 (2024) 16–30 (re water releases) www.des.qld.gov.au/policies?a=272936:policy_registry/rs-gl-model-mining-conditions.pdf, archived at https://perma.cc/D4SD-BQE7. NB: an environmental authority is not required for cattle grazing, because it is an agricultural ERA that is not a prescribed ERA (EP Act ss 19, 79(1)(a), 106, 426(2)(a), EP Regulation s 19(1), Sch. 2).

xv General environmental duty: EP Act s 319

xvi Vegetation clearing approvals: Vegetation clearing is classified as a kind of "development": Planning Act 2016 (Queensland) Sch 2 "development," "operational work." Clearing for extractive activities like mining will usually be exempt from a requirement for a permit under this regime: Planning Act 2016 (Queensland) s 107(c); Planning Regulation 2017 (Queensland) Sch 10 ss 4(1), 5; Sch 21 s 1(6). Clearing of regrowth vegetation on grazing land within 50 m of a watercourse located in specified Reef catchments (termed "category R areas") will usually be prohibited, as it is deemed not for a "relevant purpose": Vegetation Management Act 1999 (Queensland) ss 22A(2B)(b) (relevant purpose re grazing land and category R area), 22ANA (category R area). Note that offsets may be required for vegetation clearing under the Environmental Offsets Act 2014 (Queensland) Sch 1, but this relates to the biodiversity of the cleared vegetation, rather than carbon- or water quality-related aspects: Department of Environment and Science, *Queensland Environmental Offsets Policy Version 1.16* (State of Queensland 2024) www.des.qld.gov.au/policies?a=272936:policy_registry/envoff-offsets-policy.pdf, archived at https://perma.cc/TV3G-M8QJ.

xvii Regional development loans and grants, providing incentives, potentially indirectly targeted at harm reduction: Northern Australia Infrastructure Facility Act 2016 (Australia) (financial assistance for economic development); Northern Australia Infrastructure Facility, *Public Benefit Guideline* (2024) 7 (investment mandate requires considering positive and negative environmental impacts in these general terms) www.naif.gov.au/media/4lmhutf1/public-benefit-guideline-update-march-24.pdf, archived at https://perma.cc/66P9-7JPF; Northern Australia Infrastructure Facility, "Our Projects" (n.d.) www.naif.gov.au/our-projects, last accessed March 22, 2025 (projects include a coal mine, but no clear grazing project to date); Regional Investment Corporation Act 2018 (Cth) s 8(1)(a) (farm business loans); Regional Investment Corporation (Australia), *Annual Report 2022/23* (2023) 11 www.ric.gov.au/sites/default/files/documents/2022-23%20Annual%20Report_Regional%20Investment%20Corporation%20cl.pdf, archived at https://perma.cc/F9GL-CK27 (developing environment, social and governance framework).

xviii Project EIA for "coordinated projects": State Development and Public Works Organisation Act 1971 (Queensland) Pts 4, 4A (declaration of coordinated project; considerations relevant to declaration; assessment; power of Coordinator-General to impose harm-reducing and offset conditions, and including, under s 54U(2)(b) re repairing or mitigating damage to the environment, whether or not the damage has been or will be caused by the project, but only if the proponent consents); Department of State Development Tourism and Innovation (Queensland), "Preparing an Environmental Impact Statement: Guideline for Proponents" (2024) 19–21, 27–28 (re water and climate, but with no direct link to the Reef) www.statedevelopment.qld.gov.au/__data/assets/pdf_file/0034/86884/c9a552d64dbc27e6ff2d8f9cfb489fdfe467b066.pdf, archived at https://perma.cc/364C-33CS. NB: coal mines are regularly declared to be "coordinated projects," but it appears this has never occurred for a grazing development: Coordinator-General (Queensland), "Completed Projects" (n.d.) www.statedevelopment.qld.gov.au/coordinator-general/assessments-and-approvals/coordinated-projects/completed-projects, last accessed March 22, 2025.

TABLE 9.1 (*continued*)

xix Land development assessment, approvals and potential for harm-reducing conditions: Planning Act 2016 (Queensland) chapter 3, noting that mines are exempt from the application of planning legislation due to the operation of s 4A, Mineral Resources Act 1989 (Queensland); in rural zones under local government planning schemes, cattle grazing is usually categorized as "accepted development" for which development approval is not required: Planning Act 2016 (Queensland) s 44; e.g. Burdekin Shire Planning Scheme (2022) table 3.4.9 ("animal husbandry").

xx Mining lease conditions: Mineral Resources Act 1989 (Queensland) s 276 (general conditions of mining lease with potential for harm-reducing conditions); neither the statute nor the guidelines for mining leases foresee any significant use of these conditions for environmental purposes: Department of Resources (Queensland), "Mining Lease Application Guide" (September 2024) www.resources.qld.gov.au/__data/assets/pdf_file/0003/217893/mining-lease-guide.pdf, archived at https://perma.cc/4TPY-9T49.

xxi Pastoral lease conditions: Land Act 1994 (Queensland) chapters 4 and 5 (binding conditions of leases relate to harm reduction including conserving soil and protecting riparian vegetation under s 199(2)(d)); appears to be rarely enforced, e.g., current "strategic compliance areas" for non-freehold tenure management do not refer to pastoral leases: Department of Resources (Queensland), "Strategic Compliance Focus Areas 2024–25," www.nrmmrrd.qld.gov.au/__data/assets/pdf_file/0007/1893202/strategic-compliance-focus-areas-2024-25.pdf, archived at https://perma.cc/P9WN-JK73.

substantially modified (see Key). Regulatory mechanisms are arranged according to their focus using the broad categories introduced in Chapter 3, as mainly directed to: protecting the matter of concern (the Reef, (a)); a specific type of environmental impact, (b); or specific types of activities, (c).[118]

Before examining these areas in detail, here are some preliminary observations. While this chapter cannot assess the likely effectiveness of this regulatory toolbox "on the ground," nor the administrative gusto or resources applied to each mechanism, it is at least clear that the toolbox is diverse. It uses most categories of regulatory approaches and strategies discussed in Chapter 6. That diversity aligns with theoretical recommendations for dealing with diverse activities that contribute to cumulative environmental problems in a way that responds to the varying motivations and circumstances of the diverse contributors.[119] As might be expected, more burdensome "sticks" apply more commonly to coal mining than cattle grazing, to which regulatory carrots, and, to a lesser extent, sermons, apply. This reflects an implicit position that diverse activities require diverse approaches, particularly where some actors tend to be large, highly profitable, and traditionally regulated (coal miners), and others smaller, financially more precarious, and traditionally unregulated (cattle graziers). Concerns remain, however, at the financial impacts of water quality controls on graziers.[120] The policy mix also includes significant use of mechanisms that reduce regulatory burdens but also reduce reliability of outcomes (carrots and harm-offsetting).[121] The fainter traces of regulatory possibilities also emerge – those options for which laws already provide, but which do not routinely apply to the greenhouse gas or water pollution of coal mines or cattle grazing. Strikingly, all of the mechanisms noted as "not routinely used" involve regulatory sticks. This is a comparatively burdensome and politically difficult approach, the nonuse of these mechanisms bearing out these difficulties. Yet some of these mechanisms present particular promise for regulating cumulative risks, notably the general environmental duty discussed earlier in Chapter 6.[122]

9.5.1 *Influencing Regulatory Interventions in General*

The SEA "workhorses" for influencing rules for intervention are the twenty-five-year endorsed programs, and the policies and plans to which they commit.

[118] This follows the schema in Chapter 3, which argues that many areas of law can address cumulative environmental problems.

[119] See the approach for navigating large systems of laws described in Section 3.4.

[120] Jane Waterhouse and others, *2017 Scientific Consensus Statement: Land Use Impacts on Great Barrier Reef Water Quality and Ecosystem Condition* (Queensland Government 2017) 13, https://nla.gov.au/nla.obj-630161592/view.

[121] See Section 6.3.2.

[122] See Table 6.3, Table 6.8.

These policies are framed as influencing regulatory interventions in general, since they are not limited to a particular type of environmental impact or activity.[123]

The promisingly named Cumulative Impacts Management Policy requires policymakers to consider cumulative impacts when formulating plans and programs that influence relevant "drivers and pressures"[124] and project approvals under laws that are listed in the Policy[125] (light shaded rows, Table 9.1). Its potential influence extends across diverse regulatory strategies for which those listed laws provide: harm-reducing, offsetting, and restoring. Restoring is important given the legacy impacts of sediment pollution.[126] The Policy's link to project approvals is significant because a requirement to consider cumulative impacts would not otherwise generally apply: Unlike most national EIA legislation around the world,[127] neither Commonwealth nor Queensland environmental law expressly mandates considering a project's cumulative impacts.[128]

The Policy's likely influence is weakened, though, by its ambiguous wording and the fact that it does not call out activities like coal mining and cattle grazing that contribute to recognized high-risk[129] "drivers" of major pressures on the Reef, such as climate change and water pollution. Decision-makers need not assess cumulative impacts "[w]here assessment and management of cumulative impacts is consistent with this policy and has been included in plans, governing arrangements or class assessments."[130] It is unclear which plans and arrangements fulfill this criterion, and, therefore, when decision-makers must independently consider cumulative impacts: Each decision-maker must therefore determine whether the Policy requires

[123] Commonwealth of Australia, *Reef 2050 Plan Policy Guideline for Decision Makers* (2016) https://hdl.handle.net/11017/3164; GBRMPA, *Reef 2050 Plan Good Practice Management for the Great Barrier Reef* (GBRMPA 2018) https://hdl.handle.net/11017/3390; GBRMPA, *Reef 2050 Plan Net Benefit Policy* (GBRMPA 2018) https://hdl.handle.net/11017/3388; GBRMPA, *Reef 2050 Plan: Cumulative Impact Management Policy*.

[124] GBRMPA, *Reef 2050 Plan: Cumulative Impact Management Policy*, 9, 12.

[125] Ibid 3, 13.

[126] See n 19.

[127] See generally, Rebecca Nelson and L. M. Shirley, "The Latent Potential of Cumulative Effects Concepts in National and International Environmental Impact Assessment Regimes" (2023) 12 *Transnational Environmental Law* 150–174.

[128] Note a narrow requirement in relation to some coal mines and coal seam gas projects at the national level: Nelson, "Breaking Backs," 1194–1200. Queensland policy for EIA of "coordinated projects" briefly encourages proponents to consider cumulative effects: Department of State Development Tourism and Innovation (Queensland), "Preparing an Environmental Impact Statement: Guideline for Proponents," 4, 16.

[129] GBRMPA, *Reef 2050 Plan: Cumulative Impact Management Policy*, 12, Att 1 and 2.

[130] Ibid 12.

them to do something extra. This introduces the potential that these connections are not made, and hampers accountability.

The Cumulative Impacts Policy recognizes that "new information, emerging issues and changing circumstances" require managing adaptively, including "if the condition of [Reef] values declines,"[131] but it provides no further detail, process, or principles for when or how to adapt. Intervening adaptively is vital for regulating cumulative impacts,[132] but requires further guidance given the uncertainties and time lags involved, for example, between land practice changes and observed reductions in sediment pollution.

9.5.2 *Influencing Interventions Concerning Water Quality*

The Reef SEA endorsed program led to significant changes in existing regulatory interventions and new regulatory interventions aimed at water quality (rows with shaded cells in last two columns, Table 9.1). The *Reef 2050 Water Quality Improvement Plan* sets multiscale targets for sediment load reduction,[133] and for land cover and management practices on grazing lands in "priority areas" to reduce sediment.[134] These targets influence how existing laws operate, such as point-source water pollution approvals for coal mines, which Queensland's program report repeatedly insisted it would "rigorously condition."[135]

New interventions also pursue these water quality targets (Table 9.1, dark shaded rows). These new mechanisms include mandatory minimum land management standards for graziers, which apply requirements to maintain ground cover – Queensland's first generally applicable regulatory stick applied to grazing practices.[136] A new A$3.7 billion (since inception) Commonwealth Reef Trust[137] delivers incentive-based ("carrot") and information-based ("sermon") interventions:[138] extension and education programs for land

[131] Ibid 35.
[132] See Section 2.2.3.3 (need for adapting) and Section 6.5.4 (approaches to adapting).
[133] DESQ, *WQIP*, 16, 19.
[134] Ibid 27.
[135] DSDIPQ, *Reef Coastal Program Report*, 29–30, 64, 79, 82, 83. See n. xiv to Table 9.1.
[136] Note an earlier geographically restricted mandate: Great Barrier Reef Protection Amendment Act 2009 (Queensland) s 6, introducing chapter 4A to Environmental Protection Act 1994 (Queensland).
[137] PGPA Act (Reef Trust Special Account 2014) Determination 01 2023 (Australia).
[138] DESQ, *WQIP*, 26–36. See generally Alluvium Consulting Australia, *Final Report: Part A. An Evaluation of the Australian Government Reef Trust Water Quality Investments* (2023) especially 7–11, appendix A (list of projects), www.dcceew.gov.au/sites/default/files/documents/alluvium-part-a-evaluation-report.pdf, archived at https://perma.cc/KXU5-TPBB.

managers about best management practices;[139] funded catchment restoration activities such as revegetation and gully repair to control soil erosion;[140] and a government-supported, voluntary Reef Credit scheme to facilitate landholders selling water quality credits to government, industry, and nonprofit buyers.[141] These mechanisms focus on both harm-reducing and restoring strategies (Table 9.1), providing important incentives to address legacy harms that continue to cause impacts. The sheer number of available mechanisms – of which Table 9.1 presents a simplified view – itself presents an implementation challenge, however. That there are so many possible options for landholders itself creates complexity and cost, and is seen to require more extension work to explain.[142] Distrust of government and scientists further impedes take-up of these options.[143]

These influences are significant from a cumulative impacts perspective. While similar voluntary initiatives existed previously, the Reef Trust provided a "large, overarching initiative" with robust reporting arrangements for increased accountability.[144] More generally, the Reef SEA has diversified the policy mix through the first generally applicable regulatory "stick" applied to graziers to reduce sediment pollution, potentially influencing contributors who were not responsive to incentives.

In a missed opportunity to adopt a stronger cumulative impacts mindset, though, the Plan's spatial prioritization for implementing these initiatives is based on the ecosystem's risk of exposure to pollutants[145] rather than cumulative exposure to multiple stressors. An alternative would have been to investigate building on the SEA's cumulative exposure mapping[146] to target water quality reduction efforts to areas suffering from greatest cumulative stress.

Given how deforestation for pasture contributes to sediment pollution,[147] Queensland's vegetation clearing laws deserve special mention. Before the

[139] DESQ, *WQIP*, 31.
[140] Ibid 34, 36.
[141] Ibid 30, 44.
[142] Hugh Possingham and others, *Native Vegetation Expert Panel Report* (Queensland Government 2023) 32, https://environment.desi.qld.gov.au/__data/assets/pdf_file/0025/324574/expert-panel-report.pdf, archived at https://perma.cc/37EE-2GGR.
[143] J. Waterhouse and others, *2022 Scientific Consensus Statement Summary: Land-Based Impacts on Great Barrier Reef Water Quality and Ecosystem Condition* (Government of Australia and Queensland Government 2024) 83, https://reefwqconsensus.com.au/wp-content/uploads/2024/06/2022-Scientific-Consensus-Statement-Summary_FINAL.pdf, archived at https://perma.cc/TKU4-AF9Z.
[144] Australian National Audit Office, *Reef Trust – Design and Implementation*, 26–27.
[145] DESQ, *WQIP*, 19.
[146] See n 90 and accompanying text.
[147] See above nn 36 to 38 and accompanying text.

Reef SEA, a prohibition on clearing riparian vegetation in certain Reef catchments was introduced in 2009,[148] and has since been expanded more generally to Reef catchments.[149] Amid intense conflict with farmers, land clearing laws later alternated between phases of greater and lesser robustness.[150] The Reef SEA conspicuously made no clear commitments on this front, and its progeny, the Reef 2050 Water Quality Improvement Plan, merely promised vaguely to strengthen and enforce the laws.[151] However, rates of land clearing – under both significant exemptions from regulation, and illegal land clearing – remain high, and the most significant concern related to sediment pollution of the Reef.[152]

9.5.3 *Influencing Interventions Concerning Climate Change*

Given its scoping, it is unsurprising that the Reef SEA had little influence on climate-directed mechanisms (shaded rows in third and fourth columns from the right, Table 9.1). Its influence was circuitous at best, highlighting the importance of water quality on the basis that climate impacts require "building resilience," for which water quality is "the most critical issue."[153] The endorsed programs and policies did not directly contemplate new or existing measures to reduce greenhouse gas emissions, and only briefly mention Australia's international mitigation commitments.[154] An implementation policy for Queensland's EIA laws (which are expressed to be subject to the Cumulative Impacts Management Policy) only briefly mentions considering climate.[155] The Commonwealth EIA law contains no requirement for a decision-maker to consider greenhouse gas emissions, which has spurred several unsuccessful lawsuits using the Reef to argue for an implicit requirement to consider climate.[156] This is a significant gap in comprehensiveness of

[148] Vegetation Management (Regrowth Clearing Moratorium) Act 2009 (Queensland) ss 3(1)(b), 5(1)(b).
[149] See note xvi to Table 9.1.
[150] Philippa England, "Between Regulation and Markets: Ironies and Anomalies in the Regulatory Governance of Biodiversity Conservation in Australia" (2016) 3 *Australian Journal of Environmental Law* 44–66, 48–51.
[151] DESQ, *WQIP* 29.
[152] Possingham and others, *Native Vegetation Expert Panel Report*, 12; Waterhouse and others, *2022 Scientific Consensus Statement*, 38–40.
[153] DSDIPQ, *Reef Coastal Program Report*, 77.
[154] E.g., Commonwealth of Australia, *Reef 2050 Plan Policy Guideline for Decision Makers*, 12.
[155] See n xviii to Table 9.1.
[156] See generally, Jacqueline Peel, *Legal Opinion – Gaps in the Environment Protection and Biodiversity Conservation Act and Other Federal Laws for Protection of the Climate: Report for the Climate Council* (2023) www.climatecouncil.org.au/resources/expert-opinion-our-national-environment-law-is-fundamentally-flawed/.

the Reef SEA's coverage of important impact types (a key regulatory design feature for cumulative environmental problems), especially for a jurisdiction that prominently produces and exports emissions-intensive products.

Although the Reef Authority's strategic assessment report committed to continue implementing its climate adaptation plan,[157] by 2019, staffing changes had removed its climate unit and the plan was defunded.[158] According to independent reviewers, this shifted the Reef Authority from "being a 'consequence maker' advocating for effective climate mitigation to being a 'consequence taker' responding to climate change impacts with actions to improve Reef resilience as part of an adaptation strategy."[159]

This situation is now changing. The Reef Trust now invests significantly in a Reef Restoration and Adaptation Program – said to be "the world's largest effort to help an ecosystem survive climate change"[160] – which is cofunded by nongovernment organizations. Its research and development programs investigate Reef cooling through marine cloud brightening and climate-resilient coral larvae seeding (a coping intervention strategy) and restoring carbon-storing coastal and marine ecosystems (a restoring intervention strategy).[161] Implementing the strategy, however, would require regulatory reform.[162] Despite this shift in attention, these changes are disconnected from interventions related to water quality, raising the question of how interventions dealing with climate change, and the Reef, respectively, might better connect decision-making, and deal with the most threatened areas in terms of cumulative stress.

9.5.4 *Connecting across Problems and Impacts: Possibilities and Prospects*

The earlier analysis shows that the Reef SEA did not effectively connect decision-making across the regulatory silos that correspond to two separately conceived cumulative environmental problems: first climate change, focusing on the climate in general as the matter of concern; and second, conceiving of the Reef as the matter of concern, affected by both climate change and other

[157] GBRMPA, *Great Barrier Reef Region Strategic Assessment: Supplementary Report*, 143–144.
[158] GBRMPA, *Great Barrier Reef Outlook Report 2019*, 208.
[159] Ibid.
[160] DCCEEW, "Reef Restoration and Adaptation" (n.d.) www.dcceew.gov.au/parks-heritage/great-barrier-reef/protecting/case-studies/helping-the-gbr-adapt-changing-climate, last accessed March 22, 2025, archived at https://perma.cc/BXT9-LYF8.
[161] Ibid; L. K. Bay and others, *Reef Restoration and Adaptation Program: Intervention Technical Summary* (Australian Institute of Marine Science 2019) https://gbrrestoration.org/wp-content/uploads/2020/09/T3-Intervention-Technical-Summary-FINAL3.pdf, archived at https://perma.cc/WBR9-J4ST.
[162] See generally, Fidelman and others, "Regulatory Implications of Coral Reef Restoration."

impacts such as water pollution. The Reef SEA worked like a camera taking a zoomed-in photo of the Reef while missing the larger panorama of activities contributing to climate change that threatens the Reef. An alternative approach would connect decision-making across Australia's regulatory silos for climate mitigation and Reef impacts.

The most obvious and ambitious way to connect decision-making about protecting the climate and protecting the Reef would be to design climate-protecting interventions in a way that considers the Reef's climate-related vulnerability. Assessment and approval requirements for coal mines could follow an emerging approach to recognize all downstream emissions in the EIA context,[163] and compare these emissions to a cumulative threshold of global emissions informed by the Reef's vulnerability to determine the project's significance. Such an approach would implement that urged in multiple largely unsuccessful lawsuits under Australia's environmental laws.[164]

A less ambitious form of regulatory link-making between climate change and water pollution impacts on the Reef could recognize the nontarget effects of offset and credit regimes. These regimes apply to both water pollution and greenhouse gas emissions (Table 9.1(b)). Cattle graziers currently may generate carbon credits by sequestering carbon in soil, but this mechanism does not consider benefits for sediment pollution;[165] conversely, planned savanna burning that generates carbon credits does not consider impacts on sediment production.[166] Making these links would better harness synergies and avoid mutual undermining between interventions directed at overlapping problems.

[163] E.g., see generally, Benoit Mayer and Mateusz Slowik, "A Duty to Assess an Oil Project's Downstream Greenhouse Gas Emissions: The UK Supreme Court in *Finch*" (2025) 34 *Review of European, Comparative and International Environmental Law* 288–294 (advance).

[164] See generally, Peel, *Legal Opinion* esp. 13, 21–23.

[165] Carbon Credits (Carbon Farming Initiative – Estimating Sequestration of Carbon in Soil Using Default Values) Methodology Determination 2015 (Australia); Clean Energy Regulator (Australia), Participating in the Emissions Reduction Fund: A Guide to the Estimating Sequestration of Carbon in Soil Using Default Values Method (2015), https://cer.gov.au/document/guide-to-estimating-sequestration-carbon-soil-using-default-values-method, archived at https://perma.cc/9TWF-2BEH; DCCEEW, "Improving Soil Carbon Storage and Measurement" (n.d.) (recognizing benefits for water quality), www.dcceew.gov.au/climate-change/emissions-reduction/agricultural-land-sectors/soil-carbon-storage-measurement, archived at https://perma.cc/ALG2-HH29.

[166] Carbon Credits (Carbon Farming Initiative – Savanna Fire Management – Sequestration and Emissions Avoidance) Methodology Determination 2018 (Australia); Department of the Environment and Energy (Australia), "Understanding Savanna Fire Management Methods in the Emissions Reduction Fund: Frequently Asked Questions" (2019) www.dcceew.gov.au/sites/default/files/documents/understanding-savanna-fire-management-methods-in-the-emissions-reduction-fund-faqs.pdf, archived at https://perma.cc/B729-SUC5

A further alternative would be to better link interventions from an adaptation perspective. This could involve designing water quality interventions to prioritize areas of the Reef most at risk from climate change using cumulative exposure mapping, supported by further research on the interactions between these impacts, if necessary. Enforcement of interventions could equally be prioritized on this basis.

With wider terms of reference, the Reef SEA could also have generated insights from comparing across types of impacts and activities to reveal inconsistencies and gaps. Such insights could help assess issues of fairness, or inform revisions to interventions to increase comprehensiveness – a key design feature for regulating cumulative environmental problems. Unlike coal mines, cattle graziers need not report their greenhouse gas emissions nor comply with an emissions cap, but they benefit from being able to produce carbon credits and access grants for emissions-reducing activities in the same way as coal mines (Table 9.1(a) and (b)). Cattle graziers need no approval for activities that produce sediment in a diffuse way, while coal mines do in relation to point sources (Table 9.1(b)).

Similar comparisons could also reveal possibilities for change by identifying regulatory mechanisms that apply only in respect of one impact type, but theoretically might be suitable for another. Minimum land management standards and extension-based approaches to encourage good land management practices apply to cattle grazing to control sediment, but not yet to limit greenhouse gas emissions, which instead attracts carbon credits (Table 9.1(b)). Different forms of mandatory and voluntary disclosures (regulatory sermons) apply in the carbon context, but not yet in relation to water pollution. Carbon offset systems exist to soften burdens of regulatory sticks related to greenhouse gas emissions and mining point source pollution, but appear not to have been explored for grazing. Subsidized loans are available for greenhouse gas–reducing investments but not the equivalent for water pollution.

International concern about cumulative impacts on the Reef remains strong, and in 2022, UNESCO formally urged Australia to accelerate progress meeting water quality targets and revise the Reef 2050 Plan to incorporate greenhouse gas emissions mitigation.[167] Relevant regulatory revisions were yet to be made at the time of writing. However, after a change in national government, there are early signs of regulatory change to strengthen Reef-related intervention in relation to climate change mitigation. In the wake of

[167] Commonwealth of Australia, *Great Barrier Reef Progress Report to UNESCO World Heritage Centre* (2024) 9, 22, www.dcceew.gov.au/sites/default/files/documents/great-barrier-reef-progress-report-2024.pdf, archived at https://perma.cc/8MAY-4SCJ.

major coral bleaching in early 2024, and in parallel with Australia's formal response to UNESCO, the Reef Authority released a new climate plan. The plan continues an adaptation focus, but complements it with "new programs" for climate mitigation through influencing activities *both within and outside* its geographic jurisdiction.[168] These include advising government about climate change impacts on the Reef "and the need to urgently reduce CO_2 emissions,"[169] encouraging "transformative actions," "speak[ing] for the Reef and advocat[ing] for stronger global action" in international fora, and engaging with the Australian Government's emission reduction strategies and carbon sequestration initiatives.[170] Just as notably, the Reef Authority committed to "use its statutory powers or other management tools" to reduce carbon emissions from Reef users such as tourism vessels[171] – a symbolically important step.

These statements and commitments lie within the Reef Authority's existing statutory advisory purposes and functions,[172] and they are objectively modest, but in the context of the Reef SEA and its previous approach, they are extraordinary. They propose to use information to make links across regulatory silos: feeding information about climate change impacts on the Reef into government structures that have the capacity to influence interventions for greenhouse gas mitigation. At the very least, the proposal to regulate tourism vessels draws attention to other, more substantial contributors to climate change, such as coal mining. Controls over coal mines lie within the jurisdictions of the Queensland and Commonwealth governments that might receive relevant advice from the Reef Authority, perhaps informed by the Cumulative Impacts Management Policy that would seem capable of applying to greenhouse gas emissions.

9.6 CONCLUSION

SEA has long been considered well-suited to dealing with cumulative impacts, enabling proactive, larger scale assessment of multiple sources of impact. Ideally, SEA connects information and regulatory by influencing decisions about individual projects, and perhaps land use plans. The Reef SEA suggests this view underestimates the power of SEA to influence cumulative impacts

[168] GBRMPA, "Great Barrier Reef Blueprint for Climate Resilience and Adaptation" (2024) 9, https://hdl.handle.net/11017/4035.
[169] Ibid 16.
[170] Ibid 21.
[171] Ibid.
[172] Great Barrier Reef Marine Park Act 1975 (Australia) s 7(1)(ca), (cd).

from the perspective of regulatory intervention and information. In fact, SEA can be structured not only to influence project approvals but also to entrench and expand ongoing monitoring programs (information), and influence other, impact-focused laws, and thereby rules that influence activities that are cumulatively significant but do not trigger EIA, like cattle grazing.

In relation to water quality, the Reef SEA influenced existing regulatory interventions that provide for reducing and offsetting harm and restoring, and facilitated new interventions that diversified the regulatory mix, important for cumulative environmental problems. However, the Reef SEA viewed climate change solely through the lens of adaptation, overlooking greenhouse pollution from the same activities as contribute to sediment pollution, where both impact types are "external" to the Reef, both involve legacy impacts, and both involve data challenges. This blinkered view largely persisted long after the SEA.

SEA offers great potential to connect interventions that deal with different impact types across cumulative environmental problems. The Reef SEA might have better connected water quality interventions and both climate adaptation and mitigation. SEA scoping likely played a key limiting role in relation to mitigation. The analysis here has suggested possibilities to better connect interventions with varying degrees of ambition. However, continued flows of information under international arrangements for protecting World Heritage are even now demonstrating the enduring and adapting characteristics of the Reef SEA and its policy progeny.