Design for Regulating a Thousand Cuts Summary Guidance and Concluding Reflections

This guidance presents the key insights about designing formal rules to deal with cumulative environmental problems from the ten substantive chapters of this book. It is aimed at readers who work with laws and regulations in government agencies or as consultants, community advocates, or researchers, and who are considering how to improve those laws to better deal with cumulative impacts.

11.1 CUMULATIVE ENVIRONMENTAL PROBLEMS AND THE IMPORTANCE OF FORMAL RULES

Cumulative environmental problems are those that are caused by many diverse actors undertaking diverse activities, engaging multiple regulatory regimes that often deal with single natural resources (such as biodiversity, or water pollution), and where the effects aggregate relatively slowly in scientifically complex and sometimes unpredictable ways. Cumulative environmental problems are the result of "a thousand cuts" (figuratively) to something we care about, inflicted by many, sometimes unknowingly.

The three case studies in this book (for more details, see Section 11.5) illustrate the diverse scales and natures of these problems:

- Long-term overpumping for farms and cities has caused groundwater levels to decline and wells to go dry for some populations that lack other sources of water in California's Central Valley (Chapter 8).
- The health of a large, biodiverse, and beautiful coral reef is declining due
 to diverse impacts caused by many actors, from water pollution to climate
 change, and legacy effects from land management long ago (Australia's
 Great Barrier Reef, Chapter 9).

• The ecological and cultural values of Alpine meadows are threatened by the abandonment of traditional grazing practices that have maintained them for thousands of years, combined with many small developments (South Tyrol, northern Italy, Chapter 10).

While these problems are diverse, they suffer common challenges because of their key characteristics: many and diverse actors and activities; relatively slow, scientifically complex, and potentially uncertain aggregation; and links to multiple regulatory regimes. Many environmental problems have these aspects to varying degrees; this book focuses on problems in which these aspects are especially pronounced.

What Are "Formal Rules"?

As discussed here, formal rules appear in laws, regulations, and some formal policies. Critically, they are not just rules that try to influence behavior. Formal rules can – and should – also facilitate defining what matters for protection or restoration; collecting, sharing, and analyzing data and information, and coordinating different actors.

A foundational premise of this book is that for cumulative environmental problems, adequate management is unlikely to arise informally, without intentional design. Multidisciplinary research reported in this book (Chapter 2) suggests that many factors act as barriers to effective management. Effective action requires clarifying several dimensions of what we care about, which engages value-rich, subjective issues and the potential for contestation and inadvertent changes through time. Political, commercial, and community concerns and costs disincentivize generating, sharing, and aggregating the information that is needed to understand and respond to the problem. Risk perception, a sense of futility, ethical ambiguity, path dependence, and short-termism stand in the way of intervention. And the number and diversity of relevant actors and government silos mean that cooperation is unlikely to arise organically or be sustained through time.

Regulatory systems can anticipate and be designed to surmount these barriers and promote the conditions for addressing these problems. Synthesizing these challenges produces a framework of key interlinking functions that rules can be designed to support to help address cumulative environmental problems: conceptualization, information, regulatory intervention, and coordination (the "CIRCle Framework"). But – a caution and a

disclaimer. Good design does not guarantee a cure. Formal rules have a unique and important role to play, but they may not be the whole solution to cumulative environmental problems. Introducing, implementing, and enforcing formal rules is rarely straightforward and trouble free. Many important issues lie outside the realm of what rules can solve, such as insufficient resources, loss of institutional knowledge, or difficult relationships with stakeholders or other agencies. Conversely, without careful design, rules may be part of the problem.

11.2 USING THIS GUIDANCE

This guidance does not prescribe specific rules to support each CIRCle Framework function. This necessarily depends on local context. Rather, it prescribes questions and considerations. Practitioners can use these questions to diagnose gaps and other problems to improve existing rules, or to plan new rules.

A practitioner might use this guidance in different situations, including when a cumulative environmental problem is possible, predicted, manifest, or critical, or when a formal scheduled review of a law or regulation is required. In many cases, some form of regulation will already exist to influence the problem. In other cases, perhaps in jurisdictions that are at an early stage of developing their environment-related laws, responding to a problem will require considering whether to introduce entirely new laws.

This guidance draws attention to "red flags" () that suggest addressing certain issues is likely to be needed. It also highlights key challenges associated with each function, and types of regulatory mechanisms () that can support dealing with that challenge. The Framework function chapters of this book (Chapters 4–7) provide numerous illustrative examples of these mechanisms. The case studies (Chapters 8–10) illustrate and analyze how these mechanisms can come together in a legal regime. This guidance includes cross-references to these chapters for more information ().

This book deals with a broad variety of environment-related laws across many jurisdictions globally. Because practitioners in different contexts often use different words to describe similar broad concepts, this book adopts terminology that is intended to be context-neutral and applicable in diverse situations (see Glossary).

While the examples given in this book attempt to reflect geographic and jurisdictional diversity, and innovative approaches emerge from around the world, jurisdictions with larger economies are overrepresented. If you are considering this guidance in the context of a less industrialized or smaller

jurisdiction, you may need to give more emphasis to issues such as resourcing and local capacity, but you also may benefit from less entrenched legal silos and less sprawling government bureaucracies.

11.3 THE CIRCLE FRAMEWORK FOR ANALYZING RULES

There are many government frameworks of "best practice principles" for regulating public policy problems in general. This book offers a more targeted framework of four "best practice functions" that a regulatory system should deliver to best support action to address cumulative environmental problems: conceptualization of the thing that matters ("matter of concern") and the conditions that should be protected or restored; information about the matter of concern and threats to it; intervention to influence human activities and other factors that impact the matter of concern; and coordination between agencies and levels of government, and between government and nongovernment actors in relation to each of the other three functions. Each function is important, and its absence would pose a key risk to effectively addressing a cumulative environmental problem (Table 11.1). In addition, each function integrates with all the others, and these linkages are key (Figure 11.1), see integration notes () in text that follows.

This Framework was developed deductively, based on cross-disciplinary research about challenges, and refined inductively by considering numerous real-world examples of rules, many of which are presented as illustrative examples in this book.

11.4 APPLYING THE CIRCLE FRAMEWORK

The CIRCle Framework provides a structure for evaluating gaps and weaknesses in legal regimes for dealing with cumulative environmental problems. It is not designed to provide "the answer" to filling gaps and strengthening weaknesses, though Chapters 4 to 7 provide many sources of relevant legal inspiration drawn from 73 jurisdictions across 55 countries around the world. The following steps are a guide to applying the Framework, and a basis for discussions among agencies and stakeholders.

E.g., see generally, Caroline Morris (ed), Making and Changing Law in Small Jurisdictions (Springer 2024).

TABLE 11.1 Definitions and risks of rules omitting a CIRCle Framework function

Brief definition of best practice function

Conceptualization: Rules clearly and coherently define or provide a process for defining the matter of concern in terms of spatial extent, what elements of it are important, and what level of change is unacceptable, and therefore constitutes a cumulative environmental problem.

Information: Rules provide for collecting, sharing, aggregating, and analyzing data and information about the condition of the matter of concern, impacts, predicted future conditions due to cumulative impacts, and interventions.

Regulatory intervention: Rules provide for influencing the behavior of contributors to cumulative harm or otherwise addressing impacts or creating benefits, using diverse regulatory approaches and strategies to match the different circumstances of the problem and of contributors to harm.

Coordination: Laws provide for interaction between and across levels of government and with nongovernment stakeholders in carrying out functions related to conceptualization, information and intervention

Key risks if function is absent

- No clear focus or goal to guide action to prevent unacceptable change;
- Contestation about goals; and
- Information collection, intervention and coordination are not focused on addressing the same thing.

A legal regime is ineffective because its implementation:

- overlooks the emergence of the cumulative environmental problem, or
- misunderstands the severity or causes of the problem, or
- falsely assumes enough is being done to address the problem.

Unacceptable cumulative harm does not trigger intervention, or adequate intervention, so:

- impacts continue to grow, and
- unacceptable impacts remain.

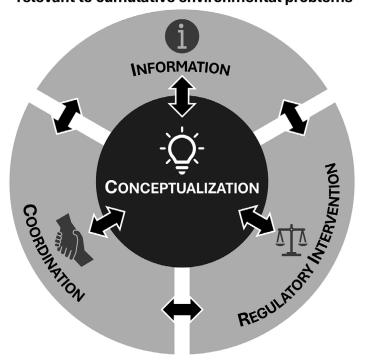
A legal regime has gaps, antagonistic features, or inefficient duplication in relation to conceptualization, information or regulatory intervention, and lacks useful ways to resolve disputes.

Preliminary step: Identify your cumulative environmental problem and related rules and actors

First, identify, in broad terms, the thing that you are concerned to protect or restore, or perhaps create: your "matter of concern." This might be one or more of:

 A species or place, for example, an ibex, a sacred site, a national park, a river basin, or a mountain range;

Steps for using the CIRCle Framework to assess rules relevant to cumulative environmental problems



Survey regulatory landscape

Identify relevant rules and government and non-government actors – an iterative process



Step 1

Assess rules for **C**onceptualization of matter of concern, including interactions with other functions



Step 2

Assess rules for Information, including interactions with other functions



Step 3

Assess rules for **R**egulatory intervention, including interactions with other functions



Step 4

Assess rules and institutions for <u>C</u>oordination of each function above

Pursue reforms

Pursue reforms to rules, and measures to support their implementation, to strengthen links, fill gaps and improve integration

FIGURE 11.1 Applying the CIRCle Framework: integrated regulatory functions needed to address cumulative environmental problems

- A resource or "service" that people use directly, for example, a drinking water source, pollination, a fishery, or land for agriculture;
- A legal or cultural relationship or an interaction between people and an element of the environment, for example, a right to a healthy environment, or a cultural practice linked to a place; or
- An environmental element, characteristic or function, for example, biodiversity, ecological resilience, soil, or climate.

Next, map out the laws, regulations, policies, and government and nongovernment actors relevant to your matter of concern.² In doing so, consider the impacts and activities that are already known to affect the matter of concern, and who undertakes and regulates them. Different government and nongovernment actors may be relevant to different CIRCle Framework functions. Cast a wide net. When considering laws, regulations and policies, one or more of the following types might be relevant:

- Those that focus on protecting the matter of concern, for example, endangered species laws, protected area laws, or water resources planning laws;
- Those that focus on impacts generally, or specific kinds of impacts, for example, laws that control pollution, or require environmental impact assessment;
- Those that relate to specific kinds of activities, for example, mining laws, or land development laws; or
- Those that focus on governance or institutions that are relevant to a function, or that otherwise indirectly influence the matter of concern, for example, laws that provide for intergovernmental coordination, or an environmental data repository.

Look beyond narrow "regulation": Make sure that the rules you identify are not restricted to "regulation" in the narrow sense of rules that mandate changes in behavior. Relevant rules may also provide for collecting relevant data or coordinating between government actors, for example.

Tources of rules: As well as formal domestic law, consider whether customary, Indigenous, and international laws may be relevant. Also consider existing rules in which government is not involved – state rules should be designed not to undermine other effective rules.

A complete review would also consider the laws, regulations, and policies that might pose barriers to dealing with the cumulative environmental problem or create drivers of activities that impact your matter of concern. This book and these guidelines focus on improving the support offered by regulation that is expressly aimed at the problem.

Rules in these different categories inherently may focus more or less on certain CIRCle Framework functions. Being alert to these possible differences can help prioritize functions for analysis, for example:

- laws focused on impacts prime contributors to expect intervention, but
 they may not provide for aggregating information across activities and
 impact types that affect the same matter of concern; this may require
 coordination across regulatory silos (e.g., in relation to water pollution
 and climate change impacts on the Great Barrier Reef: see Chapter 9); by
 contrast,
- laws focused on protecting a matter of concern may more clearly conceptualize what matters than other laws, but interventions may not apply comprehensively to activities that affect the matter of concern: addressing relevant activities comprehensively may require coordination and embracing more diverse approaches to intervention.

Jurisdictional boundaries: Responsibility for laws that affect a cumulative environmental problem probably lies with multiple agencies or levels of government. A regulatory designer dealing with one law may not be intimately familiar with others. However, it will not be possible to assess potential regulatory gaps and needs for coordination without looking at the "bigger picture," even if acting on this knowledge will require iterative regulatory change.

Exections 3.2 (Domestic Legal Landscape) and 3.3 (International Legal Landscape) elaborate on major categories of laws that often apply to cumulative environmental problems.

Step 1: Do laws clearly and coherently conceptualize the matter of concern, including elements of it that are important and "goal" conditions or thresholds of acceptable change for those elements?

Regulating a cumulative environmental problem requires clarity about the thing that matters and its important elements, such as its ecological and social elements and its spatial boundaries. This clarity is important so that rules for collecting *information* about it, including the activities and impacts that threaten it, and those that support it, and *intervening* and *coordinating* to address the problem, focus on the right thing, and do so in a coherent way.

Implementing a law to address a cumulative environmental problem may require trade-offs with other policy objectives and perhaps other environmentrelated matters of concern. Clarity about what matters is important to ensure that trade-offs are made transparently, and not by arbitrarily or unintentionally reconceptualizing what matters if an element is hard to protect. Adjusting what matters in this way can create "shifting baselines," by changing conditions that are deemed acceptable. This can result in neglecting opportunities to use creative options for *intervention* to deal with the real problem.

Ensuring that different laws coherently conceive of what is important and thresholds of acceptable change helps to avoid conflicts and promote synergies in pursuing the same goal.

Unclarity about matters of concern can be lacking in emerging areas of environment-related law (e.g., rights of nature), and in contexts that involve human relationships with aspects of the nonhuman environment (e.g., environmental justice; see Chapter 8).

The passage of time sometimes strengthens the value of what matters (e.g., biocultural value of seminatural Alpine grasslands; see Chapter 10); in other cases, values may change. Mechanisms for adapting a conceptualization may be warranted in that case, but watch for shifting baselines.

Key design features of regulatory mechanisms associated with conceptualization:

- Clearly specifying the important biophysical and social elements of the
 matter of concern, either by specifying them directly or by setting processes for establishing these elements where contestation is likely and
 debate and additional transparency are required, or where there is uncertainty that first needs to be resolved;
- Clearly specifying threshold conditions for these elements, beyond which
 any additional impact will be unacceptable and require intervention, or
 restoration goals for these elements; and
- Providing for adapting a conceptualization of a matter of concern, for example, in response to new information about it.

Integration with other functions (see Figure 4.2):

- Rules should provide for generating, sharing and analyzing data and information about the condition of important elements of the matter of concern, impacts on those elements, and interventions that deal with those impacts.
- Rules for intervention to address impacts on the matter of concern should support reaching the goals specified in rules for conceptualization; intervention may be triggered when conditions approach thresholds of unacceptable change specified in rules for conceptualization.
- Coordination between government actors and with nongovernment actors can support articulating what is important about the matter of

concern and reaching shared understanding, including, in settler states, between governments, and Indigenous governments and peoples.

Chapter 4 ("Conceptualization") sets out illustrative examples of legal mechanisms that include these design features, drawn from around the world. The case study on California groundwater (Chapter 8) shows how conceptualizing disadvantaged groundwater-dependent communities in different ways changes the interventions that are appropriate to deal with groundwater depletion, where information should be collected, and which agencies need to coordinate to deal with depletion (Chapter 8).

Step 2: Do laws provide for government or nongovernment entities to produce, share, aggregate, and analyze data and information about the matter of concern and threats to it?

Having information about the condition of what we care about, and a comprehensive view of the threats to it, lets us take action to address cumulative impacts to it (*regulatory intervention*). Laws can help build understanding of how impacts interact and aggregate through rules that make information "FAIR" (findable, accessible, interoperable, and reusable). This requires information sharing between public and private entities who hold it. Some contexts require integrating information produced outside Western science (e.g., Indigenous knowledge systems, local knowledge), with appropriate protections. Designing interventions also requires information about existing interventions and the circumstances and motivations of contributors to harms and benefits, as for policy problems in general.

It can be easy to overlook some kinds of threats and impacts. A comprehensive picture includes impacts of: (1) activities that are regulated and lawfully undertaken; (2) activities that are regulated but carried out unlawfully; (3) activities that are not subject to regulation; and (4) "background" factors that affect a matter of concern but are difficult to attribute to an individual actor or action, for example, climate change or the spread of invasive species. Information about each is necessary to address cumulative impacts.

Key design features of regulatory mechanisms associated with information:

- Providing for allocating and reducing costs associated with collecting, sharing, aggregating, and analyzing data and information;
- Guiding requirements for high-quality data and information and analysis;

- Providing for sharing privately held data relevant to a cumulative environmental problem; and
- Standardizing data to ensure interoperability.

Integration with other functions (see Figure 5.2):

- Rules for collecting data and information about the matter of concern should correspond to its important elements, aligned with rules for *conceptualization*.
- Rules for information should link that information to intervention, for example, triggering intervention when information reveals that the matter of concern is unacceptably declining or is predicted to do so, and facilitating decision-making with incomplete information to avoid "paralysis by analysis."
- Coordination between regulatory actors and stakeholders can support sharing information, and developing standard data collection and analysis methods to make sure that information can be aggregated to reveal cumulative impacts. It can also increase the legitimacy of the information.

Chapter 5 ("Information") sets out illustrative examples of legal mechanisms that include these design features, drawn from around the world. The Great Barrier Reef case study (Chapter 9) shows how a regulatory mechanism that focuses mostly on information – a strategic assessment – can influence intervention to address ecological decline in a multilevel government context that deals with diverse actors and impacts.

Step 3: Do laws provide for intervening to ensure cumulative impacts do not exceed acceptable levels? Do laws use diverse regulatory modes for intervention? Do they consider other intersecting problems?

Rules can influence behavior that causes harm in different ways. Major well-known approaches are "sticks," "carrots," and "sermons" (see Figure 11.2). In an environmental context, we can add the further option of "state rescue": where government acts directly to address harm instead of trying to change the behavior of the many actors that cause it. Each of these is here termed a "regulatory" approach in the sense that it can be supported by formal rules (e.g., a prohibition, a stewardship payment, a requirement to publish information, or a statutory power to undertake certain works).

But this is only half of the intervention story: The other half of the intervention story is considering how the rule affects the harm. It may

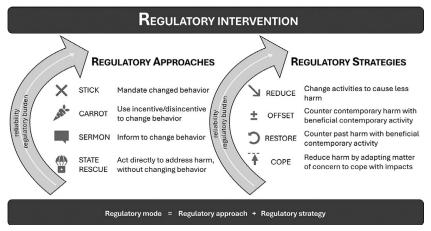


FIGURE 11.2 A "menu" of regulatory modes for intervening to address a cumulative environmental problem

directly reduce harm, offset harm, repair legacy harm, or help the matter of concern to cope, lessening the harm even though impacts stay the same (e.g., finding an alternative water supply for a town that has lost access to groundwater due to overpumping).

Combining regulatory approaches and strategies produces a menu of possible regulatory modes to "mix and match" for a given context (see Figure 11.2, and Chapter 6 for examples).

Since diverse actors and activities contribute to a cumulative environmental problem, and the nature of impacts can vary, using varied regulatory modes can help match these diverse circumstances. Combining different modes can also help balance different advantages and disadvantages. Some options may be less reliable in influencing behavior, but more palatable to governments and contributors to harms and benefits (e.g., regulatory carrots compared to sticks). Others may be more reliable but pose a greater regulatory burden (e.g., a strategy to reduce harm rather than offset it).

Key design features of regulatory mechanisms associated with regulatory intervention:

- Connecting decision-making so that individual activities or types of impact are not considered in isolation;
- Comprehensively addressing impacts, so that few or no actions, including small actions that could cause cumulatively significant impacts, are unaddressed (though different modes of intervention might be used for different types of actions);

- Keeping administrative costs associated with intervention manageable; and
- Intervening in an anticipatory and adaptive way, so that the regulatory system and its implementation can change in response to anticipated or actual changes in impacts, new information about the matter of concern, or evidence that intervention is not working.

Integration with other functions (see Figure 6.1):

- Rules for intervention should seek to meet goal conditions of the matter of concern, or ensure conditions of the matter of concern are unlikely to exceed acceptable thresholds of change, as specified in rules for *conceptualization*.
- Rules for intervention should respond to information about the conditions of the matter of concern, and information about threats to it, for which rules provide.
- Rules for *coordination* between key actors can help ensure interventions are connected (so that individual harms are not considered in isolation or in silos), comprehensive, not mutually undermining, and take account of intersecting environmental problems.

Chapter 6 ("Intervention") sets out illustrative examples of legal mechanisms that include these design features, drawn from around the world. Two case studies (Chapters 9 and 10) analyze how the respective legal regimes for dealing with cumulative environmental problems combine different regulatory modes for intervention.

Step 4: Do laws provide a framework for relevant government and nongovernment actors to coordinate in general, or in relation to conceptualization, information, or intervention?

Large-scale cumulative environmental problems can make it difficult for the numerous and diverse contributing actors to participate as individuals in problem-solving. Accordingly, the focus here is on rules that structure repeated interactions between and across levels of government and with nongovernmental actors, where those actors represent groups of individual contributing actors or other stakeholders. Rules for coordination to address a cumulative environmental problem support comprehensiveness, alignment in how different actors undertake key functions, and efficiency by providing repeated opportunities to reveal gaps, new approaches, lack of alignment, and unnecessary duplication.

The function of these rules is to bring relevant actors "to the table," and help create conditions for fruitful interactions. Other factors that are beyond the reach of rules, though, such as power dynamics, resources, and so on, will influence ultimate outcomes.

Coordination comes with its own challenges. Coordinating multiple actors can be expensive, time-consuming, complex, and challenging to maintain, especially in the face of policy "drift" and disagreement. Formalizing coordination through legal mechanisms can bring structure to navigate complexity and provide some stability.

The Rules about preemption – where a decision or rule of one level of government prevails over another – do not remove the need for coordination to respond to cumulative environmental problems. These rules tend to apply to inconsistent regulatory *intervention*, rather than *conceptualization* or *information*. Coordination is required across all functions.

Key design features of regulatory mechanisms associated with coordination (see Figure 7.2):

- Rules for coordination tend to take two major approaches. One approach
 is establishing and using an institution as coordinator, often across multiple functions, for example, a general intergovernmental standing committee. Another approach is facilitating coordination through rules, such
 as a duty of one government actor to cooperate with or consult
 with another government or nongovernment actor in intervening to
 address a problem, or a duty to notify or share information with another.
 Both approaches can support dealing with cumulative environmental
 problems.
- Coordination mechanisms can expressly provide for dealing with policy "drift" and resolving disputes between regulatory actors where the cumulative environmental problem is regulated by multiple agencies or levels of government.

Integration with rules for other functions: The purpose of rules for coordination is to ensure that coordination among government actors and with nongovernment actors occurs in undertaking the other functions of the CIRCle Framework: conceptualization, information, and regulatory intervention.

Chapter 7 ("Coordination") sets out illustrative examples of legal mechanisms that include these design features, drawn from around the world. The South Tyrol case study (Chapter 10) analyzes coordination among regulatory mechanisms for intervention that are used across vertical levels of government, also involving nongovernment actors, to maintain and restore Alpine meadows as biocultural landscapes.

Next steps: Moving from analysis to implementing changes

While it is beyond the scope of this book to discuss implementation issues in any detail, and many others offer analysis that is likely to be as relevant for cumulative environmental problems as for other kinds of problems,³ a brief word is warranted. Cumulative environmental problems can engage so many laws that **prioritizing reforms to address gaps and weaknesses emerges as a key issue**. Issues such as urgency; political viability; resource constraints; and legal, technical, and administrative barriers are all relevant to consider when prioritizing changes (as they always are). But the special characteristics of cumulative environmental problems point to some additional considerations in prioritizing change:

- Reforms confront the challenge of building consensus (or perhaps grudging acceptance) across many diverse actors. Approaches to building consensus about reforms can be the foundation for enduring coordination mechanisms. Establishing these mechanisms is likely to be a priority, since coordination is required across multiple regulatory functions. Formalizing coordination mechanisms may be a relatively easy starting point: They do not directly require anyone to change activities that contribute to the cumulative environmental problem though they may indirectly raise issues about regulatory "territory." Coordinating about information can be an easier entry point for relationship building than starting to talk about intervention or the fine details of conceptualization.
- If dramatic reform is required but is not feasible in the short term, consider working from what you have. This might mean collecting better information about compliance with existing rules using simple technology, prioritizing the enforcement of existing rules based on cumulative risk to the matter of concern,⁴ or closing loopholes in existing rules.⁵ Developing experience with voluntary interventions (carrots and sermons), or with sticks applied to smaller pilot areas, can pave the way for more generally applicable sticks where and if they are required.

See, e.g., Karoline S. Rogge and Kristin Reichardt, "Policy Mixes for Sustainability Transitions: An Extended Concept and Framework for Analysis" (2016) 45 Research Policy 1620–1635, 1625–1626 (re policy processes and policy implementation); Sebastian Sewerin, Benjamin Cashore and Michael Howlett, "New Pathways to Paradigm Change in Public Policy: Combining Insights from Policy Design, Mix and Feedback" (2022) 50 Policy and Politics 442–459 (re paradigmatic policy changes).

⁴ See, e.g., Table 6.5, row 1.

⁵ See, e.g., several approaches to this in Section 6.5.2.

• Since cumulative harm is often nonlinear, it can manifest as a step change in the conditions of a matter of concern. A high-profile incident can be a window of opportunity for reform. A massive coral bleaching event on the Great Barrier Reef allowed its Marine Park Authority to contemplate greenhouse gas regulation for the first time, albeit in a largely symbolic way, creatively reinterpreting its regulatory jurisdiction. Severe drought, along with other factors, triggered California's inaugural and long-overdue general groundwater management law, which provided the first meaningful path to protect drinking water sources for some disadvantaged communities.

11.5 GUIDE TO THE CASE STUDIES

The case studies in this book are illustrative rather than comparative. Diversity drove their selection. Each case study illustrates different parts of the CIRCle Framework and its application to diverse areas of law and legal mechanisms across diverse jurisdictions (California/United States, Queensland/Australia, South Tyrol/Italy/European Union (EU), see Figure 1.2) and environments (groundwater, the land–sea interface, and mountain grasslands). Each case study focuses on a central legal mechanism that is often advocated to manage cumulative environmental impacts (bold, Table 11.2).

You may find a case study useful to explore a particular regulatory function in more depth, especially if applying the CIRCle Framework through the above-mentioned steps suggests that that function needs special attention. You might also consider a case study if your situation has similar features in terms of a key element of the legal landscape or a similar matter of concern or type of impact (Table 11.2).

11.6 CONCLUDING CROSS-CASE REFLECTIONS

Though they are illustrative, rather than comparative case studies, when taken together, common themes recur and point to issues for further exploration.

11.6.1 Taking a Panoramic View When Assessing Rules

The case studies show that assessing rules for dealing with cumulative environmental problems benefits from a panoramic view of relevant laws, 8 rather than

⁶ See Section 9.5.4, especially n 171 and accompanying text.

⁷ See Section 8.4.1.

⁸ E.g., see Sections 8.3 and 8.4 (regulatory landscape relevant to managing groundwater for drinking water in California); Table 9.1 (laws relevant to intervening to address the impacts of coal mining and cattle grazing on the Great Barrier Reef); Table 10.1 (laws relevant to intervening to address grassland degradation in South Tyrol).

TABLE 11.2 Key elements of case studies selected for diversity of legal mechanisms and environmental contexts

Case study	Groundwater depletion and environmental justice in California's Central Valley, US	Biodiversity of the Great Barrier Reef, Australia	Alpine grasslands as biocultural landscapes, Italy
Legal landscape for addressing cumulative environmental problem (major focus)	Water resources management plans, safe drinking water, pollution, environmental impact assessment ("EIA"), land use law	EIA and strategic assessment; pollution law; land management standards; greenhouse gas emissions cap; carbon offsets; restoration subsidies	Constitutional protections for landscapes; landscape plans; EIA protected species and conservation areas; farm subsidies; food product certification; farm inheritance law; public acquisition
Levels of governance	State and local laws	International convention, federal and state laws	International conventions, EU, national, provincial and local laws
Matter of concern and impacts in focus	Preventing aggregate withdrawal of water for farms and large cities reducing access to groundwater for vulnerable communities reliant on household or small community wells	Preventing decline in health of the World Heritage Great Barrier Reef due to polluted runoff from catchments and greenhouse gas emissions causing climate change, focusing on catchment grazing and coal mines	Maintaining and restoring biodiverse and culturally valuable Alpine grasslands, countering abandonment of traditional extensive grazing practices and small-scale development
CIRCle Framework functions in focus	Conceptualization and its links to the other CIRCle Framework functions	Information Regulatory intervention Links between intervention and information	Coordination Regulatory intervention Links between coordination and intervention

"tunnel vision" focusing on a single mechanism. This challenges the dominant focus of the scientific literature, at least, on rules for assessing cumulative environmental impacts in the context of environmental impact assessment. The case studies were chosen to explore key mechanisms that practitioners and scholars often advocate as being promising candidates for dealing with cumulative environmental problems. In practice, though, each case study reveals a much wider and sometimes unexpected landscape of laws that deals with the problem in important ways, from laws for groundwater monitoring in California, to minimum land management standards to benefit the Great Barrier Reef, to farm inheritance laws in South Tyrol.

11.6.2 Local Influences and Vertical Coordination

The case studies explore problems at very different scales – Alpine grasslands of a few hectares in South Tyrol, to the over five million hectares of the Central Valley in California, to the thirty-eight million hectares of catchments that drain to the equally large Great Barrier Reef. In each context, but in different ways, local factors matter, regardless of the scale of governance. In South Tyrol, local cultural identity links strongly to Alpine grassland landscapes as a matter of concern, producing modern interventions based on centuries-old local norms about inheritance. These norms flow from modern provincial law, administered locally, and operate alongside a complex web of provincially administered EU laws for biodiversity and many other relevant areas of law. In the Central Valley, local agencies set thresholds of acceptable groundwater level decline under state law, but some agencies have overlooked the reliance of disadvantaged local communities on groundwater for drinking water. In some areas, this oversight is escalating supervisory responsibility for interventions from local agencies to the state. Intervention to address the decline of the Great Barrier Reef in the face of climate change and catchmentsourced water pollution requires prioritizing actions at the local scale, such as targeting catchment repairs of highly eroding lands. But a key motivator for this action has been international attention through the Reef's World Heritage listing, which produced a large-scale mechanism for information, a strategic assessment.

In other words, large-scale problems can require legal functions tailored to the local scale, and small-scale problems can be influenced by laws at much higher levels. CIRCle Framework functions can connect these scales. For example, a regime of laws may seek to protect something because it is locally important; gather information about how impacts accumulate at a local scale; calibrate interventions with an eye to local factors that affect how effective those interventions will be; and coordinate stakeholders and agencies from the local to the international.

11.6.3 Diverse Interventions, Unaddressed Tensions, and Agriculture

Regulatory approaches have long diversified away from solely using regulatory sticks to change behavior. Carrots, sermons, and state rescue provide other options. Equally, the dominant focus of environment-related law has traditionally been protecting and conserving things (wilderness, species, etc.) by avoiding and reducing harm as the key regulatory strategy. But more recently, environmental legal scholarship has focused favorably on restoration, "rewilding," and repair, 9 more cautiously on offsetting harm through compensatory measures, and less overtly on coping.

Agriculture underscores the importance of taking a wide view of available regulatory approaches and strategies. Food production is a major use of habitable land,10 and has produced a vast literature on sustainability and policy failures.¹¹ The analysis here points to the value of understanding the positive and negative environmental impacts of agriculture in a socially informed, place-based way in the context of a wider range of impacts that accumulate to affect specific matters of concern. Agriculture may be crucial to maintaining a matter of concern (traditional grazing that maintains bioculturally valuable grasslands in South Tyrol), produce a proximate cumulative impact on a matter of concern (irrigation that depletes groundwater in the Central Valley), or act as a distant but cumulatively significant influence on a matter of concern (grazing leading to polluted runoff from the Great Barrier Reef catchments). In all cases, how agriculture happens matters. This can be a challenge for formal rules based on sticks to reduce harm, given historically minimal intervention in agricultural operations, often supported by political factors and cultural resistance to interference. But the case studies present a combination of interventions that defy traditional lack of legal attention to agriculture, using diverse regulatory approaches and strategies.

Each case study involves laws that aim to both protect the matter of concern by reducing or avoiding harm to it, and by offsetting harm, as well as laws that facilitate restoration. Local agencies advance state rescue measures to help disadvantaged communities in the Central Valley cope with declining groundwater levels caused by pumping for irrigation. Regulatory carrots in the form of carbon credits, water quality credits, and funding for catchment

⁹ See, e.g., Afshin Akhtar-Khavari and Benjamin J. Richardson (eds), Ecological Restoration Law: Concepts and Case Studies (Routledge 2019).

¹⁰ Hannah Ritchie and Max Roser, "Land Use" (2019, revised 2024), https://ourworldindata.org/land-use.

¹¹ For a synthesis, see generally, FAO, The State of Food and Agriculture 2023 – Revealing the True Cost of Food to Transform Agrifood Systems (2023).

restoration address the impacts of grazing to the Great Barrier Reef, alongside efforts to breed heat-resistant coral that can better cope with climate change. In South Tyrol, international treaties, European, national, and provincial laws provide for restoring Alpine grasslands and maintaining traditional grazing using economic incentives, noneconomic sermons, and regulatory sticks that formalize local cultural norms.

These regulatory modes are adopted for reasons that are pragmatic (carrots are more palatable to government and regulated stakeholders than sticks) and necessary (restoration appropriately recognizes the ongoing effects of legacy impacts). But they raise questions about tensions with harm-reducing strategies, the comprehensiveness of interventions, and the difficulties of connected decision-making to address cumulative impacts. For example, to what extent are investments in restoration carrots reversed by allowing exemptions for activities that cause new harms of the same kind (e.g., governments paying to restore some Alpine grasslands while EU Common Agricultural Policy exemptions allow ongoing destruction) or a different kind (e.g., incentivizing catchment restoration to reduce water pollution to the Great Barrier Reef, while not intervening comprehensively to mitigate greenhouse gas emissions that also threaten the Reef)?

11.6.4 Establishing and Integrating Functions and Mechanisms Takes Time

None of the case studies is an unqualified success, but each has important design elements that integrate laws for CIRCle Framework functions to deal with diverse accumulating impacts to a matter of concern. In California's Central Valley, the vehicle for this integration is statutory groundwater planning. The key planning law deals with both the quality and quantity of groundwater in aquifers, but is yet to recognize a broader, cumulative view of environmental justice that has been prominent in environmental laws. In the Great Barrier Reef context, although laws dealing with water quality and greenhouse gas emissions are relatively unconnected, a strategic assessment provided a linking function between mechanisms for information and intervention. By contrast, more diverse laws relevant to South Tyrol's Alpine grasslands (which deal with nature, impact assessment, agriculture, and land-scape) are well integrated through express and mutually supportive legislative links.

But in each case, integrating links have taken time to emerge. California's 2014 Sustainable Groundwater Management Act is the state's first comprehensive groundwater legislation, despite a long history of intensive groundwater usage. The first protections for the Great Barrier Reef were enacted half

a century ago, but serious legal attention to catchment-sourced diffuse water pollution and greenhouse gas emissions has arisen only relatively recently. Laws for South Tyrol's grasslands build on centuries-old customary norms as well as decades-old treaties and agricultural incentives that have substantially changed in response to criticisms that they did little to address environmental destruction.

This observation about time is both cautionary and encouraging. Impacts accumulating to things that we care about mean that action is often needed urgently. Sometimes impacts are difficult or impossible to reverse. Where does that leave us, if assembling and linking the right tools is so time-consuming? I have argued that the CIRCle Framework functions of conceptualization, information, regulatory intervention, and coordination are all needed and must be integrated. We must look beyond law as a narrow tool to force behavior change (intervention in the form of sticks), to also recognize and use law as a tool to help us decide what matters, understand it, and take broader action to protect or restore it, together. Taking this wider view of law likely means some or even many elements of the toolbox are already in place. The journey has already begun.