

Practitioner's Guide to Developing
River Basin Report Cards



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Dear Practitioner's Guide user,

We are thrilled that you have expressed interest in using the Practitioner's Guide to possibly develop a report card in your river basin. We hope that this Guide meets your expectations. We see it as a living document that we will improve upon and refine over the coming years. We want to bring in your experience and learning in developing a report card, but more importantly, in using the report card to make your river basin healthier for people, nature, and sustainable economic development. Please contact us on your plans to use the Practitioner's Guide so that we may follow up and learn from each other on the power of report cards to bring real change in river basins for current and future generations.

All the very best and thank you!

Please contact us at wwf.umces.partnership@umces.edu



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Practitioner's Guide to Developing River Basin Report Cards

Forward

About this Guide

Chapter 1. What is a river basin report card?

Introduction	3
What is a river basin report card?	4
Anatomy of a river basin report card	5

Chapter 2. Why do a river basin report card?

Introduction	9
Socialize science	10
Lead to revelations	11
Increase awareness and enhance management	11
Provide balance among competing values	12

Chapter 3. Getting started

Introduction	15
Enabling conditions	16
Determine the conceptual scope	17
Identify staff and secure commitments	17
Secure adequate funding	19
Define spatial boundaries	20
Identify key stakeholders	21
Plan the workshop	23
Stakeholder workshop tips	25
Set up steering and technical committees	26
Develop an evaluation strategy at onset	27
Develop a communications strategy	28
Find a champion	29
Create a realistic timeline	31

Chapter 4. Creating a river basin report card

Introduction	35
Step 1: What is the big picture?	37
Step 2: What do we measure?	39
Step 3: What is healthy?	41
Step 4: How does it add up?	43
Step 5: What is the story?	47

Chapter 5. Empowering change

Introduction	51
Case Study: Chesapeake Bay Report Card	53
Case Study: Laguna de Bay Report Card	54
Case Study: Chilika Lake Report Card	55
Case Study: Healthy Waterways and Catchments Report Card	56
Case Study: Orinoco River Basin Report Card	57
Case Study: Mississippi River Watershed Report Card	58

Chapter 6. Overcoming barriers

Introduction	61
Overcoming resistance and vested interests	63
Cultivating champions and host institutions	65
Incorporating climate change	67
Working across trans-boundary river basins	69
Insufficient data	71
Mobilizing civil society	72
Adapting to external impacts or influences	73
Maintaining momentum	75

Foreword



Water has finally risen to the forefront of global attention. The challenge ahead of us is turning awareness into action, and driving decisions that lead to healthier river basins. Decisions that impact how water is managed are often made behind closed doors and without enough information. This can lead to unsustainable choices. Environment is seen as the user to be considered last, or even

ignored, until “enough” development or funding is in place. However, this ignores the basic fact that healthy river basins mean healthy children, people, communities, businesses. As the world grappled with the creation of the United Nation’s Sustainable Development Goals (SDGs), one of the challenges was how to accurately determine if river basins are getting healthier—or, as is often the case, understand where and why are they getting worse. Through our partnership with the University of Maryland Center for Environmental Sciences we hope to help fill this gap. What a different discussion it would have been in developing SDG Goal 6 on Clean Water and Sanitation if we had a report card for every river basin of the world. But it is not too late. This Guide is intended to spur report cards in every region of the world, so that better river basin health is owned by everyone. The aim is not to point fingers, but to drive investments, decisions and actions toward sustainable water management. When the global community comes together in 2030 to evaluate progress against the SDGs, we hope that you have made use of this Guide so the river basins you care about are on the path to being healthier—for current and future generations.

Carter Roberts
President and CEO
World Wildlife Fund



Regardless of the region of the world, our water problems are often defined as a failure of governance. This is the case whether it is a river basin that is over-allocated, or one suffering from poor water quality, or even a river basin that is currently pristine but facing enormous development pressures. How do we build good governance in river basins so decisions are based on science, take into account the interests of all stakeholders and the environment, and effectively allocate resources for current and future uses? The University of Maryland Center for Environmental Sciences started developing report cards over 10 years ago. The idea was to bring science and stakeholders together to give river basins grades. A parent can’t help a child improve their math or reading skills if the parent doesn’t have any sense of how they child is performing. There is no point in spending time helping the child with subtraction when the child in fact needs help with addition. The same can be said for how we try to improve our river basins. In a world where we do not have the luxury of unlimited financial resources, investments by governments, businesses or communities need to be strategic and effective. We came together with the World Wildlife Fund with a vision to make science-based, stakeholder driven report cards the foundation for building good water governance. Water is local. Each river basin is different. But this Guide provides the tools and resources regardless of where you may be in the world to help ensure that river basins of the future are healthier for people and nature.

Donald F. Boesch
President
University of Maryland Center for Environmental Science



About this Guide

We have developed this Guide for you, the user—government or non-profit employees, development officials, river basin managers, private sector representatives, community organizers, academics, journalists, and any and all interested in the health and future of our freshwater resources. Whether your interest is in an overview of river basin report cards and their utility, or in the mechanics of report cards and leveraging the process and results to drive change, this Guide was developed for you. We intend for it to be a reference and resource for those either on the path of developing a report card or exploring the possibility of pursuing one.

For an overview of report cards and why they are important, turn to Chapters 1 and 2. To delve into the mechanics of report card development and the step-by-step process, visit Chapters 3 and 4. For insight and guidance on how the report card process and results can be leveraged to drive changes in water resources policy, management, and investment, consult Chapter 5. And, finally, for troubleshooting and ensuring that you are ready to address any challenges that may arise along the way, refer to Chapter 6.



Waterbody in the Meta River basin, Colombia. Photo courtesy of Catherine Blancard, WWF.



Orinoco River, Colombia. Photo courtesy of M. Kohut.



**What is a
river basin report card?**



Mekong River, Cambodia. Photo courtesy of Nicolas Axelrod / Ruom and the Luc Hoffman Institute.

What is a river basin report card?

Introduction

In this chapter, we introduce the concept of report cards and provide an overview of their structure and purpose in communicating the health of river basins to decision makers and the general public. We also provide an overview of the anatomy of a report card and the core components necessary for the highest level of effectiveness.

Defining a river basin

A basin is an area of land that drains all the streams and rainfall to a common outlet, such as the mouth of a river flowing into the estuary or ocean, or any point along a stream channel (Figure 1.1). The word “basin” is sometimes used interchangeably with “watershed” or “catchment”. A basin consists of the land surface, associated surface water—lakes, streams, reservoirs, and other wetlands—and all the associated underlying ground water. Larger basins contain many smaller sub-basins. All of the land that drains water to the outflow point is the basin for that outflow location¹.



Figure 1.1 This example of a river basin shows the many tributaries that drain from the watershed into the mainstem of the Mississippi River.

¹ Basin definition from USGS (<http://water.usgs.gov/edu/watershed.html>).

What is a report card?

Report cards are assessment and communication products that compare ecological, social, and/or economic information against predefined goals or objectives (Figure 1.2). Similar to school report cards, river basin report cards provide performance-driven numeric grades or letters that reflect the status of a river basin on a regular basis. They effectively integrate and synthesize large, and often complex, information into simple scores that can be communicated to decision makers and the general public (Figure 1.3). With expanding digital connectivity around the world, river basin report cards can reach even larger audiences and provide transparency and scientific information to help us make good decisions.

Report cards enhance research, monitoring, and management in several ways. First and foremost, the process of developing a report card facilitates interaction among people, governments, and industries who have different agendas, perspectives, and levels of awareness—often leading to a shared vision of what the future will be, and what is needed to get there. For the research community, report cards can lead to new insights through multi-disciplined data analyses that reveal patterns not immediately apparent, help design a conceptual framework to integrate scientific understanding and ecological and socio-economic values, and to scale approaches that allow for comparison in time and space.

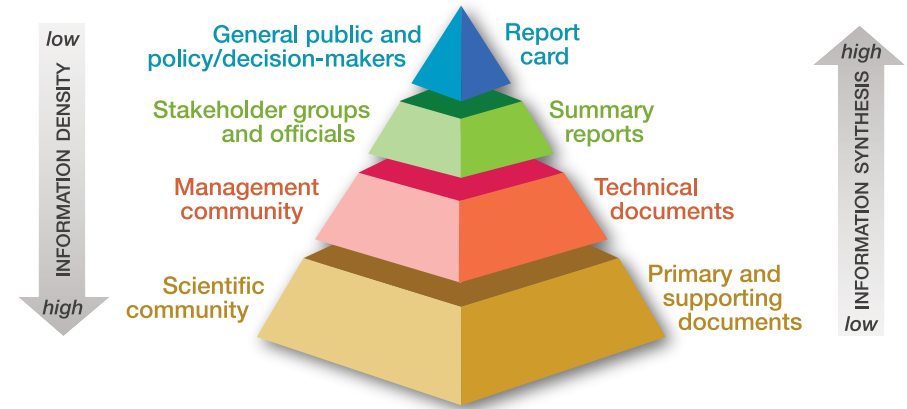


Figure 1.3 This pyramid depicts where report cards fit within the spectrum of information density and information synthesis. Report cards act as the ultimate synthesis tool for communicating large amounts of information relevant to policy and decision makers, and the general public.

By providing timely and relevant basin status updates, report cards have the added benefit of accelerating management and community response. For basin managers, they provide both accountability and focus by measuring the success of restoration efforts and identifying impaired regions or issues of concern that require resource attention. These elements catalyze improvements in basin health through improved public awareness, peer pressure between communities, and more informed decision makers.

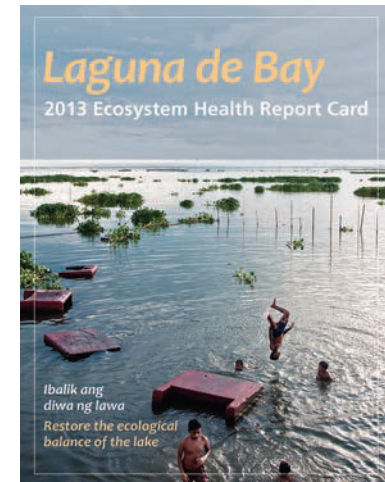
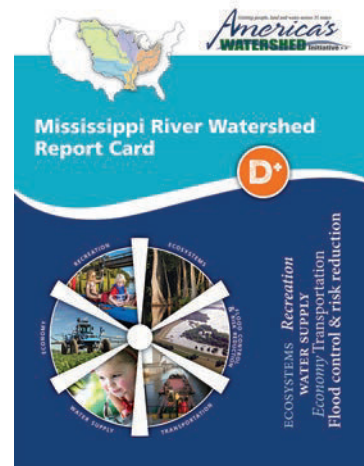
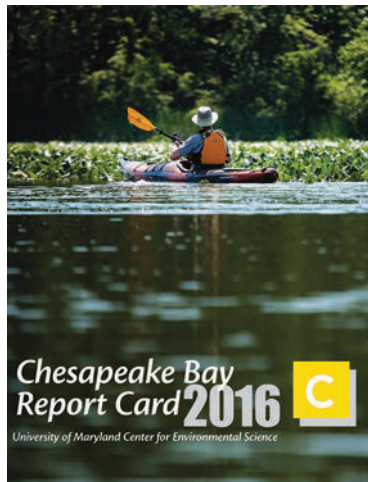


Figure 1.2 Examples of ecosystem health report cards. Source: UMCES.

Anatomy of a report card

Report cards should contain key sections and graphic components that ensure that the scientific results are communicated in a visually appealing and informative manner. We recommend that report cards be graphically rich, with at least 50% of the available space devoted to graphics and photos instead of text. Include graphics, data maps, data graphs, and relevant photos that clearly communicate results, processes, or issues. Also acknowledge those individuals and institutions that were involved in the development of the report card, including logos and e.g. group photos.

Map with regional description

Include a map that clearly provides the spatial area covered by the report card (Figure 1.4). This can provide not only the local context, but the regional and global context so that a reader can know what part of the world the report card is addressing, the local conditions, and key geographic features important to the region.

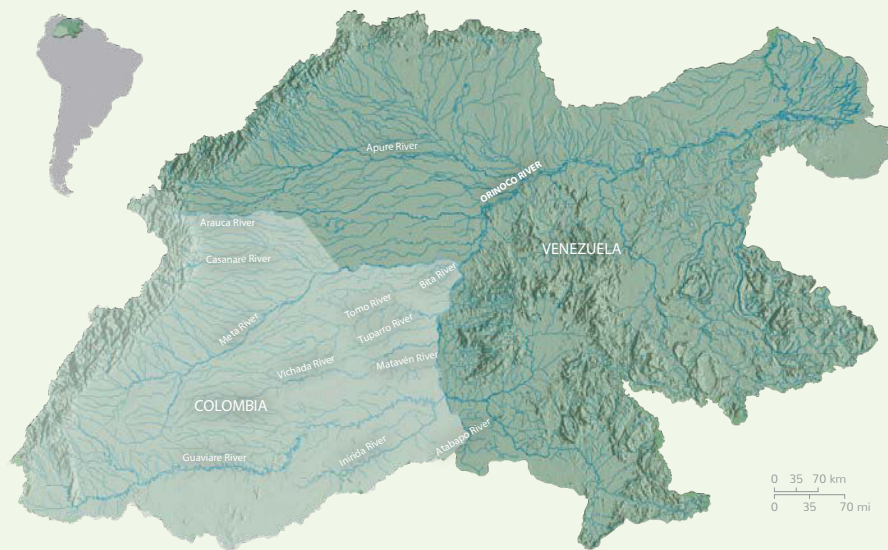


Figure 1.4 Map of the Orinoco River Basin highlighting the region of interest in the report card.

Key values and threats

Provide a section that summarizes the key features and threats addressed in the report card (Figure 1.5). A conceptual diagram is an effective visualization tool used to communicate the interactions of environmental, social, and economic values.



Figure 1.5 Indicators of basin health for the Orinoco River Basin Report Card.

Indicators and thresholds

Describe the indicators selected to evaluate river basin health. Graphic representations will provide additional identification (Figure 1.5). The process by which the indicators were chosen and how they are to be measured is equally important.

Grades and results

Use a grading scheme and representation that is easy to understand. Grades, whether alpha or numeric, provide a clear communication of the results of the indicators across categories (Figure 1.6).

Use spotlight colors that reflect the health of the indicator (Figure 1.7). For example, the use of red connotes the need to ‘stop’, consider that something is seriously wrong, and that some major intervention is required. Conversely, the use of green indicates that it is OK to ‘go’, that the status is very good, and it is acceptable to continue with current activities. Different terms may be used depending on the local norms and expectations.

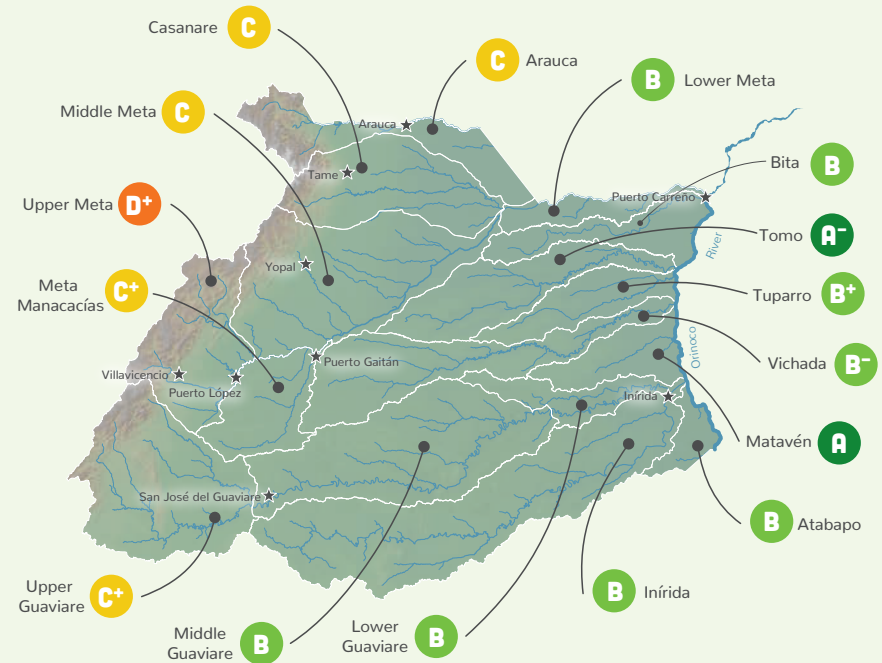


Figure 1.6 Individual region grades throughout the Orinoco River basin.

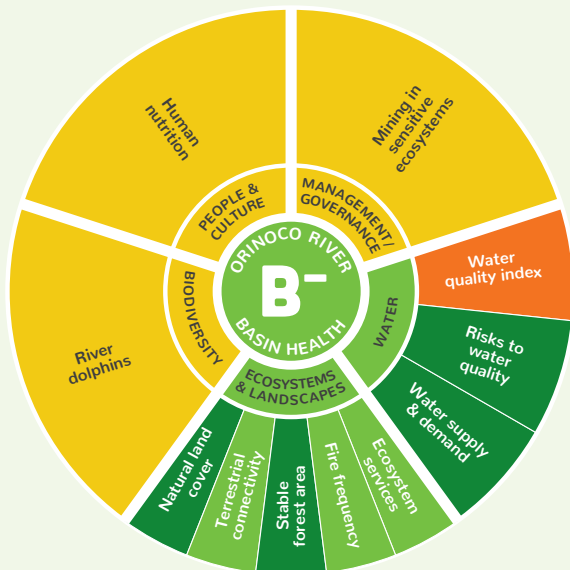
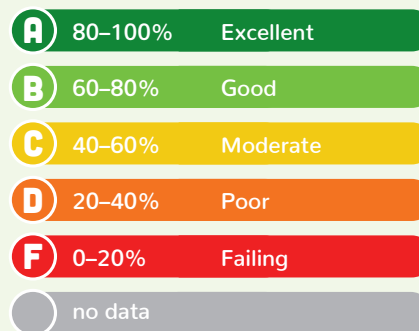


Figure 1.7 Overall grade for the Orinoco River Basin Report Card and spotlight color grading scheme.



Findings and recommendations

Outline what the grades mean, key findings (supported by data), and recommend actions that could be implemented to improve river basin health—which will be reflected in future report cards.

Encourage involvement

Suggest how the report card readers can make a difference in their river basins. Depending on the scale and goals of the report card, this section can include specific things that can be done in a village or on a household scale, or can include actions like supporting policy decisions to improve wastewater treatment.



Villagers prepare to pump water from the Mekong River, Cambodia. Photo courtesy of Nicolas Axelrod / Ruom, Luc Hoffman Institute.



**Why do a
river basin
report card?**



Orinoco River, Colombia. Photo courtesy of M. Kohut.

Why do a report card?

Introduction

We acknowledge that report cards can provide multiple benefits. By engaging stakeholders and providing easily understandable interpretation, they socialize science and create a shared understanding of the issues facing a river basin. They provide a concise, big-picture understanding of the condition of a basin that can lead to new insights and increase awareness of important issues. By engaging stakeholders directly in the process of creating a report card, we are provided a holistic view that helps balance competing uses and values.

Ultimately, a report card is intended to catalyze management action and stakeholder engagement that leads to improvements in river basin health (Figure 2.1). Because report cards are data-driven, geographically detailed, and transparent, they lead to shared understanding of regional or use-based differences in condition. This understanding not only increases awareness of important issues by examining differences in condition, it also allows better insights into what works and, as report cards are repeated over time, allows insights into whether interventions to raise the grade are having the intended effects.

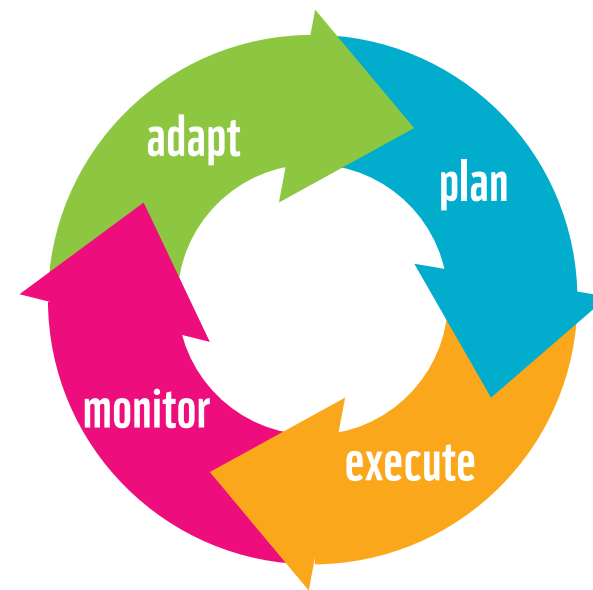


Figure 2.1 Adaptive management is a decision process that promotes flexible decision-making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood. Adaptive management does not represent an end in itself, but rather a means to more effective decisions and enhanced benefits.

Socialize science

River basin report cards provide readily accessible, synthesized, and interpreted information to a wide audience. Traditionally, scientists share their results with their colleagues through a peer review system of scientific publications. These scientific publications or journals generally have restricted access and are difficult to obtain outside of academic libraries, and are difficult to understand due to the high level language used in them. But report cards provide a means of delivering accurate information in a timely manner to broad audiences in a more comprehensible language.

To produce a report card, consult various stakeholders, including scientific experts, to help select indicators, determine thresholds and obtain data, as well as help with the data analysis and interpretation. In particular, scientific and technical experts are helpful in providing review of methods and results of data analysis. Your report card should include extensive consultation with managers, decision makers, and stakeholders, and communicate results to a wide audience. This distinguishes river basin report cards from scientific publications, in that consultation is open to as many relevant stakeholders as you can include. Publish results using non-technical language and in local

languages (Figure 2.2), and support the results with graphic elements like maps, diagrams, figures, and photos.

Every step in creating a report card involves a diversity of stakeholders (Figure 2.3). Stakeholders are consulted to develop reporting regions, select indicators, define the period of the year to integrate measurements, and the units and measurement techniques. The report card scoring, design, layout and color palette for the final product is done in consultation with your key partners.



Figure 2.2 The Samoa 2012 Report Card was produced in English and Samoan. Source: UMCES.



Figure 2.3 Participants in these workshops in Zanzibar, Tanzania, ranged from scientists, local resource managers, government or military personnel, to local fishermen and village elders. Photo courtesy of Jane Hawkey.

Report cards usually receive extensive media coverage. This media coverage aids in the broad dissemination of results. Ultimately, good science addresses fairly basic questions phrased in a manner that is easily understood by a wide audience. The technologies and analyses used to answer these basic questions are often very sophisticated and difficult to explain. But they can be written in the same manner that the original question is framed. In terms of your river basin report card, the basic question is “How healthy is your basin?” This question takes many people and many measurements to answer, but the answer can be equally simple using the report card scoring approach.

Employing a stakeholder-driven approach for developing report cards is a process that attempts to engage and solicit input and support from all sectors of society that depend on, or impact, river basin health.

Lead to revelations

The process of developing report cards can lead to new and important insights. By integrating data and providing data visualizations, patterns in the data emerge that may not have been previously apparent.

We saw this happen when a prototype report card was being developed for the Great Barrier Reef in Australia, shown in the case study below.

CASE STUDY

Great Barrier Reef

Dr. Bill Dennison, Vice President for Science Application
University of Maryland Center for Environmental Science

A scientific workshop was convened with water quality experts, ecologists, and resource managers to select a suite of indicators, establish thresholds, and calculate scores for a reef report card. We divided the Great Barrier Reef into six reporting regions and selected a variety of independent water quality, coral, and seagrass indicators to generate scores for each region. Our unexpected insight was when we saw that the Burdekin region scored consistently and appreciably lower than any of the other reporting regions. But it was not clear why this section was so degraded. A 2003 book *“Catchments and Corals: Terrestrial Runoff to the Great Barrier Reef”* by Miles Furnas², provided the overwhelming data—the large Burdekin River catchment was very heavily impacted from grazing and agriculture with the highest concentrations of suspended sediments and nutrients in sporadic runoff events. And, in fact, when we looked at a map, we could see that, offshore of the mouth of the Burdekin River, the Great Barrier Reef was relatively depauperate in reefs compared with the rest.

On reflection, in spite of having spent decades (and collectively, centuries) studying various aspects of the Great Barrier Reef aboard ships and at research stations, we still had not seen this overall pattern of impact from the Burdekin River on the Great Barrier Reef. The report card process provided us with a novel insight which was so obvious once we saw it. The lesson was the value of integrating disparate indicators—the integration provided new insights, even to those of us closest to the process. The revelation forever changed our view of this Great Barrier Reef ecosystem.

Increase awareness and enhance management

Report cards can make large and often complex amounts of information universally understandable to a broad audience using basic principles of communication, like alpha or numeric grades and stoplight colors which most people are familiar with from primary school (Figure 2.4).

For resource management, report cards provide accountability by measuring the success of restoration efforts and identifying impaired regions or issues of concern. In addition, they justify continued monitoring by providing timely and relevant feedback.



Figure 2.4 The Mississippi River Basin Report Card used both alphabetic grades and stoplight colors to represent ecological health scores for the five sub-watersheds.

2 Furnas, M.J. 2003. *Catchments and Corals: Terrestrial Runoff to the Great Barrier Reef* Australian Inst. Mar. Sci.

Provide balance among competing values

Report cards can integrate social, economic, and ecological information in a way that acknowledges the balance between these often competing values (Figure 2.5). Reporting on categories of values can provide a holistic view of an interconnected system. In some cases, there will be win-wins, where the delivery across values will be in harmony. However, we find potential trade-offs between delivering on one category of values relative to the others. For example, the opening of a canning facility may deliver a large quantity of river-dependent employment, but the effluent from the cannery may limit the availability of socially and ecologically important resources. Recognizing these inherent trade-offs provides you the opportunity to consider creative solutions that can support multiple perspectives.

The three pillars of sustainable development—social, economic, and ecological values—can be described as follows.

Social

The social and cultural values (e.g., aesthetics, recreation, cultural and spiritual uses, access to food, clean water, electricity) that a river basin provides are numerous, and often are some of the most convincing arguments to the general public for maintaining river health. Examples of social value indicators include provision of tribal fisheries, recreational opportunities, flood control and risk reduction, and ecotourism.

Economic

As evidenced by human settlements adjacent to rivers, they have always provided vital components to human economies. Examples of economic indicators (e.g., industry, transport, energy, agriculture, tourism, fisheries) in report cards include commercial navigation and river-dependent employment.

Ecological

At its core, any measurement of river health must include a thorough assessment of ecological values (e.g., chemical, sediment, species, flow, habitat, biochemical processes). Examples of ecological indicators in report cards include: habitat indicators such as floodplain forest, aquatic grass cover, or channel complexity; water quality indicators such as nitrogen, phosphorus, toxic chemicals, or dissolved oxygen; flow regime indicators such as peak flows or water stress; and bio-indicators such as benthic community or native fish.



Figure 2.5 Indicators should reflect



Meta River, Colombia. Photo courtesy of Catherine Blancard / WWF.



3

Getting started



Yangtze River, China. Photo courtesy of Andrew and Annemarie / Flickr Commons.

Getting started

Introduction

Before developing a river basin report card, it is important for you to scope the situation and address certain issues that can increase the likelihood of success. We recommended that practitioners assess the status of enabling conditions (such as political will and adequate funding), so that you have a clear understanding of the objectives and scope of the report card, and have thought through project planning elements like logistics, communications, stakeholder engagement, and evaluation. Spending time to work through these elements will improve the likelihood of your report card meeting its objectives.

A cause brings about an effect, whereas an enabling condition makes the effect possible. It is important, but not always easy, to distinguish the two. This is true with river basin report cards—you may have all the pieces ready, but unless the surrounding climate is just right, these pieces may not come together as planned.

In chemistry, activation energy was introduced in 1889 by the Swedish scientist Svante Arrhenius to describe the minimum energy which must be available to a chemical system with potential reactants to result in

a chemical reaction (Figure 3.1). The reaction requirements outlined by Arrhenius are analogous to the effort required during a report card's lifetime. The first report card is always the most demanding from a human and cost resource standpoint. Subsequent report cards for the same region become easier over time, even to the point of automation.

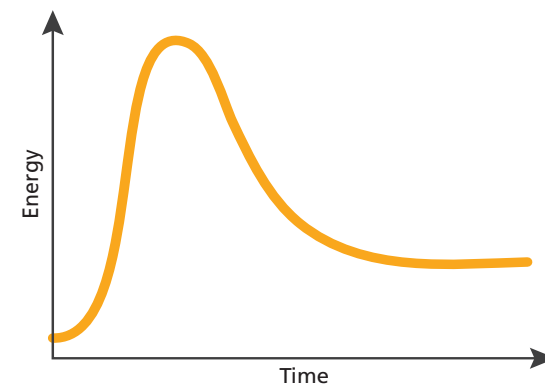


Figure 3.1 The activation energy required to start a reaction is always much larger than the energy required to sustain a reaction.

Enabling conditions

There are many elements that consistently appear on the journey to successfully developing a river basin report card. Some of those elements, probably a little less apparent, yet imperative to success, is the political, social, and economic climate surrounding the process. There are six enabling conditions that we have identified as supportive elements for the development of a successful report card (Figure 3.2).

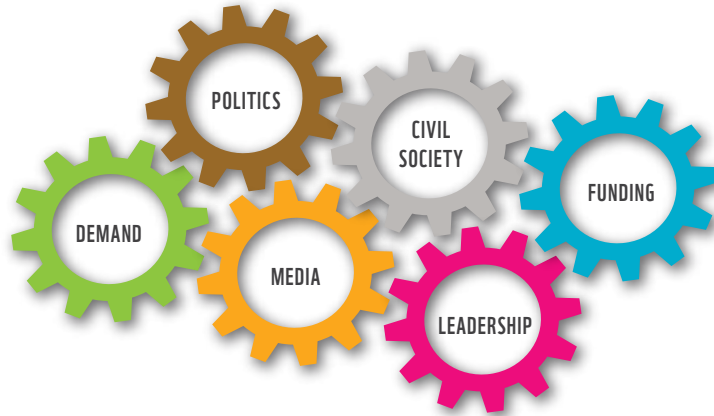


Figure 3.2 The six enabling conditions required to successfully create an effective river basin report card.



The desired outcomes of report card adoption, ownership, and continued implementation and use are best achieved in situations in which stakeholders identify a need for a report card within their river basin and then decide to pursue creation of a report card. Hence, it is useful to socialize the concept with stakeholders of the river basin by visiting them, outlining the concept, and jointly creating a vision for what the report card can offer for improved system management.



Inclusion and support of government officials in the report card process can boost involvement of stakeholders, adoption of findings, and influence implementation of report card recommendations. Senior government officials or politicians do not need to attend the entire workshop or be present throughout the entire process, but it is useful to have at least a representative involved that can keep the momentum throughout.



The strength of civil society varies around the world. Where civil society is strong, the capacity for developing, sustaining, and/or responding to a report card in a free and open manner is higher. Developing and implementing a report card within a society that does not have free speech, or a mechanism for change from the bottom up, will create challenges that will need to be overcome (read more about mobilizing civil society in chapter 6). A functioning civil society is not a prerequisite to an effective report card, but the process will likely need to be adapted in situations where civil society is weak.



Developing a report card, particularly for the first time, will require capital and human resources. Funds will be required for staff salaries to begin the process of planning (stakeholder engagement, workshop preparation, communications) and general expenses (venue rental, printing of materials, stationary, travel, stipends for participants, food for breakout sessions, and accommodations). Securing initial funding throughout the report card socialization process can often be used to leverage more funding as the report card development process is underway—we have seen the value of report cards become more evident to potential funders once the process was underway.



As with any project, effective leadership by an individual or team is essential to the success of a report card. Developing a report card involves many moving parts that need to be organized, scheduled, and executed over an extended period of time. Identifying a point-person to manage all of this is paramount.



The power of a report card rests heavily in the response to its results. As such, proactive communications throughout a report card's development is critical to its success. Plan for and implement outreach to target audiences, such as mass media, from the onset. If possible, stage a press event at a relevant location within the river basin for the launch of the report card project.

Determine the conceptual scope

A fundamental question to resolve at the beginning of your report card project is: what will this report card include? This vision should be communicated to all participants, so that everyone is working toward the same, shared objectives. Scoping issues include:

- Clearly identify the boundaries of the region to be included in the report card. A report card is normally bounded by a river basin drainage boundary, but these boundaries may be interpreted differently, or different versions of the boundaries may exist. Additionally, the report card may be targeted to a smaller sub-basin or portion of the larger river basin. See more details on page 20.
- Identify the extent of issues to be included. Report cards can be used to evaluate a host of ecological, social, and economic values. A balance should be reached between what is important to the stakeholders and what is achievable given data, funding, or other constraints. Ideally, indicators that reflect the six major categories of river basin health will be included. For more about categories of river basin health, refer to Choosing Indicators, page 39.
- Differentiate between Pressure-State-Response factors. A common question is how to include key threats that influence the condition of the system, and what is being done to improve conditions. Although these are important factors, we usually report them separately: e.g., we could

have a system in poor condition (State), but for which many restoration efforts (Response) to reduce threats (Pressure) are underway. An average of these metrics may result in a relatively good score, even while the conditions are still poor. We usually consider the State of the system as the most important score, which integrates the effects of all of the Pressures and Responses (Figure 3.3).

- Additional issues may be important to report card stakeholders or supporters, and care should be exercised to include specific issues that are important to the regional context. These issues can be included strategically.

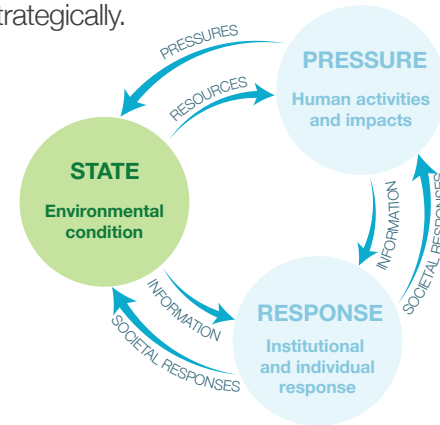


Figure 3.3 The Pressure-State-Response model is a reference for tracking environmental trends. However, it is the State of the environment that is the focus of an river basin report card.

Identify staff and secure commitments

Build your team

Roles within the core project team should be clearly defined. The first report card is the most labor intensive and can include unexpected obstacles. For this reason, high level institutional buy-in and commitment to the project can be an important factor for its success. Leadership by these institutions must be willing and able to step into tricky situations and leverage their position to resolve potential issues that may arise.

Additional to the key project roles, the project team carrying out the report card process will need to possess a few critical skill sets (Table 3.1). These can either be held within the teams, contracted through consultancies, or even brought in through partnership with other institutions. In some cases, these skill sets may need to be fulfilled by more than one individual.

Table 3.1 Critical skill sets that will be needed throughout the report card process.

Skill	Specific capabilities
Project management	<ul style="list-style-type: none"> • Experience in tracking expenditures and managing project budgets. • Personnel and stakeholder management. • Scheduling meetings, and managing timelines and deliverables. • Logistical organization.
Communications	<ul style="list-style-type: none"> • Ability to effectively engage media and the public. • Knowledge of key software packages (e.g., Adobe Creative Suite) in order to produce visually appealing and information rich report card products. • Strong writing skills in order to produce written content for the report card itself as well as related communications pieces.
Science	<ul style="list-style-type: none"> • Competency in relevant scientific fields (e.g., ecology, hydrology, social sciences, economics, etc.). • Ability to compile data. • Ability to process data. • Familiarity with data analysis tools (e.g., ArcGIS, MS Excel). • Advanced knowledge of indicators including knowledge of what constitutes a good indicator, and how to calculate indicators including best practices for setting thresholds.
Knowledge of regional, local and cultural landscapes	<ul style="list-style-type: none"> • Assist in identifying stakeholders and running workshops. • Understand cultural sensitivities. • Assist with data collection and language edits.
Stakeholder engagement and activation	<ul style="list-style-type: none"> • Knowledge of the stakeholder landscape. • Ability to identify influential players. • Proven success at the formation of strategies for how processes similar to the report card can be used to influence various audiences including politicians, resources managers, and private sector, among others.
Facilitation	<ul style="list-style-type: none"> • Good facilitators are essential for all stakeholder workshops. Due to the technical content of these workshops, it is sometimes necessary to both have a general facilitator in addition to a technical facilitator who can objectively ensure the credibility of the technical outputs of workshops.
Report card experience	<ul style="list-style-type: none"> • Expertise and/or experience in report card development.

Secure adequate funding

The process of developing report cards is as important, if not more important, than the product itself. It is stakeholder-driven, which means that you must have sufficient funding for stakeholders to meet and define the values for your river basin, review the draft scores, and discuss the ways in which the report card will be used. If funding is not available to begin the process for your entire region of interest, the process can begin with developing a report card for a sub-basin. It is possible to then add sub-basins or parts of a river basin as you find more funding, but it is good to have an overall vision and be strategic on how this will be achieved. Also, a report card can begin even if only partial funding is in hand. The report card can continue to proceed as fundraising for the remainder of finances continues.

Determine your budget

Your budget should have four main components:

- staffing and consultancies
- travel
- workshops
- communications and evaluation

In addition, you may have indirect or other operational costs to include. Estimate how much you will need without considering how much funding you may have available. Look realistically at what you think it will cost to conduct an effective process where the conclusion will be a credible report card owned by the stakeholders. This process may take one year or more to develop. It is important to remember that even when you have the draft report card, you are not done. The process of socializing the draft is critical and these costs need to be included.

Salaries and consultancies—Most of your funding will be required for salaries or consultancies. Consider staff or consultants that have the skills outlined in Table 3.1, such as project management, policy, science, technical aspects of water resource management, communications, and workshop facilitation.

Travel—You may be able to bring stakeholders together in urban areas, but your river basin may require travel to remote regions. Consider who will need funding for travel, not only staff and consultants but perhaps some key stakeholders as well as a steering committee, if you have one.

Workshops—Depending on the river basin, you may need to conduct several workshops in order to involve all stakeholders. The workshops typically last 2-3 days and require factoring in all costs of venue, lodging, food, materials, local transportation, and translation (if needed).

Communications and evaluation—Your report card success depends on communications, so include sufficient budget for production of not only the draft and final products, but also other materials (e.g., methodology or summary reports, website, blog). You will want to develop these materials for various audiences such as policymakers, management institutions, and the public. Additionally, budgeting to evaluate the reach and impact of your report card can help you better understand if objectives were met, identify shortfalls, and help guide future activities.

Identify funding sources

As with your stakeholder identification, you should map out all potential funding sources for the report card. Think broadly, so not just funders interested in freshwater, but also potential donors interested in supporting improved transparency, democratization, technology and data, and climate change. Consider whether the **private sector** could give through their corporate social responsibility or stewardship programs, or even wealthy individuals or families. **Foundations** provide funding through grants and other mechanisms. Even with countries that do not have a long history of philanthropy this is evolving, so think as broadly as possible. Academic institutions are also great to consider.

Government and other associated institutions, including traditional foreign bilateral donors, but also various other government agencies in your country might have discretionary funding sources. Consider contacting various embassies that may be able to help identify potential donors.

Define spatial boundaries

Early in the report card development process, it is important to define the spatial boundaries of the region that your report card will cover. Defining boundaries provides a scope for the information that needs to be sourced and informs the stakeholders who need to be involved. These boundaries are sometimes already delineated, which can be a good point for you to begin the process. For example, spatial boundaries can be defined by:

- river basin/watershed boundaries (Figure 3.4),
- physiographic boundaries,
- political boundaries,
- eco-region boundaries, and
- management boundaries.

Report cards rarely provide only one grade—rather the area of interest will be divided into multiple reporting regions that are analyzed, scored, and graded individually: enabling comparison between regions and providing information on a finer scale. This allows grades to be more sensitive to change over time, again as a result of not averaging/rolling up scores. Methods for defining reporting regions (in addition to those previously stated for defining the overall reporting region) can include:

- habitat types,
- salinity regimes,
- confluences of river systems,
- physical barriers (e.g., waterfalls, weirs, dams, etc.), and
- land-use transitions.

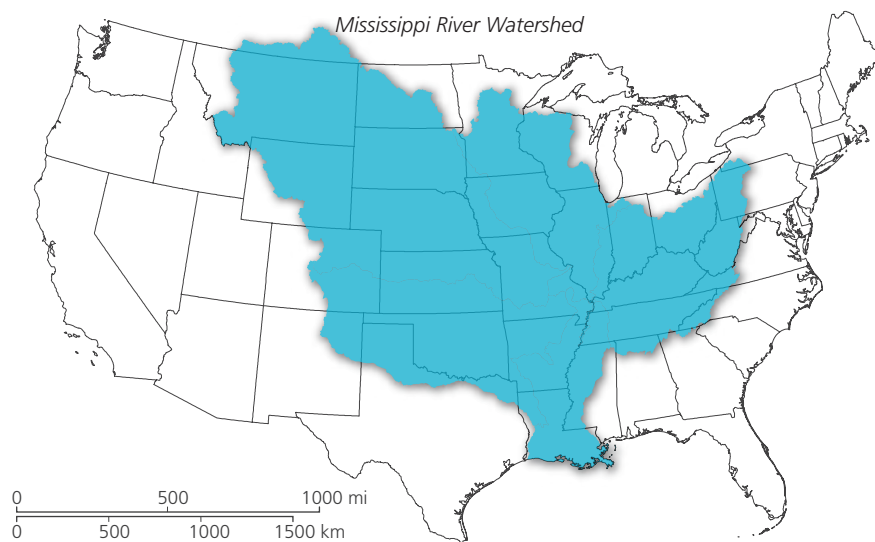


Figure 3.4 In the U.S., the boundaries of the Mississippi River watershed (left) are expansive. With the watershed draining about 41% of the entire U.S., the area was divided into five sub-watersheds for the purpose of a report card assessment.

Identify key stakeholders

Any community is represented by a wide variety of interests and perspectives, making it difficult to know who should be involved in the report card process. In general, it is beneficial to include as many perspectives as possible. Engaging a diverse group of stakeholders early in the report card process is critical to fostering a sense of shared visioning and metrics for measuring progress. Although inclusion is a good principle, it is unreasonable to think that you can convene the perfect group of stakeholders. It is important that you move forward with the report card, even if the representation in the group is not ideal—additional people can always be brought into the process at a later time.

Broad representation is needed

The diverse perspectives that stakeholders bring to the design and implementation phase also increase the relevance of the report card indicators and messages to all important community interests (Figure 3.6). Indigenous groups or communities, agricultural interests, fishing groups, and cultural organizations should all be considered depending on the scope of the report card. The health of the river and basin are important in different ways to each of these groups, and it is important



Figure 3.5 Local fishermen can provide unique perspectives. Photo courtesy of M. Kohut.

that every group understand and respect the position of the other representatives. It is especially important to understand the perspectives of groups that may be under-represented, such as indigenous people.

Adapt and expand the stakeholder group as needed

The stakeholder group that is identified in the beginning of the process may need change as new information becomes available. Groups not included in the beginning may be identified as the project progresses. If, for example, fishing is discussed in an area, then inclusion of a local fishing cooperative would be recommended (Figure 3.5). Be open to modifying the group of stakeholders that are consulted as these types of changes or needs are identified.



Figure 3.6 A diverse stakeholder group may include scientists, local citizens, and the military, all of whom may have an interest and can provide valuable support and insight. Photo courtesy of M. Kohut.

Another sector to consider in the process is the business community. It is important that report card practitioners engage the private sector early and emphasize the business case for their engagement. Many corporations see water simply in terms of efficiency and do not immediately understand that the health of the entire river basin is relevant to their needed water supply. Physical risks such as nutrient, sediment, and toxic pollution can adversely affect the quality and

quantity of their water supply, which can in turn affect their bottom line. Other factors such as loss of key habitats like wetlands and forest may affect their business in ways that they do not fully realize.

Good geographic representation is important

In addition to inclusion of different social sectors, representation may also vary by region. There is likely geographic variation across your river basin in terms of the aspects that stakeholders value, as well as the threats to river basin health. This is especially true in larger watersheds. In this case, it is important you try to include perspectives from different regions. Once again, it may not always be possible to include everyone, but including as much geographic representation as possible is a good rule to follow.

Physical engagement of the group is critical

Our prior experiences have demonstrated the value of having the group physically meet and engage in an activity together. A tour through a section of the community, a discussion of issues around a particular part of the river basin, or a mapping exercise are all good examples of ways to get the stakeholders to begin real conversations about the river (Figure 3.7). Working on an activity together fosters a sense of trust and safety, where participants can talk freely, while expecting a respectful and thoughtful consideration of their perspective.



Figure 3.7. A stakeholder tour of the assessment location reinforces social bonds and provides useful photo opportunities for communication purposes. Photo courtesy of M. Kohut.

Encourage ownership through engagement

Involvement of stakeholders at the design and implementation stages of your report card process will increase 'buy-in' to the report card, making it more likely that the results will be accepted in the community. Having stakeholders active in the design and implementation of your report card also provides important perspectives on cultural sensitivities and issues (Figure 3.8).



Figure 3.8. The key stakeholders from academia, state and local government agencies, industry, and the fishing community assemble for a group photo, affirming their involvement and commitment to the report card process. Photo courtesy of Jane Hawkey.

Plan the workshop

A significant demarcation in the report card development process is the initial (and often follow-up) stakeholder workshops where the content and design of your report card is developed collectively. Preparing for these workshops requires careful and detailed preparation in order for them to be satisfying for the participants, and effective in acquiring the correct information. Considering that workshops are expensive (factoring in the costs of participant per diems, travel, lodging, and venue) as well as a unique opportunity to solicit input and generate buy-in, it is imperative that your workshops be well designed and executed. You should also aim to make your workshops as brief as possible (typically 2-3 days) to maximize participation of busy people and to avoid the attrition of participants either physically leaving or mentally checking out.

Where and when to meet

Workshop preparation includes carefully formulating a list of invitees well in advance in order to maximize participation of key people. You should attempt to assemble a variety of participants to ensure diverse input and to avoid leaving out potential detractors (see Identifying Key Stakeholders on page 21). It is generally better to have detractors in the room than outside, undermining the effort. The venue size and setting is selected to allow easy access, avoid cramped rooms, and include space for breakout sessions. Data projection capability, white boards, and large paper pad needs are available, often with backups (Figure 3.9). Akin to an "inverted" or "flipped" classroom, some workshop materials can be provided as short recorded videos (10-15 minutes each) to avoid losing the attention of the participants. Consider providing newsletters or fact-sheets in advance, but do not give participants entire white sheets– we want to avoid giving excessive homework. Workshop timing should also be considered. Avoid starting on Mondays or ending late on Fridays– your workshop participants will appreciate it.

Choosing the timing and location of your workshop requires careful consideration of cost, travel time, cultural sensitivities, stakeholder availability (i.e., farming seasons), facilities, lodging, and food services. For example, although it may be easier to host a workshop in a large city, it is often very advantageous to consider hosting the workshop within the river basin. This achieves three goals:

• participants can see first hand the river basin to be assessed,
• you are much more likely to get local stakeholders to attend, and
• it removes participants based outside the river basin from their everyday life, helping them focus on the task at hand (avoids them stepping out of the workshop for meetings and leaving early).

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- you are much more likely to get local stakeholders to attend, and
- it removes participants based outside the river basin from their everyday life, helping them focus on the task at hand (avoids them stepping out of the workshop for meetings and leaving early).



Figure 3.9. A workshop venue should be able to adjust from well-lit to a dark space for projection, tables and chairs for discussions, wall space for posters, and if possible, media equipment. Photo courtesy of Simon Costanzo

Having the workshop locally also allows for a field trip at the beginning or in the middle of the workshop to a location within the river basin, highlighting the various values of and threats to the system, and providing useful photography opportunities for communication purposes. A field trip or social event of some sort held during the workshop allows your participants to get to know each other, begin side-discussions, and lay the groundwork for future collaborations or partnerships.

Depending on workshop logistics and composition, start times are typically late morning. This allows people travel time and an opportunity to read through emails or make phone calls, so that they have cleared their day for the workshop. Having the workshop over multiple days is not only required to achieve the objectives of the workshop, but is useful for a number of other reasons:

- Discussions on the first workshop day are typically driven by the various agendas brought forward by participants. Having 'vented' their respective agendas, and sharing a drink or meal with other participants in the evening, the second day is often more productive in terms of collective, focused effort.
- Evenings allow the workshop facilitators to adjust the activities and schedules as needed, for interim synthesis, and draft storyboards, conceptual diagrams, and document designs.

Facilitators and training of involved groups

You should not underestimate the importance of choosing a facilitation team to run stakeholder workshops. The facilitation team you choose should consist of a lead facilitator who will be the 'face' of the workshop, and co-facilitators who combine good organization, synthesis, scientific, and creative software skills. A facilitation team is essential to maintain momentum over multi-day workshops.

The lead facilitator should be charismatic with excellent communication, interpersonal, presentation, and management skills. Additionally, knowledge of local and regional culture is essential. A strong scientific background is not necessary, but can help navigate certain discussions that are likely to arise throughout the workshop.

Provide your facilitation team ample time to make the necessary preparations for your workshops. From our previous experiences, we recommend that the training and guidance of the facilitation team you choose begin a minimum of three months prior to your first stakeholder workshop.

Stakeholder workshop tips

Meeting space

For best results and continued engagement of participants throughout the course of the workshop, we advise you host the workshop in a large, bright and comfortable room, preferably with natural light. If possible, have food catered or available nearby. Often participants will have traveled to the venue, so hosting the meeting in a location with associated lodging is beneficial.

Group size

Due to the interactive nature of stakeholder workshops, we have found that limiting group size to approximately 40 people (not including the facilitation team) works best. Too many people increases the risk of not engaging all the participants, and too few people increases the risk of not sourcing an adequate breadth of opinion and expertise.

Seating arrangements

Participants should be seated at round tables—rather than in a lecture format—to encourage discussion and enable group activities. Tables of 6-8 participants each works well.

Materials

Stakeholder workshops generate intense discussion that needs to be adequately captured. Therefore, there can never be enough white-boards, flip charts, colored pens, sticky notes, note paper, data projectors, and cameras.

Facilitation tips

Your facilitation team needs to be well-versed in the report card process and be able to respond to potential questions and ensure the workshop objectives are met. Keeping the workshop fun, engaging, and succinct are excellent goals. As the workshop occurs over two-three days, it is wise to share the facilitation roles to maintain stamina and momentum.

Opening speeches/speakers

The intent of your stakeholder workshop is to strategically extract as much information from the stakeholders as possible within the given time frame. It's also an excellent opportunity for your participants to network and get to know each other. Subsequently, it is important that you allocate time for introductions and succinct presentations outlining the history, current status, and planned initiatives for the river basin at the beginning of the workshop. But, it is important to keep presentations short or they can take up large parts of the day.

Activities

Aim to include 'icebreaker' activities at the beginning of the workshop and other fun group games to punctuate the workshop and invigorate participants. If time and logistics permit, a guided field trip to visit the river basin can be very useful for orienting the participants to the geography, values, and threats of the river basin. Including a social event (e.g., group dinner) on the first night of the workshop is also a great way to build relationships among participants.

Group photo

During a break on the first day of the workshop, organize to have a group photo of all participants to be featured on the back page of the published report card. This acts to make a record the participants that contributed to the report card as well as to provide a sense of participant ownership of the report card process and products that eventuate.

Post-workshop newsletters

Following the workshop, it is recommended that a workshop summary newsletter be prepared and distributed to workshop participants. Additional newsletters throughout the process can keep participants engaged and up-to-date with progress of the report card development.

Set up steering and technical committees

Establishing a steering committee composed of high level stakeholders and managers that are not directly involved in the report card development process can be helpful in maintaining focus on project objectives (Figure 3.10), while providing context to broader issues and considerations. Often the steering committee can provide new and unique perspectives that can improve the utility of report card results, identify possible challenges that may lay ahead, and provide connections to other interested groups.

We also highly recommend to set up a technical committee made up of leading scientists and technical experts for the river basin. During the stakeholder workshops, participants should be identified who will serve well on the technical committee that will assist in sourcing and analyzing data, preparing and reviewing methodology, and providing early reviews of scores and grades. Each member of the technical committee is usually assigned at least one indicator for which they will be the report card team contact to assist in data interpretation and scoring for that indicator. This time commitment is usually backed by their institution or voluntary.



Figure 3.10 A steering committee is necessary to establish a common vision and clear objectives, and determine if the enabling conditions are right for the development of an river basin report card. Photo courtesy of IAN-UMCES.

Develop an evaluation strategy at onset

You should develop an evaluation strategy at the onset of the process for creating a report card. This strategy can be as simple or as robust as desired and as resources allow for. Evaluations are not only beneficial to tracking progress towards the goals initially set out by your report card team, but potentially can even document additional unforeseen outcomes of the report card process.

How can you evaluate your report card process?

When deciding what approach and tools you will use to evaluate your report card process, you should consider what about your report card you want to track, staffing requirements needed (internal vs external), and cost (Table 3.2). Combining more than one tool can be useful to validate results as well as to better understand the intricacies of why an outcome is occurring.

What should be measured?

General records should be maintained about the report card and workshops: specifically, indicators themselves, if the indicators, thresholds and/or calculation methods change over time; changes in relevant data availability; and, workshop participant information that includes overall composition of workshops (e.g., representation of under-represented and/or disadvantaged populations).

More in-depth and nuanced information will be necessary in order to assess the influence of the report card on stakeholders and their perceptions, intent, behavior, and actions. Actions will require both qualitative and quantitative assessment approaches and should be explored based on the local context and evaluation tools at your disposal.

Table 3.2 Potential tools to be considered for an evaluation of your report card process.

Tool	Good for Tracking	Staffing Needs	Cost
Workshop evaluations	<ul style="list-style-type: none"> • Unique revelations • Big picture/synopsis 	Internal	Minimal
Individual surveys or interviews	<ul style="list-style-type: none"> • Unique revelations • Socialize science • Actions 	Internal or external	Minimal
Focus groups	<ul style="list-style-type: none"> • Unique revelations • Big picture/synopsis • Socialize science • Actions 	Internal or external	Minimal to moderate
External evaluations	<ul style="list-style-type: none"> • Unique revelations • Big picture/synopsis • Socialize science • Actions 	External	Moderate
Public polling	<ul style="list-style-type: none"> • Unique revelations • Socialize science • Actions 	External	High
Report card results	<ul style="list-style-type: none"> • Increased demand and production of information • Actions implemented • Improved grades 	Internal	n/a

Develop a communications strategy

Communication is an integral part of the report card development process. Effective communications build a groundswell of support that helps ensure report cards influence top decision makers to take better water management actions. Inadequate communications may result in your report card being produced without significant results or interest.

Identify target audiences

Who can best influence those responsible for decision-making? Is it public officials, businesses, or other leaders? Would a strong case made by select scientists or river basin managers be enough to attract the decision makers' attention, or change their minds? Would a public outcry on social media help or hurt your cause? Identifying who you want report cards to empower will help narrow down your target audiences.

Use appropriate channels

The most effective communications outlets will vary depending on local cultures. Identify the channels most used by your target audiences and focus resources there. In many places that will include traditional print and broadcast media outlets, as well as social media channels. In other places, mobile phone texting may be most effective for mass communications.

Create moments

There are certain milestones in report card development that can be leveraged for communication opportunities. Initial workshops, for example, provide a moment to announce the process and tease potential impacts. As champions emerge throughout development, sharing their stories can provide a personal look at how much life depends on the health of the river basin, and begin to build the storyline towards the launch of the report card—the most important moment.

Nurture on-going engagement

While moments are important to engaging more audiences, consistent communications with report card development participants and other 'internal' audiences is essential to ensuring a feeling of ownership. To maximize impact, a report card communications strategy should include regular newsletters, community events, and other activities that maintain internal support.

Communication tactics

- Create a website that hosts all relevant information in one place, from stories to report card development process updates, to final results and technical documentation.
- Invite 'important' people, such as government officials or local celebrities, to kick off workshops and the report card launch event to help attract media attention.
- Take feature reporters on a trip to key stretches of the river basin and introduce them to people who depend on the river basin's health.
- Profile charismatic species and individuals on social media channels.
- Initiate a mobile texting campaign to raise money or awareness for river basin conservation.
- Host private meetings with key decision makers. Use a compelling presentation to underscore the importance of the river basin. Identify how the report card can guide action to maintain or improve its health.
- Organize community events, such as festivals or classroom projects, to engage remote stakeholders.
- Start a petition that demands management action on one of the river basin areas identified in the report card.
- Utilize blogs, short videos, and other multi-media approaches to engage a vast, diverse audience.

Find a champion

A “champion” is defined as someone having an extraordinary amount of focus, discipline, drive, and complete dedication. Champions, who may represent different sectors of society, tend to have the ability to infuse energy, inspire, and effectively communicate. By combining the efforts of champions with knowledge (e.g., scientists) and the efforts of champions with power (e.g., politicians), it is possible to create

the paradigm shifts needed for achieving improved river basin health. Champions can be obvious at the beginning of the report card process, but they can also emerge organically during the process. For more on how to find your champion, see *Cultivating Champions and Host Institutions* on page 67.

What makes a champion?

At a recent steering committee meeting of resource managers and scientists to discuss report cards, this question was posed. A human outline was drawn and put up on the wall where each participant noted what he/she thought was the most important feature or characteristic of a champion. The figure quickly became covered with words.

A graphic of the key features was created (Figure 3.11), with the size of each word based on how many times that same characteristic was used by the participants. The word “passionate” really stood out. But there were a series of other popular words that helped add to the picture of a good environmental champion including: credible, knowledgeable, articulate, trusted, and charismatic—all traits that combine passion and knowledge to achieve effective environmental outcomes.



Figure 3.11 The key characteristics of a champion as identified by a group of resource managers and scientists during an early steering committee meeting.

Real champions



Martin O'Malley, Governor of Maryland 2007 - 2015

In 2007, the O'Malley administration for the State of Maryland created a program called *BayStat* (baystat.maryland.gov) to help restore the health of Chesapeake Bay. This new initiative was based on the *CitiStat* program Governor O'Malley implemented

when he had been Mayor of the City of Baltimore, Maryland. *BayStat* gathered information from an array of performance indicators on the health of the Bay, sources of the problems, and restoration solutions. As an overall measure of success, *BayStat* adopted the Chesapeake Bay Report Card to provide a timely, transparent, and geographically detailed annual assessment of ecosystem health.

The *BayStat* process required state agency (e.g., Maryland Department of Natural Resources) and University of Maryland representatives to attend *BayStat* meetings every two to four weeks with Governor O'Malley. Each agency was required to provide an analysis of key indicators two weeks before each meeting. During the meetings, strategies were developed, managers were held accountable, and results were measured. In O'Malley's words, *BayStat* "put a face on the problem."



Dr. Ramesh Ramachandran , Director National Centre for Sustainable Coastal Management Government of India

Since 2011, Dr. Ramesh Ramachandran, has served as the Director of the National Centre for

Sustainable Coastal Management (NCSCM; www.ncscm.res.in), Ministry of Environment, Forests and Climate Change, in Chennai, India. After finishing a PhD in Environmental Sciences in India and a PhD in Marine Science in Canada, Dr. Ramachandran has worked at Harvard University, U.S., Max-Planck-Institute für Chemie, Germany, and at the University of Newcastle, U.K., advancing his career in coastal and marine conservation, planning, and management.

Dr. Ramachandran spearheaded the first ecosystem health report cards in India for Chilika Lake in the state of Odisha, and the Marine National Park and Sanctuary-Jamnagar in the state of Gujarat. Their impacts in the region gained extensive media coverage and provided the first holistic assessments of these systems leading to a raft of recommendations and actions. The Chilika Lake Report Card will be updated on a 2-year cycle of publication, prepared through the Chilika Development Authority. Dr. Ramachandran continues to promote the benefits of report cards in India with plans to develop report cards for the Gulf of Mannar, Tamil Nadu and Kavaratti Island, Lakshadweep.

Create a realistic timeline

Our rule of thumb for how long a first report card takes to complete (a question often asked) is about 12-18 months after funding and commitments are finalized. Some take less time and some take more, but on average it is wise to plan for at least a year to complete the process. A timeline built from our experiences that can be provided to participants in the report card process, is shown here (Figure 3.12).

▶ PROJECT INITIATION

- Create and train a project team
- Undertake stakeholder mapping
- Send out stakeholder invitations
- Begin socializing the report card concept to potential stakeholders for buy-in
- Organize workshop logistics (venue, accommodation, food, travel, etc.)
- Identify and train facilitator/s



▶ COMMUNICATIONS

- Develop communications strategy
- Implement and adapt strategy throughout the project

▶ STAKEHOLDER WORKSHOP/s

- Outline key features of river basin being evaluated and identify values to protect and threats to these values
- Create a conceptual framework, and choose indicators and thresholds
- Identify technical team and assign tasks for data provision and/or analysis
- Take a group photo that will appear on the report card
- Present a draft report card
- Follow up promptly with a workshop summary newsletter



▶ DATA ACQUISITION, ANALYSIS, AND METHODOLOGY REPORT

- Source and acquire data
- Work with the technical team to analyze data and develop draft report card scores, and to develop a methodology report



Figure 3.12 The process of creating a river basin report card follows this sequence and on average, takes about 12-18 months to complete.

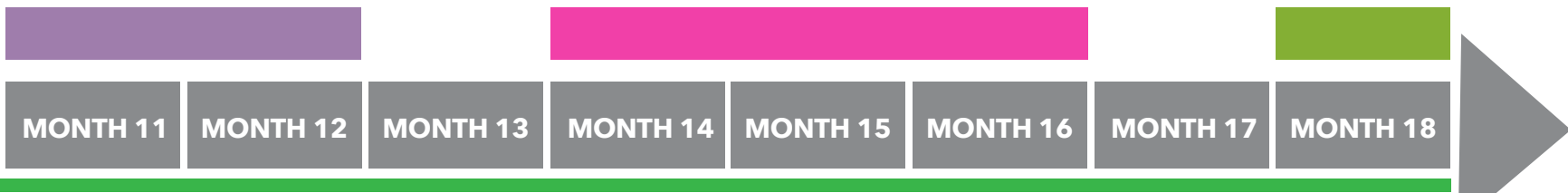
▶ **DISTRIBUTION OF DRAFT REPORT CARD AND METHODOLOGY REPORT TO WORKSHOP PARTICIPANTS**

- Distribute draft report card to workshop participants for review and comment
- Begin outlining major findings and potential recommendations that will populate the the report card

▶ **REVISION OF REPORT CARD SCORES AND METHODOLOGY REPORT**

- Revise report card based on feedback and finalize overall stories/content for the report card
- Begin preparations for report card release (media, venue)

▶ **RELEASE OF REPORT CARD TO PUBLIC**



▶ **2nd STAKEHOLDER WORKSHOP/s (optional)**

- Option here to have a second workshop with all, or a sub-group of, initial workshop participants to discuss methodology, initial results, conclusions and recommendations
- Address any concerns and “reality check” scores and grades

▶ **SIGN-OFF OF REPORT CARD SCORES AND METHODOLOGY REPORT BY STAKEHOLDER REPRESENTATIVES AND/OR TECHNICAL COMMITTEE**

▶ **ONGOING STAKEHOLDER ENGAGEMENT AND PREPARATION FOR NEXT REPORT CARD**



Badong on the Yangtze River, China. Photo courtesy of Bernd Thaller / Flickr Commons.



4

**Creating a
river basin
report card**



Meta River Basin Workshop participants, Colombia.

Creating a report card

Introduction

Report card development and delivery is essentially a five-step process (Figure 4.1), with the groundwork for steps 1-3 undertaken within the initial stakeholder workshop (Figure 4.2), and step 4 completed post workshop. Step 5, which is the communication strategy, is run in parallel with all steps but does come to the fore predominantly towards the end of the process at the report card release. In this section, we provide details on each of the five steps and how each step can be achieved.

This process has evolved over time as report cards have been developed in river basins around the world. Innovation and adaptation are built into the nature of river basin report cards, and we anticipate that to continue as more report cards are developed. For example, research is underway to evaluate and incorporate future scenarios into the process.



Figure 4.1 Creating report cards is a 5-step process.



Figure 4.2 Stakeholder workshops are held to communicate report card results and initiate conversations on how to improve grades at the local level. Photo courtesy of Ministry of Natural Resources and Environment, Samoa.

Step 1: What is the big picture?



Identifying basin values and threats

The first step in developing a report card is engaging stakeholders to define and describe the river basin graphically, i.e., coming to a shared understanding of what is the current situation within the basin. The goal of this step is to help define the values within the basin that are to be protected and/or restored, as well as define the threats that are causing degradation to those values or impeding their restoration. These values and threats will form the basis for you to identify indicators in the next step. A couple of activities of how this can be achieved are outlined here.

Conceptualization

Start by drawing a conceptualized diagram or a map of the river basin on flip chart paper or whiteboard. Ask the workshop participants to draw on the diagram/map the features (ecological, social, and/or economic) that they consider to be of value to that basin. Then, ask the group to draw what is threatening these values and/or the basin as a whole. These values and threats can then be transcribed onto a list that can be ranked in order of priority through voting by the group. This can be illustrated and used in the report card to graphically represent key features of the river basin as well as important values and threats that were identified (Figure 4.3).



Figure 4.3 Final conceptual diagram of Samoa's unique habitats and culture that came from a sketch (inset) as defined by participants at a stakeholder workshop.

SNAP!

Another interactive and fun process for developing a conceptual diagram of the river basin is to provide each workshop participant three sticky notes (preferably green) on which they, or the sector that they represent most highly, are required to write what they value about the basin in 1-2 words (i.e., each participant comes up with three values). Then the facilitator asks everyone to come to a wall where a facilitated game of “Snap!” begins. Someone starts by sticking one of their values on the wall, and people that have the same values say “Snap!”, read out their value, and place it on top of the original value (Figure 4.4). Once that value is exhausted, a second one begins the process until no one has a sticky note left. At the end of this process there will be numerous clusters of values on the wall. The same activity is conducted for the threats (preferably red sticky notes) to the basin which also results in clusters of threats. This enables input from every participant and is a relatively quick way to get the process achieved.

What is often found is that some values and threats are posted that participants may not have previously considered. So it is important to transcribe the clusters of values and threats into lists (preferably also on the wall/white-board), so that participants can vote on the values/threats they feel are most important. This can be achieved by giving every participant three sticky dots, for example, that they can use to paste next to the values they feel are important, and three sticky dots for the threats they feel are important. Participants can only paste one dot to each value (i.e., they cannot paste all three dots on one value). At the end of this process, the number of dots are counted, and values and threats are separately ranked from most to least votes (Figure 4.4).

There are certain circumstances where public voting as outlined above may be a little uncomfortable for certain participants due to cultural, political, or contentious sensitivities. In these situations it is possible to employ an anonymous voting and graphing system so that participants can nominate values and threats (and indicators). Such a voting tool exists that allows users to nominate/vote via a computer or smart device on a local network, providing efficient real-time graphing of results.

TIP: Indicators and corresponding thresholds resulting from this process are strongly dictated by the participants engaged in the activity. Therefore, a balanced choice of stakeholders at the workshop is necessary. In addition, it is important that at the end of the activity, there is reflection as a group on whether environmental, social, and economic sectors are represented.



Figure 4.4 Report card workshop participants play “Snap!” (top). Values and threats chosen by participants are then ranked according to importance (bottom).

Step 2: What do we measure?

Choosing indicators



Report cards evaluate the health of river basins based on a set of science-based indicators and thresholds. River basin health has been generally defined to encompass the chemical, physical, and biological integrity of riverine systems³. We broaden this definition to include the social and economic values that healthy river basins deliver to society as well as the health of the management and governance systems that provide an enabling environment for the maintenance or restoration of river health. Figure 4.5 outlines six categories for which stakeholders are encouraged to develop indicators (at least one indicator per category). But the process of selecting specific indicators should reflect the report card objective, and local and regional values/threats particular to the river basin.



Figure 4.5 Indicator categories of river basin health.

Approach

At this point of the workshop, stakeholders are organized into groups and assigned one of the top values and one of the top threats identified in Step 1. Each group's task is to identify or develop potential indicators for their assigned value and threat. At the end of this session (1.5-3 hours), groups report their short-list of indicators to the entire participant group for discussion and constructive critique. By providing space for open dialogue and feedback, an interesting dynamic develops as each group is questioned about their indicators and defend their decisions, thus progressing the process of ownership of the report card.

Guiding principles

It is likely that many more indicators will be nominated than what is possible to capture in a report card. Too many indicators can: a) cloud interpretation, b) exceed financial and human resources for collection and analysis, and c) reduce the influence of each indicator on the report card score (Figure 4.6). Too few indicators can lead to a report card grade that is overly sensitive to change in indicators. Either situation increases the risk of not adequately representing river basin health, potentially leading to erroneous conclusions and ill-advised policy decisions. Therefore, additional refinement is required to finalize the choice of indicators.

Be flexible

You may find that some indicators will be relevant in one part of the river basin and not in other parts. For example mangroves may be nominated as an important indicator for the estuarine reach of a river, but would not be applicable to the upper freshwater reaches of the river where mangroves do not occur naturally. In such a situation, mangroves could be left out of the analysis for the upper reach of the river, or replaced with another representative indicator (e.g. salt-marshes).

³ Karr, J.R. 1999. Defining and measuring river health? *Freshwater Biology* 41: 221-234.

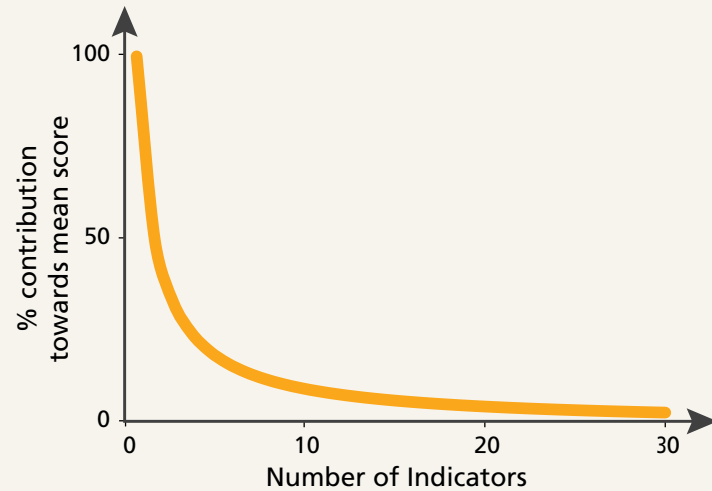


Figure 4.6 Relationship showing the diminishing contribution towards the report card score with an increasing number of indicators.

There are a number of "SMART" questions that can be asked to help workshop participants screen the initial list of indicators:

Sensitive

- Is the indicator sensitive to change in environmental and/or management conditions?
- Will it reflect changes in a timely manner for reporting? For example, some ecological processes may take a decade or more to show measurable change, making them unsuitable for tracking on a shorter time frame.

Measurable

- Are the indicators cost effective to collect and analyze?
- Are desired spatial and temporal frequency of measurements achievable?
- Is data availability and quality consistent across all reporting regions?
- Can the indicators be quantified (e.g., social and governance indicators are often qualitative making it difficult to assess)

Available

Data availability is not always a prerequisite, and sometimes choosing an indicator which does not have data can be a useful way to drive demand for collection of data for an important and needed indicator that may not already exist.

- Is there an embargo on the data (e.g., until it is published)?
- Is there historical data to calculate trends in the past?
- Are there plans for the indicator be measured in the future so that change can be detected and the indicator can be included in future iterations of the report card?
- Are there restrictions on public sharing or access to the data?

Relevant

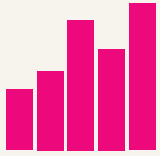
- Does the indicator reflect or have a connection to management goals and actions?
- Can a response in this indicator be linked to management actions?
- Is the indicator relevant/consistent to existing reporting mechanisms at the local, river basin, country, and international level (e.g., existing river basin reporting systems, national reporting, environmental accounts, Sustainable Development Goals, etc.).
- Are indicators relevant to stakeholder wishes and needs?

Thresholds

Thresholds are specific goals, upper or lower limits, or standards specific to each indicator beyond which the measured resources are known to change condition. Some examples of what can be used as a threshold include national or international guidelines, institutional goals, reference conditions, socio-economic requirements, historical benchmarks, or professional judgment. Professional judgment is used as the last option in cases where it is difficult to identify thresholds for indicators from other sources.

- Do suitable thresholds for this indicator exist? Can these be applied to the current context?
- If no threshold is available, can one be developed?

Step 3: What is healthy?



Defining thresholds for indicators

As mentioned earlier, thresholds are specific goals, limits, or standards specific to each indicator and that represent change in the condition of the resource that those indicators are representing. Report card thresholds manifest an agreed upon value or range that, when crossed, indicate a river basin health indicator is moving away from the desired state and towards an undesirable endpoint. Choosing thresholds for indicators can often be one of the more challenging activities in the report card development process. Table 4.1 and Figure 4.7 list examples of indicators from previous report cards and their corresponding thresholds. Below are some guidelines for identifying thresholds that can be followed.

Regulatory and/or management guidelines

If regulatory or management guidelines (or standards) are available for an indicator, then these should be first considered for their suitability as a threshold. Preference should be given to local guidelines if available, followed by regional, national, and even international guidelines. Such guidelines are generally based on agreed-upon expert advice and therefore provide a defensible choice of threshold.

Biological limits

Protection of organism health and/or habitat provides an opportunity to formulate a defensible threshold. Thresholds based on biological limits can include environmental factors required for life (e.g., adequate flow of water and dissolved oxygen concentrations in a stream) or contaminants levels outlined in the scientific literature as threatening organism health.

Baseline and/or reference conditions

Looking to the past, or in other locations, can be useful to identify suitable thresholds. Historical records of conditions (e.g., habitat extent, water quality, employment levels, cultural education) can be used as baseline thresholds. Alternatively, if baseline conditions are not available, or deemed unachievable, desirable conditions in other less impacted river basins can be used as reference thresholds. If required, another option is "change from now": using the current status of the indicator as a baseline for measuring change in the future.

Socio-economic requirements

Socio-economic requirements can be a good basis for defining a threshold for an indicator. For example, setting a threshold for fish abundance required to maintain a sustainable fishing industry benefits both ecological and socio-economic perspectives.

Professional judgment

If none of the above sources of information is available to derive a threshold are available or agreed upon, it may be necessary to rely upon best professional judgment to derive the thresholds. Often, many of the experts who would be best consulted are among the participants in the workshops. It is recommended that either during or following the workshop relevant experts be consulted to provide the best professional judgment for determining a threshold.

Table 4.1 Indicators and corresponding thresholds for the Chesapeake Bay, Orinoco River, and Mississippi River Report Cards.

	Chesapeake Bay Report Card	Orinoco River Basin Report Card	Mississippi River Watershed Report Card	
Regulatory and/or management guidelines	Indicator	Chlorophyll a	Human nutrition	Gulf "dead zone" size
	Threshold	Seasonal thresholds Literature value	% Children healthy weight	Hypoxia Task Force target
Biological limits	Indicator	Water clarity	-	-
	Threshold	Literature value for protection of submerged aquatic vegetation	-	-
Baseline and/or reference conditions	Indicator	Aquatic grasses	Fire frequency	Coastal wetlands change
	Threshold	Restoration goals	10 year median fire frequency	Change since measures began in 1932
Socio-economic requirements	Indicator	-	Mining	Employment
	Threshold	-	Presence/absence in sensitive ecosystems	National median income
Professional judgment	Indicator	Striped bass	River dolphins	Infrastructure condition
	Threshold	Long term average compared to the three year average	Current:maximum expected populations	Duration out of commission

In large systems, such as Chesapeake Bay (surface area = 11,470 km²), different thresholds may be necessary to accommodate different salinity regimes, water column depths (i.e., above or below the pycnocline), and seasons (spring vs. summer), such as the seasonal thresholds used for Chlorophyll a in the Chesapeake Bay Report Card. Accordingly, how these thresholds are selected will depend on the system and the available research that can be used to define possible thresholds that are meaningful within the context of that particular river basin.

TIP: As long as thresholds are clearly defined and justified they can be updated in light of new research or management goals.



Figure 4.7 Chesapeake Bay, Orinoco River Basin, and Mississippi River Watershed Report Cards.

Step 4: How does it add up?



Calculating scores and determining grades

You can use multiple approaches to assess if an indicator meets or exceeds a chosen threshold. Before outlining these approaches, it helps to understand that regardless of what indicators you have chosen, the results of each need to be standardized against a common scale of 0-100. This is required to enable indicators to be 'rolled-up' (or averaged) to provide an overall score for each indicator category, sub-basin, and the entire river basin. This standardization overcomes challenges associated with comparing indicators with different measurement scales and units. Sometimes this conversion is straight-forward; sometimes it can be challenging. Therefore, a key requirement for Step 4, in addition to processing data, is finding a transparent and defensible standardization approach.

Scores and grades

The scoring and grading system used for river basin report cards is a simple, systematic ranking scale. The one hundred point scale is divided into five equal categories; A (80-100), B (60-80), C (40-60), D (20-40) and F (0-20) with corresponding colors as shown in Figure 4.8. Furthermore, the grades have a plus and minus scale, so that the upper 5 points of the 20 point range results in a plus score and the lower 5 points of the 20 point range results in a minus score. The only exception to this scale is the "F" score, which does not have a plus or minus.

This grading system does not correspond to the scales that most students are familiar with from school report cards in many western countries, where at least a 90-100 is required for an A, and less than a 60 or 70 is an F. The reasons for the broader spread in scores is that this scale is more sensitive to, and reflective of, changes in river basin conditions, and unfortunately many river basins would consistently receive an F grade if the cutoff was 60. There are also examples where the A-F grading format is not used or widely known in some countries. In these instances, we adjusted the grading format to accommodate a more recognized format, such as that shown in Figure 4.9. In this figure, the A-F grading format was changed to a 0-5 scale, with one decimal point used (e.g., a score of 72 resulted in a grade of 3.6). The grading scale has this flexibility, while the 0-100 scoring scale remains a constant.

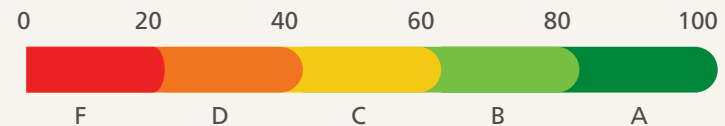


Figure 4.8 Report card scoring scale, color scheme, and grades.

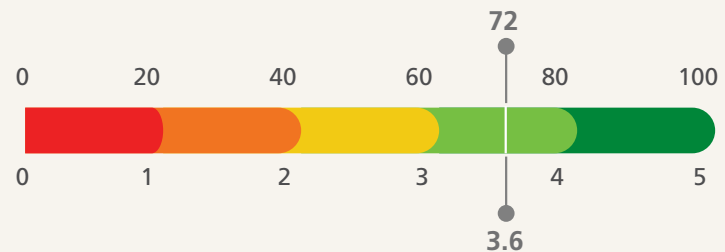


Figure 4.9 Example of alternative grading format.

Linear conversions

Linear conversions represent the simplest standardization approach. Indicator results are standardized to the 0-100 report card scale using a linear relationship ($y=mx+c$) as shown in Figure 4.10. This is common when indicator results are reported along a linear scale (e.g., 1-10), as a percentage of area, as a percentage of measurements, or locations that pass/fail a threshold.

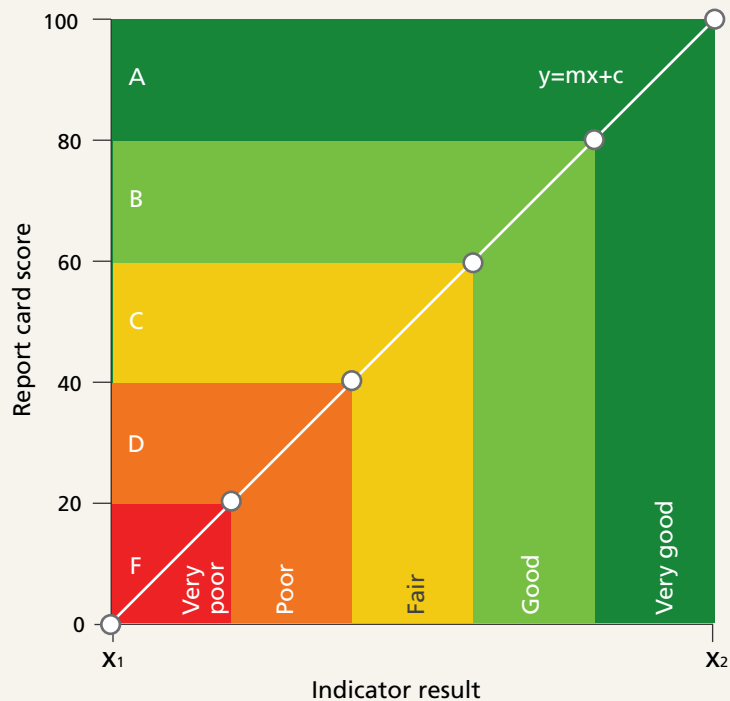


Figure 4.10 Example of a linear conversion of indicator results to the 0-100 report card scoring scale.

Non-linear conversions

Non-linear conversions are required when indicator results are not normally assessed against a linear scale. This is common when the range of indicator results are assessed against multiple non-linear thresholds such as that in Figure 4.11. In this example, Water Quality Index values are reported on a scale of 10-100. The guidelines state Water Quality Index values in the range 10-60 are "very poor", 60-80 are "poor", 80-85 are "fair", 85-90 are "good", and 90-100 are "very good". In order to maintain compatibility between reporting formats, a non-linear relationship was developed between the two scoring systems requiring multiple line equations to be developed.

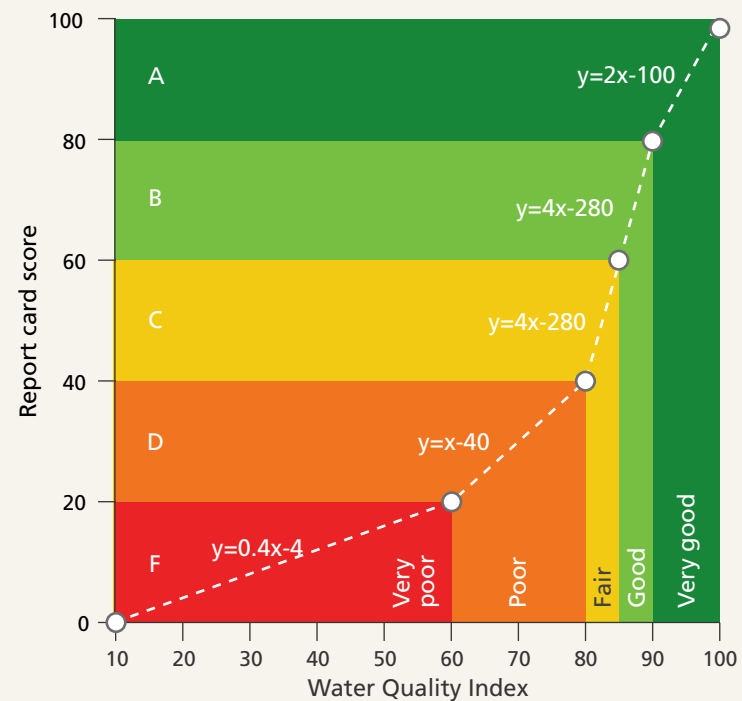


Figure 4.11 Example of a non-linear conversion of indicator results to the 0-100 report card scoring scale.

Additional examples of indicator results that have been converted to the 0-100 report card scoring format using linear and non-linear methods are outlined in Table 4.2 on the following page.

Step 4: How does it add up? (continued)

Table 4.2 Examples of linear and non-linear conversions of indicator results to the 0-100 report card scoring scale.

Conversion type	Example indicators and calculation methods
<p>Linear</p>	<ul style="list-style-type: none"> • Forest Area—area of intact forest remaining as a percentage of total forest area in the past (Orinoco River Basin Report Card). • Riparian Vegetation—percentage of river length that has riparian vegetation as percentage of total river length (Moreton Bay and Catchment Report Card). • Water Quality—water quality index that combines multiple water quality indicators into a score between 0-1 (poor-excellent) which can easily be converted to a 0-100 scale (Willamette River Report Card). • Species Diversity—Simpson's Index of Diversity Index (1-D) which measures species diversity on a scale 0-1 (no diversity-infinite diversity) which can easily be converted to a 0-100 scale. • Dissolved Oxygen—number of dissolved oxygen measurements in one year that are above the minimum threshold as a percentage of total number of measurements (Chilika Lake Report Card).
<p>Non-linear</p>	<ul style="list-style-type: none"> • Water Clarity—Secchi disk measurements of water clarity compared against different thresholds based on salinity where the measurement is made (Chesapeake Bay Report Card). • Phytoplankton—concentration of phytoplankton in water compared against multiple thresholds that differ between spring and summer (Chesapeake Bay Report Card). • River Flow—number of 7-day average stream flows greater than or equal to multiple river flow targets that vary throughout the year (Willamette River Report Card).

Final scores and grades

Once results for all indicators have been converted to the 0-100 scoring scale, you can begin the 'rolling-up' of scores and assignment of grades. This is typically performed by equally weighting and averaging indicators associated with an indicator category (described in Step 2), followed by equally weighting value categories per region being assessed. We generally recommend that individual indicators not be weighted differently to other indicators. This is because weighting can be viewed by different stakeholders as subjective, biased, or unfair. To avoid conflict on this issue, indicators are weighted equally.

Table 4.3 provides an example from the Orinoco River Basin Report Card of how indicators were 'rolled-up' and graded for each of the 10 sub-basins of the Colombian portion of the Orinoco River Basin. In the case of this report card, an overall score for the entire study area was calculated by area weighting the individual scores of each sub-basin.

Table 4.3 Examples of how indicator scores are rolled up by category.

Indicator score	Indicator category score	Overall score	Grade
Secchi depth (32%) pH (76%) Chlorophyll a (42%) Annual river flow (55%)	→ Water Quality / Quantity (51%)	69%	B
Body Mass Index (BMI) (90%) Population vaccinated (50%)	→ Health / Nutrition (70%)		
Number of cultural events (66%)	→ Society / Culture (66%)		
Remaining forest cover (40%) Biodiversity Index (65%) Fire frequency (88%)	→ Landscapes and Ecology (64%)		
Legal vs. illegal fish harvesting (77%)	→ Management / Governance (77%)		
% population above poverty line (75%) Number of tourists (95%)	→ Economy (85%)		

Review and "reality check"

It's possible that the first round of calculated scores and grades will not be the ones published. Following reviews by the technical team, steering committee, and the stakeholders, it's possible that you will have a number of iterations of the scores due to changes in how indicators are calculated, choice of thresholds, the arrival of new data, the grouping of indicators in value categories, or even the choice of indicators themselves. Often it is only at this stage of the report card development that previous decisions made in Steps 1-3, when compiled, either don't 'make sense', or are not reflective of actual river basin condition. This can be due to errors in the data, insufficient data, improper thresholds, or problems in the calculation technique. Your report card team should anticipate this situation and factor in time to address this into the time frame of report card development.

We recommend that review of the results includes a workshop with all, or select, stakeholders, where a) initial objectives and decisions are recapped, b) calculation methods and draft scores and grades are presented, c) issues are raised for discussion and addressed, and d) consensus is gained on either current findings or a path towards finalizing scores and grades. This review is imperative for buy-in of the results and ownership of the report card by the stakeholders. However, reviews cannot continue indefinitely, and your report card team must designate a cut-off date beyond which you will not accept further changes. Despite this, changes will likely be requested after the set deadline (and usually from senior people!), so create a plan to gauge the importance and inclusion of these newly requested changes.

Step 5: What is the story?



Communicating results

In the end, report cards are communications tools. They raise awareness of a river basin, explain the current health and challenges in a way everyone can understand, and create a public foundation to drive and track change.

Communications strategy

The high profile and sometimes controversial nature of report cards necessitates special attention to a communication strategy. As such, the strategy (introduced on page 28) is critical to success and should be initiated early in the report card process. The strategy helps you identify, engage and excite your most important audiences, employing a variety of tactics that build up to the main event: the release of the report card (Figure 4.12). It should deliver key messages, identify target audiences, help choose a spokesperson, and determine communication methods. The report card itself can be a printed product, it can be produced as a web page, or preferably both. A methodology report must also be prepared to provide transparency of the process and enable others to replicate the approach. This report should include descriptions of stakeholders engaged, experts consulted, data sources, indicator summaries, calculation methods, any limitations, and references.

In terms of messaging, the release of a report card provides an opportunity to communicate the overall health of a river basin, how one basin or sub-basin compares to others, and how health may have changed from one year to another. The report card also provides a vehicle to communicate other related messages such as restoration efforts being undertaken in the area or how the audience can become involved and help in restoration activities. Before releasing a report card, we advise that you brief appropriate people and agencies about what the report card scores will be (with an embargo on their release until the chosen release date), so that they have the opportunity to prepare appropriate responses.

All of these products—a printed report card, web page, methodology report, and a general communication strategy—have varying amounts of time and effort requirements associated with them that need to be accounted for early in the planning process.

Preparing to launch

After completing Steps 1-4, you will have a clear sense of what indicators you are using to measure the health of your river basin, and what grades those indicators will receive. Before publicly releasing this information, it is important to secure buy-in from key audiences and elevate important voices. To guide you through this process, consider the following questions:



Figure 4.12 Examples of report cards (top). Press release for the Orinoco River Basin Report Card (bottom). Photo courtesy of Simon Costanzo

- **Who has the authority or influence to address some of the greatest threats and lowest grades?** Have private conversations with these audiences to ensure they will not undermine the report card results, and to see if they would like to announce a solution as part of the launch event.
- **How will the report card link to ongoing development planning or monitoring processes?** The indicators and results from the report card are often useful inputs or complements to ongoing processes. These should be identified early in the development of the report card and appropriate links with the institutions made such that they are part of the development and can best leverage the results.
- **Do the grades reveal any surprises or opportunities?** The findings can form the basis of a media pitch to feature report card results across news channels.
- **Did the process unearth any compelling characters?** The results will be viewed more credibly if there are multiple perspectives talking about them. Think about the people who were involved in the process and if there are passionate, interesting, and/or compelling individuals, invite them to help champion the launch. It is ideal to engage a mixture of scientists, community members, business leaders, local and higher-level politicians, and conservationists. This panel of experts ideally will be available for media interviews and to speak at the launch event.
- **Are there indicators that were important to stakeholders that couldn't be included?** If so, inform workshop participants so they are not surprised when they are missing from the final results, and see if they would like to include stories or text that address their concerns.
- **What actions do the report card results suggest?** While the report card should be a science-based document and not turned into an opinion piece, it is important to see how the results suggest the need for certain policy or behavior changes and you need to be prepared to talk about those calls to action in media interviews and/or supporting documents. Now that all audiences can understand the status of the river basin, they will also want to know how they can raise, or maintain, the grades.



Figure 4.13 Radio interview coinciding with the release of the Orinoco Report Card.

Launch event

While report cards open doors for many creative communications tactics, it is important at a minimum to have a media event to launch the report card (Figure 4.14). At this event, your panel of experts will share their insight into the process, validating the ground-up approach. You will also reveal the current status of the river basin's health and acknowledge any new commitments to help raise the grades.

If it is possible, and in addition to the main launch event, it can be highly effective to organize community-based events in the same locations where stakeholder workshops were held to reveal the results and start conversations on how to improve grades at the local level.



Figure 4.14 Long Island Sound Report Card press conference.



Orinoco River, Colombia. Photo courtesy of M. Kohut.



5

**Empowering
change**



Congo River, DRC, Africa. Photo courtesy of Ollivier Girard-CIFOR / Flickr Commons.

Empowering change

Introduction

Report cards empower change. They provide an information-rich assessment in an understandable form to a broad audience. But the report card process is not finished when your report card is released. Therefore, the actions that the report cards catalyze are key to improving or maintaining the grades and creating positive environmental outcomes in your basin. Report cards socialize science, allowing non-scientists to interact with synthesized data and form strategies for improving the grades.

Report cards highlight areas that need improvement, and alternatively, provide positive feedback to areas that are doing well and deserve to be celebrated. For the areas in need of improvement, you can initiate a public discourse to focus on management interventions or behavior changes needed to improve report card scores. The issues surrounding river basin health are often complicated and difficult to address quickly. Therefore, report cards need to be repeated so that progress toward long-term goals can be tracked over time.

Armed with credible, science-based information contained in report cards, the stakeholders in the region are empowered to make decisions, take actions, and become advocates for improving report card grades. It is often the public dissemination of report card results that encourages decision makers to act and the general public to shift their own behavior. Therefore, having a well-developed media campaign associated with a report card release helps to ensure a broad dissemination and enhances the opportunity to influence decision makers. It is also important that you identify and engage stakeholders with the power of influence, including traditional and social media outlets, decision makers, elected officials, celebrities, etc. Leveraging the science and local knowledge that emerges from report card development will inform or even modify natural resource management.

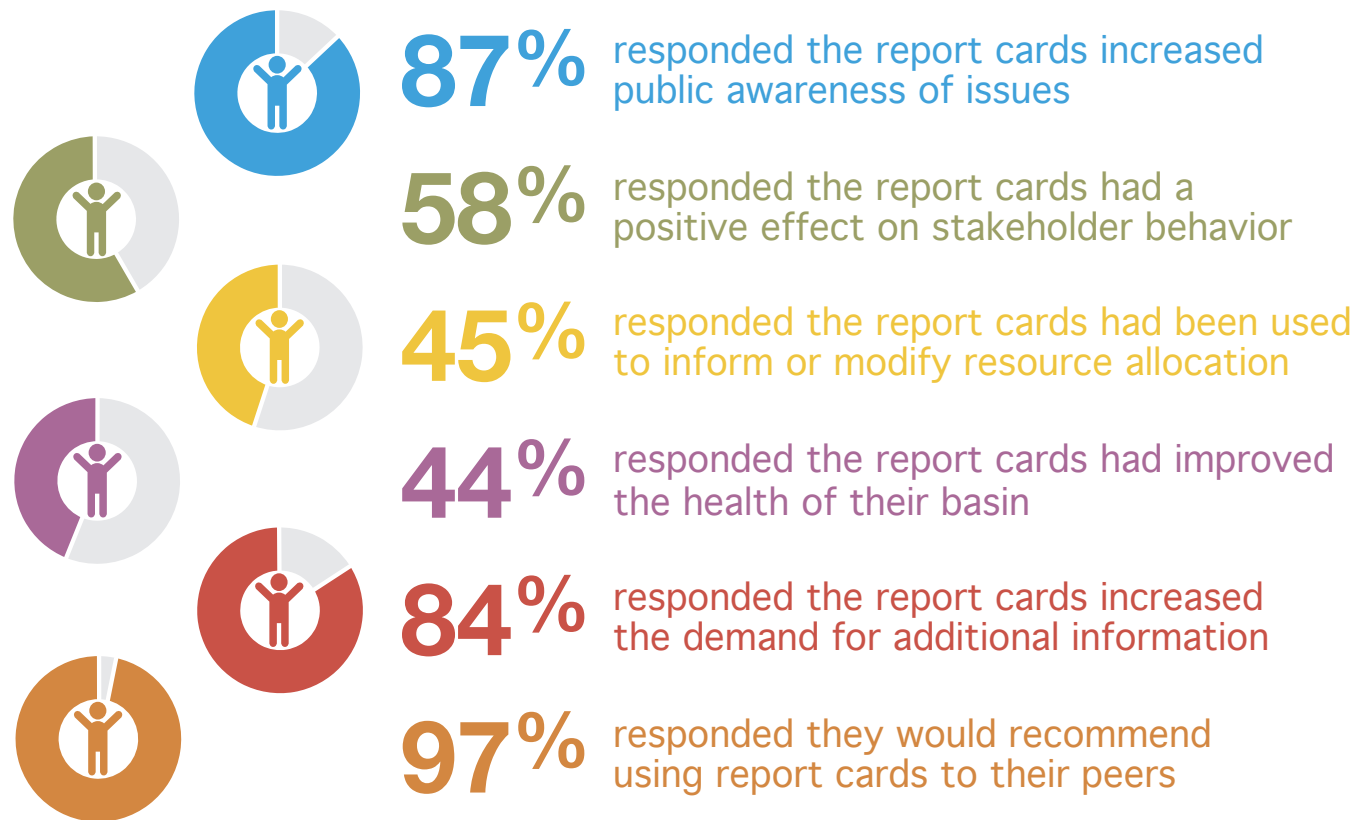


Figure 5.1 Our surveys show that report card users attribute positive changes in awareness, education, and even behavior and environmental condition as a result of their report card projects.

A survey of 40 participants in completed report card projects provided strong evidence of the value of report cards (Figure 5.1). Ninety-seven percent of respondents recommend using report cards to their peers. Report cards clearly raise public awareness (87%) and increase demand for additional information (84%). But the ability of report cards to have a positive effect on stakeholder behavior and resource allocation (45%), and to have a positive impact on basin health (44%) is less certain. This could partially be a result of a time lag for report card impacts to be manifested, but it could also be that many social, political, and ecological factors can influence basin health. Report cards can be expected to highlight the problems, but not necessarily solve the problems. It is up to the stakeholders in the region, empowered by the public conversation initiated by report cards, to turn this discourse into effective action to improve basin health.

Report card results should initiate dialogues about a) what will it take to raise and/or maintain grades, b) what policies need to shift in response to the grades, and c) what actions can individuals, businesses, non-governmental organizations, and governments can do to raise the grades. The important aspect of these conversations is that they need to be outcome-oriented. Your report card dissemination and follow-up activities need to keep the focus on actions to improve the grades and use the repeated measure of successive report cards as a way to track these outcomes.

CASE STUDY

Chesapeake Bay Report Card, USA (est. 2006)

The Chesapeake Bay Report Card was initiated in 2007, providing the first scientifically rigorous broad assessment of the Bay and its major tributaries. The report card informed the public debate that veered from "happy talk" (from Chesapeake Bay Blues⁴) to "doom and gloom" from the Chesapeake Bay Foundation and other activists. The initial results shocked the rural Eastern Shore of Chesapeake Bay when their tributaries had poor grades similar to the urbanized tributaries around Baltimore and Washington, D.C. The agricultural contributions of nutrient runoff from fertilizer and chicken manure had led to these poor grades, and various chicken manure processing and groundwater interception pilot studies were initiated due to the poor grades. In contrast, high grades were observed in the upper Bay due to sewage treatment upgrades and air pollution improvements (e.g., catalytic converters, smokestack scrubbers) that reduce atmospheric nutrient inputs, which led to aquatic grass resurgence, unprecedented water clarity and enhanced fisheries. These improvements are expected to continue with major sewage upgrades underway in Baltimore.

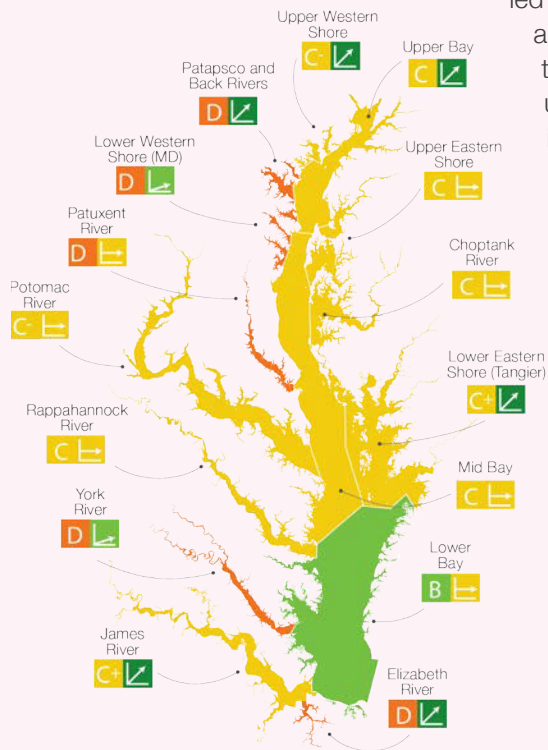


Figure 5.2 Grades in each region of the Chesapeake Bay from the 2016 report card.

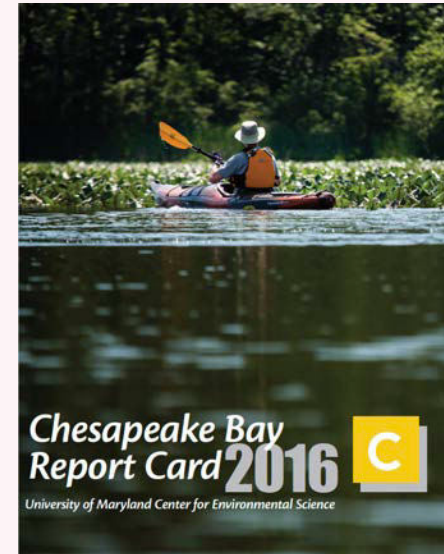


Figure 5.3 The 2016 Chesapeake Bay Report Card.

The Chesapeake Bay Report Card (Figure 5.3) has proven to be an independent arbiter of the net impact of the various actions coordinated by the Chesapeake Bay Program. The state of Maryland incorporated the Chesapeake Bay Report Card into its *BayStat* program, and the Chesapeake Bay Program is emulating this accountability approach with *ChesapeakeStat*. After decades of declines, the voluntary program was converted to a regulatory program in 2010, called the Total Maximum Daily Load.

The popularity of the Chesapeake Bay Report Card has stimulated citizen scientists to create local report cards. The number of citizen science-generated report cards in the tributaries of Chesapeake Bay has blossomed. Hundreds of citizen scientists collect, analyze, and publicize their data. The result is that citizen scientists are empowered to undertake local actions that improve the waterways.

The Chesapeake Bay Report Card has shown encouraging news over the past several years. Measurable improvements have created cautious optimism among the Bay community for the first time in decades. Report card scores (Figure 5.2) are anxiously awaited to see if the improvements continue, and the adage that the "Chesapeake Bay Program is Working" is becoming a rallying cry in the face of proposed federal funding cuts.

⁴ Ernst, H.R. 2003. *Chesapeake Bay Blues: Science, Politics, and the Struggle to Save the Bay*. Rowman & Littlefield Publishers, Inc.

CASE STUDY

Laguna de Bay Ecosystem Health Report Card, Philippines (est. 2013)

The Laguna de Bay 2013 Ecosystem Health Report Card (Figure 5.5) provides information to decision makers and stakeholders on the state of health of Laguna de Bay, the largest inland waterbody in the Philippines and the third largest in Southeast Asia (Figure 5.4). Laguna de Bay is a multi-use water resource and a major source of fisheries in the Philippines. The report card measured indicators for water quality and fisheries to assess the overall quality of the lake ecosystem. The results from the assessment were intended to inform policy and investment planning on the best management practices for improving the environmental quality of the lake.

The report card elicited interest and expression of support by different stakeholders to be part of the solution. The report card became a platform for a call to action to all sectors. The report card has led to an increased awareness of lake eutrophication and the impacts of too much nitrogen and phosphorous. In response to one of its recommendations, citizens have asked which detergents have lower phosphate levels to help reduce discharge into the water bodies. The report card has also led to a greater willingness of fishermen to collect and share information on fisheries with local authorities, as a result of the report card.

The importance of the report card as a management tool for Laguna de Bay was well recognized by the different stakeholders during the stakeholder forum and report card launch. The issues of fisheries and nutrient management were highlighted in the report card. Since its release in February 2016, local government units, agencies, and private sectors have expressed commitments to continue working collaboratively with the Laguna Lake Development Authority to implement actions and management interventions to improve the health of Laguna de Bay.

Since the Laguna de Bay Ecosystem Health Report Card release, there has been an on-going effort by the Philippine government to clean up the lake. A large number of commercial fish pens and cages are being dismantled in an effort to bring fishermen back to their traditional fishing ground.

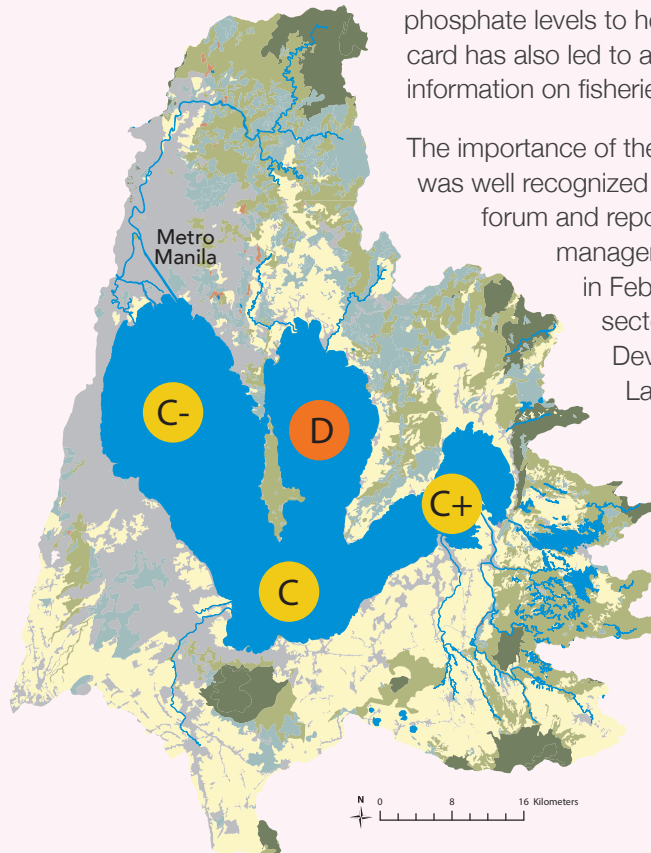


Figure 5.4 Water quality grades for Laguna de Bay, Philippines.

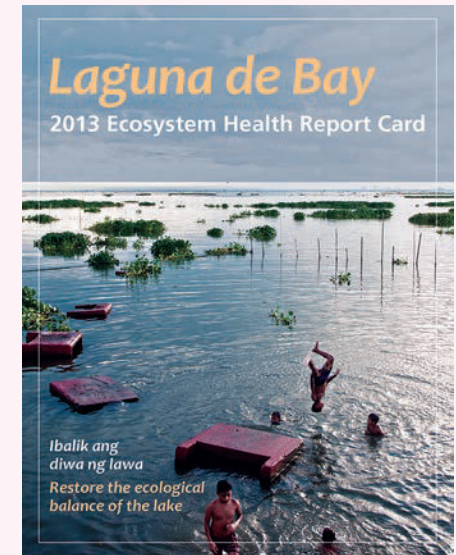


Figure 5.5 Laguna de Bay 2013 Ecosystem Health Report Card.

CASE STUDY

Chilika Lake Report Card, India (est. 2012)

Chilika Lake is one of the world's largest coastal lagoons, supporting about 225 species of migratory waterbirds and over 300 fish species. It is the largest wintering ground of migratory birds in the Indian sub-continent and home to more than 150 highly threatened Irrawaddy dolphins—the largest lagoonal population globally. In addition to its natural wonders, Chilika Lake is important for people. The area holds cultural significance with ties to historic events dating back to the second century BCE, and is an important religious and cultural tourism destination. Today, more than 200,000 fisherfolk make their living harvesting the lake's fish. In 2012, the Chilika Development Authority and the Ministry of Environment and Forests initiated a report card to better understand the lake's values, threats, and overall health. The Chilika Lake Report Card (Figure 5.7) was first published in 2012, in English and the local language Odia, as an awareness and management tool for local stakeholders and managers, and has been repeated on a 2-year cycle.

The Chilika Lake Report Card has influenced the way local people understand the lake ecosystem and has allowed the Chilika Development Authority to better track conditions and manage lake resources. For instance, management priorities were changed to include opening the inlet to the lake to promote greater ocean water exchange similar to historical conditions. This

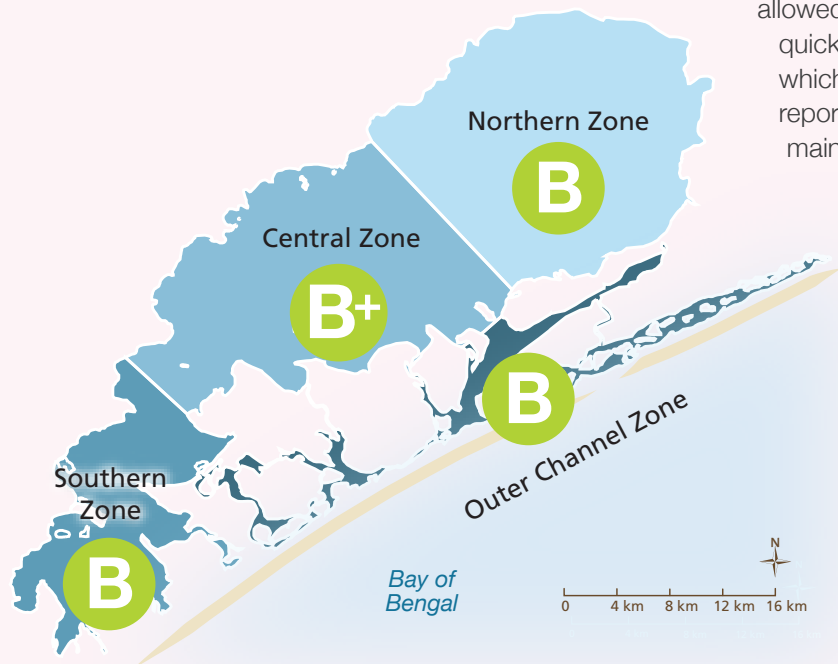


Figure 5.6 Grades in each region of Chilika Lake from the 2012 report card.

allowed the lake salinity regime to rebound quickly following the severe Cyclone Phailin, which struck the area in 2013. The 2014 report card reflects Chilika Lake's ability to maintain high fisheries economies, biodiversity,

and generally good water quality in each region of the lake (Figure 5.6). The Chilika Development Authority also decided in 2012 to improve their monitoring capacity to include indicators that would be more representative of ecosystem health, including chlorophyll *a* instead of total chlorophyll, and also include nitrogen and phosphorous in subsequent sampling program adjustments.

The results of the Chilika Lake Report Card have also informed the lake being nominated as a World Heritage site by the government of India (whc.unesco.org/en/tentativelists/5896). The report card has improved capacity within the Chilika Development Authority to better understand and manage the lake for continued food and economic security in the region, and conserve important wildlife like the Irrawaddy Dolphin.

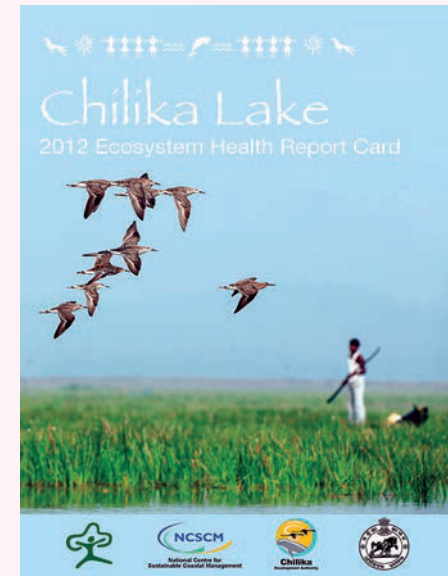


Figure 5.7 The 2012 Chilika Lake Ecosystem Health Report Card.

CASE STUDY

Healthy Waterways and Catchments Report Card, Australia (est. 2000)

The initial release of the Moreton Bay Report Card in 1998 created a large and immediate public reaction, largely as a result of failing grades for the Brisbane River and the nearshore regions of Moreton Bay, Australia. Dozens of newspaper, radio, and television stories ensued, and elected officials were challenged to respond. The public attention led to significant investments in sewage treatment upgrades, including \$150 million AUD for the Luggage Point Sewage Treatment Plant in Brisbane City, and \$16 million AUD for Redcliffe Sewage Treatment Plant in Redcliffe City. By the early 2000s, all major sewage treatment plants in Southeast Queensland were upgraded to tertiary treatment. Additionally, sand and gravel dredging in the Brisbane River was ended. As a result of these actions, water quality improvements were realized, in spite of the rapid population growth of the region. Brisbane City Council created popular bikeways along both sides of the river and a system of fast passenger ferries (CityCats) which led to urban revitalization, focused on the waterways.



Figure 5.8 Map of regions of the Moreton Bay watershed.

The eastern portions of Moreton Bay received the highest grades (A), and highlighted the conservation value of this region. Moreton Bay Marine Park was established in 1992 and became an ecotourism destination. Approximately ten thousand green sea turtles and nearly a thousand dugong feed on the seagrasses of eastern Moreton Bay. These populations have remained stable in Moreton Bay, in spite of large declines in the rest of Queensland. Advertising and

political leaders have been touting that Brisbane is the only major city skyline on the planet that can be viewed while surrounded by a healthy population of dugongs and sea turtles.

Annual simultaneous public releases of report cards for Moreton Bay, the Moreton Bay watershed, Sunshine Coast, and Gold Coast have tracked the progress of a suite of management actions, including wastewater reuse and riparian restoration. Water quality improvements have led to seagrass recovery in western Moreton Bay, diminished algal blooms, and maintenance of a vibrant prawn fishery in Queensland. The Moreton Bay Report Card was a catalyst for a broad social and economic revitalization of the Southeast Queensland waterways.



Figure 5.9 2016 Healthy Waterways and Catchments Report Card.

CASE STUDY

Orinoco River Basin Health Report Card, Colombia (est. 2016)

In the face of expanding agro-industrial activities in a post-conflict river basin, the Orinoco River Basin Health Report Card (Figure 5.11) is bringing public attention to the need for sustainable development and offering specific recommendations. Soon after its completion in 2016, the report card's influence in the region became evident.

The Regional Environmental Authority in the Meta Department (Cormacarena) expressed interest in applying the report card indicators and framework at a much finer scale within the Meta River sub-basin (a sub-basin of the Orinoco River basin). Consequently, plans are underway to update monitoring within the sub-basin so that reporting at a much more local scale is possible in the future.

Identification of data gaps throughout the report card development process has led multiple institutions to fill these gaps. Within the Guaviare sub-basin, a pilot project has been initiated with the Patrimonio Natural Fund and the Environmental Ministry to engage local communities in river basin management via monitoring of fires and deforestation (two of the indicators included in the report card).

This project will provide input to updating these indicators over time. Additionally, a lack of information for river dolphin populations in the Guaviare River has been addressed by the Omacha Foundation which is now conducting dolphin surveys there. In the Tomo and Tuparro Rivers, the Humboldt Institute has signed an agreement with the Science, Technology and Innovation Administrative Department (Colciencias) to undertake biodiversity surveys for several taxa in these river basins.

The Orinoco River Basin Health Report Card has also provided important information about biodiversity, land use change, fire dynamics, and ecosystem services to an alliance advocating for increased ecosystem representation in the National Protected Area System. This information has helped characterize and identify new areas for potential protected area designation, or extension, within Orinoco River basin. One example is the initiation of a new potential Ramsar site in the Bitá River sub-basin.

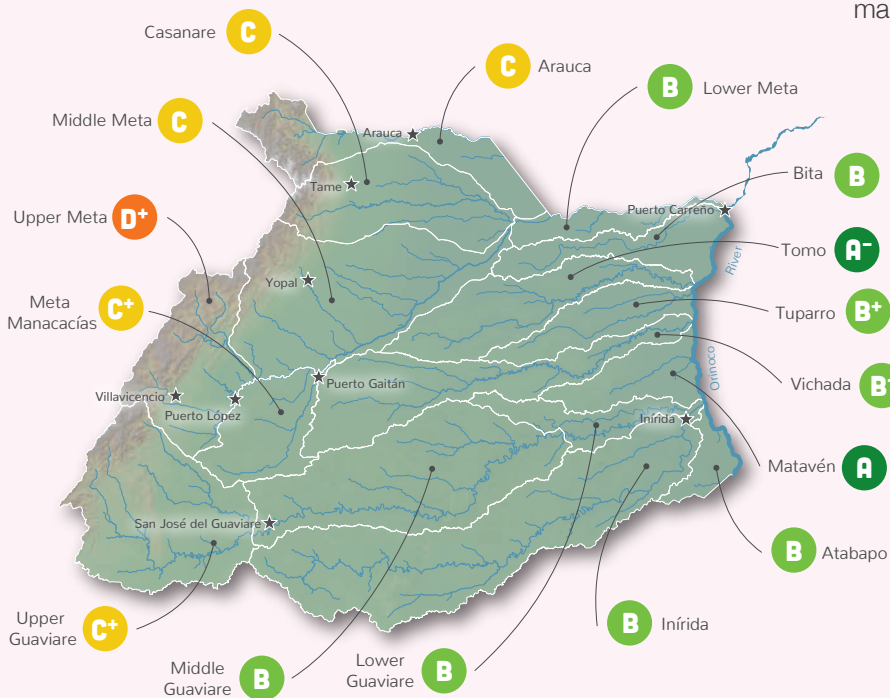


Figure 5.10 Regional grades from the 2016 Orinoco River Basin Health Report Card.

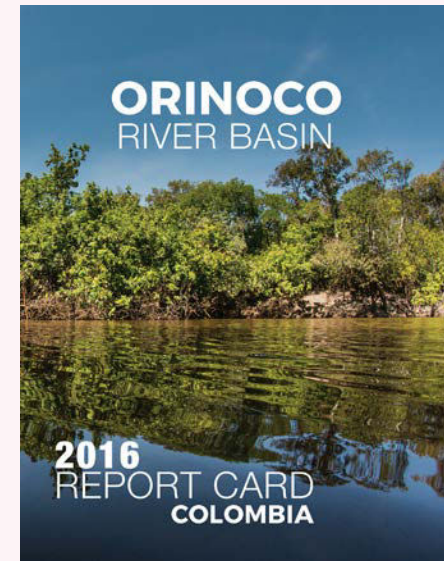


Figure 5.11 The 2016 Orinoco River Basin Health Report Card.

CASE STUDY

Mississippi River Watershed Report Card, USA (est. 2015)

The Mississippi River Watershed Report Card (Figure 5.13) assessed progress toward achieving goals for managing the Mississippi River Watershed in six thematic areas: Healthy Ecosystems, Flood Protection and Risk Reduction, Transportation, Water Supply, Economy, and Recreation. The first report card was released in 2015, and plans are to update the report card on a 5-year cycle.

The Mississippi River Watershed Report Card created opportunities for empowering change in multiple ways. By engaging a broad representation of stakeholders in the region throughout the project, the report card process created a common language for discussing river watershed issues from a holistic perspective, a common vision for the future of the watershed, and a common system of measuring progress to achieving goals. Publication of the final report card created a sense of hope that concrete actions could be taken to create positive change. The report card created a framework for addressing these needs: "Given the report card findings, what are some concrete actions that can be taken to improve the condition of the watershed and improve the grade?" This was specifically addressed in a follow-up conference for over 200 stakeholders in the Upper Mississippi River Basin, where seven specific actions were identified that could be implemented quickly, and that supported more than one stakeholder sector. This action agenda was delivered to key U.S. Congressional representatives in January 2017.

The Mississippi River Watershed Report Card was accompanied by a strong public relations campaign to increase the impact of the report card on public awareness of issues related to managing the river for diverse uses.



Figure 5.12 Regional grades from the 2015 Mississippi River Watershed Report Card.



Figure 5.13 The 2015 Mississippi River Watershed Report Card

The release event generated high media attention nationally and internationally, as well as intense social media distribution (over a million social media impressions on the first day). The report card especially highlighted the need for maintenance and restoration of transportation infrastructure for locks and dams which allow global export of agricultural and industrial products. The report card findings (Figure 5.12) inspired efforts to identify targeted actions that can increase scores and improve the condition of the river watershed. This report card was one of the first efforts to address environmental, economic, and societal interests equally. Ecosystem was only one of the equally weighted, six thematic goal areas. It was also one of the first to specifically target stakeholder engagement within the report card development process as a valuable product in addition to the printed report card product. Over 600 people representing different sectors and institutional affiliations were involved in creating the report card, analyzing data, and interpreting results, which effectively made the Mississippi River Watershed Report Card a truly transdisciplinary project.



Murray River, Australia. Photo courtesy of Jackoscage / Flickr Commons.



6

**Overcoming
barriers**



Orinoco River, Colombia. Photo courtesy of M. Kohut.

Overcoming barriers

Introduction

Creating and regularly producing report cards can be challenging for a variety of reasons. Resistance to change or vested interests can make it difficult to achieve consensus, for example. But the barriers for report card creation and production can be managed, and in this chapter we address overcoming various barriers. These strategies for dealing with such challenges have been formed through our experience producing report cards around the world over the past decade.

In this chapter, we present approaches for addressing the eight most common barriers (Figure 6.1). We also provide guidance on an adaptive approach to assessing these barriers. It is safe to assume that creating and producing report cards will encounter obstacles, and being able to understand how barriers are overcome will aid in the formulation of strategies to overcome them.

While the final report card can, and should, appear simple, achieving this simplicity takes time to do well. Barriers can make this process difficult, but surmounting the barriers serves to make the project team more cohesive and prepare them to take on larger challenges.

The barriers we describe span difficulties encountered at the onset of the report card process (e.g., overcoming resistance), during the production of the report card (e.g., insufficient data), or after the report card is released (e.g., maintaining momentum). In addition, the challenges of incorporating climate change, overcoming trans-boundary issues, or dealing with external factors or influences can be barriers as well. Overcoming the challenges outlined here will serve as examples for resolving barriers for producing and maintaining report cards.



Figure 6.1 Barriers can be encountered, yet overcome, when developing a report card.

Overcoming resistance and vested interests



Resistance to a report card can come up for a variety of reasons. There may be fear about what the report card will show and what issues will be brought to light, or about losing control of information and the consequences of the report card results. There may be uncertainty about the report card process and oversimplification of complex science, social issues, and/or relationships.

Strategies to overcome reluctant participants and stakeholders

If key stakeholders, funders, or trusted representatives are not fully supportive, it can be difficult to initiate a new report card project or maintain momentum on an existing project. Thankfully, there are some great strategies you can use to address this issue. Some strategies are similar to those in the securing funding section on page 19—the same things that can gain funding support can also help overcome reluctance in the process of creating the report card. We have used the following strategies in past projects to build momentum or re-energize a stalled process.

1. Socialize the project early

Begin discussing the idea of a report card long before the project is set to begin, or even before funding has been organized. This allows all stakeholders to get a better understanding of the report card process and benefits. With more people supporting the report card idea, it is easier for others to join in.

2. One-on-one discussion

One-on-one discussions with key stakeholders about the benefits of having a report card for their region are good opportunities to suggest that they align themselves early in the process, even if a report card wasn't their original idea. In these meetings, it can sometimes be necessary to stress that the report card project will go forward regardless of their engagement, and so, it may be in their best interest to engage in the process rather than resist it. Of course, discretion is advised when employing this latter strategy—local project teams may have insight to local political relationships and personalities, and will know best how to engage them. Guidance from other key supporters is also advisable in deciding how best to engage particular participants or stakeholders.

3. Persistence pays off

Resistance can emerge at any point during the report card process. Being persistent in advancing the project will often overcome a loss of momentum. It is important that practitioners are 100% certain that the report card will be finished regardless of the challenges that may come up. Radiating this certainty will help maintain or regain project momentum that may be lost while addressing a difficult issue.

4. Engage everyone, even the detractors and those with vested interests

It is especially important to stay engaged with all relevant stakeholders, even those who are less than enthusiastic about the report card project. Some stakeholders may just want a chance to have a voice in the process. Providing a safe place to have an open dialog will foster a sense of trust and respect that will go a long way to winning over detractors. Even if they aren't completely won over, it is still important to remain engaged and ensure that they feel that they have been heard as the process moves ahead.

5. Leverage examples of successful report cards

Use examples of successful report cards developed in other localities to highlight the direct and indirect influences a report card can have on river basin management.

6. Focus on key messages

Some members of the science community may feel that the report card would oversimplify complex scientific processes. The report card is not meant to oversimplify, but rather to provide a means of sharing scientific results in a manner that can raise awareness and educate. We prefer to focus on discovering the key messages that are contained in the complex data and science that underpins the report card. It is also important to stress that the data analysis is transparent and defensible, and that the more detailed information supporting the report card is readily available to anyone who wants it. It is not advisable to hide analysis methods if they are imperfect, but rather highlight where things can be improved in the future.

CASE STUDY

Resistance to the initial idea of a Chesapeake Bay report card

When the Chesapeake Bay Report Card was first proposed in 2005 by the University of Maryland Center for Environment Science (UMCES), it was a new idea. It had not been done before in this region of the United States, and was initially resisted by the science and management community. This community was coming under fire for previously misreporting information on the health of Chesapeake Bay, so there was understandable resistance to saying anything without absolute certainty of the data. Once the project started, there were fears about what the report card results would show and worry about how that would reflect on current management strategies. Linking health conditions to management responses, such as wastewater treatment upgrades and nutrient management plans, was a key objective of the management community in the Chesapeake region, but they were having difficulties making that connection. Additionally, the science community worried that complex science would be oversimplified, and that important variability and complexity would be lost.

Strategies that were used to overcome this resistance were mainly tailoring the methods to address concerns in order to secure buy-in, persistence, and time. The discussion about the report card project continued for almost three years before the first report card was published, allowing participants to get a better understanding of the project and process. A large constituency of the science and management community was consulted during the report card process, creating buy-in to the entire process as well as individual portions of the analysis. Over time, many skeptics became supporters, however, UMCES ultimately took on the role of champion and released the first report card on its own (Figure 6.2). This allowed the science and management community to wait and see how the media and public received the report card. Now, the Chesapeake Bay Report Card is one of the most widely anticipated science communication products to be produced in the United States, garnering much media attention, raising public awareness, and informing management.

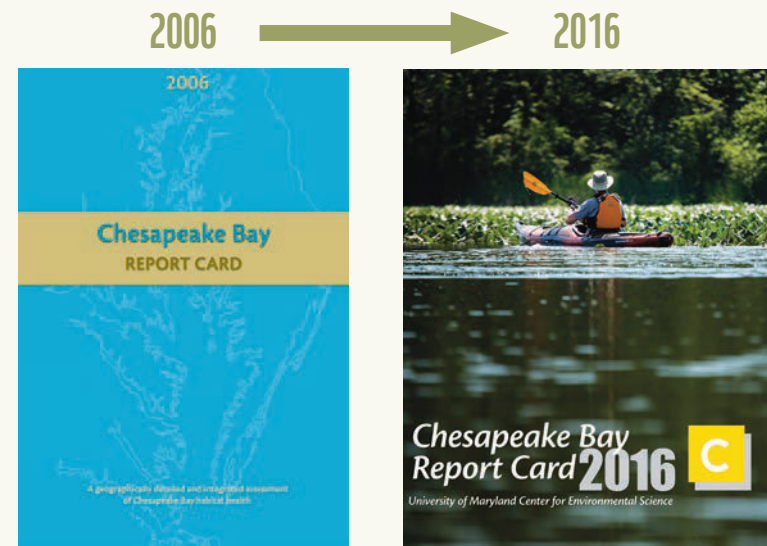


Figure 6.2 The first Chesapeake Bay Report Card (left). The 2016 Chesapeake Bay Report Card (right).

Cultivating champions and host institutions



There are many roles that need to be filled when producing a report card, including data gathering and analysis, interpretation, dissemination, and communication. This team can be a single person in the case of a small report card effort, or it can involve many people from a diversity of organizations. Leadership of this group is crucial, so that timelines and coordination are maintained.

The key to leadership is to provide opportunities for people to excel, while being aware that some degree of failure is to be expected. People are not born leaders, rather they learn how to be leaders. Leadership training is a good investment in personnel associated with report cards. A good part of leadership training is communication, and report cards are an effective tool, especially in the hands of someone trained in communication.

Finding a champion

1. Public face champion

A report card “champion” is a person or institution that may or may not be part of the process to form a report card. However, he or she will work to secure funding or people’s time, as well as help disseminate the report card findings. It is crucial that the champion have a good working knowledge of the ecosystem being assessed. The champion can come from academia, private sector, government, or non government organizations. Several people can serve as champions as well, particularly if the report card region is extensive and/or the indicators are diverse. Be aware that being labeled a “champion” can be daunting to some and they may tend to shy away from the term, as it can be perceived that superhero status is required.

2. Scientific champions

Scientific champions are necessary as well. There is a need to have someone familiar enough with the report card science who can answer questions and defend the data used for each indicator. More than one scientific champion can be used. For example, in Moreton Bay, Australia, a freshwater report card champion was complemented by a marine and estuarine report card champion. In the Mississippi River, a champion for transportation was distinctly different from the ecosystem health champion.

3. Host institution or organization

The host institution is the entity responsible for producing the report card, and while there will likely be many other organizations, agencies, and institutions involved in the report card process, it is important that there is a lead institution taking on the responsibility to deliver the report card.

4. Celebrity champion

A famous celebrity (local or broader) can be a great way to promote a report card. A familiar face that is trustworthy can be an excellent advocate of the river basin under investigation. For example, in Australia an Olympic gold medalist swimmer pledged that the Brisbane River would be swimmable by 2020 if proposed actions in the report card were enacted.

CASE STUDY

Finding the support for a Great Barrier Reef report card

The first Great Barrier Reef Report Card (Figure 6.3) took several years to become reality. Initial discussions with the science and management community in the state of Queensland, Australia were positive, although some stakeholders and participants worried about how the Great Barrier Reef Report Card would be received and results interpreted. Some in the community felt that the report card grades would unfairly reflect on factors like increasing ocean temperatures and ocean acidification that were outside of the control of Australian and Queensland Government management options. Concerns about these issues were thoroughly discussed and adjustments to key messages and data interpretation were included to address them.



Figure 6.3 The first Great Barrier Reef Report Card released in 2009 and its list of key supporters.

The most pressing issue, however, was identifying the owner and champion of the report card—who was going to be responsible for its annual production, maintain its scientific integrity, and secure the resources to ensure that it was a sustainable project. When the Queensland Government was identified as the report card's owner and leader, the process became re-energized and the report card was completed fairly quickly. In addition to persistence and time, identifying the champion and thoroughly discussing key issues were critical factors in the ultimate release of the Great Barrier Reef Report Card in 2009. The report card has subsequently continued to be released annually.

Incorporating climate change



Climate change combined with increased water resource use is affecting and further expected to affect freshwater ecosystems and the timing and availability of water resources around the world (Palmer *et al.* 2009). Given “deep uncertainty” of how climate will affect water resources both directly, and indirectly due to socio-economic shifts, it is encouraged to incorporate climate considerations into the process of developing a river basin report card.

In general, an approach of “managing for resilience”, which focuses on maintaining key processes and relationships in social-ecological systems so that they are robust against a wide range and variety of perturbations from climate or other stressors, provides a guiding framework (Allen *et al.* 2011). Below we outline a set of questions and recommendations relevant to each step in the process of report card development to assess the potential relevance of climate change, and account for climate uncertainty and climate risks in the report card results.

Strategies to move from confusion and resistance to motivation and commitment

There are several key principles to remember when deciding on how to incorporate climate change into a river basin report card:

1. Consider the following groups in evaluating those stakeholders to engage in the report card process:

- Who are the climate experts in the region?
- Who has historical, observed weather data relevant to the region? (not always government, could be fishers, farmers, indigenous peoples)
- Who is or will be most affected by climate change, now and in the future?
- Who allocates funding for or makes relevant decisions to address climate risks and plan for and build resilience? Are they different from those making water management decisions or disaster risk reduction?
- Are there private sector stakeholders that have public climate change sustainability goals with supply chains and/or operations in the river basin? Are there corporations in the river basin with large carbon footprints that might be persuaded to modify their practices?

2. What is likely to be impacted?

- What are the projected impacts and severity due to climate change in the river basin? Have studies been completed that identify the most pressing climate risks?
- Have you experienced an extreme event (e.g., an unprecedented flood, massive fish die off) or significant changes in weather patterns related to climate change or anticipate such that align with any of the 6 thematic categories (Management and governance; Health and nutrition; Water quality and quantity; Landscapes and Landscapes and ecology; Economy; and Social and cultural)?
- What adaptation actions are underway or needed to build resilience to climate change, both now and in the future?

3. Choosing relevant indicators and thresholds

- Based on existing impacts and known climate risks in the river basin, select indicators for river basin adaptive capacity and/or resiliency for reducing or avoiding those existing impacts and future risks.
- Consider how climate will affect trends in indicators of river basin health? Does uncertainty need to be incorporated in the thresholds and/or the indicator itself?
- All other options being equal, select indicators that are useful indicators of river basin health AND climate adaptive capacity and resilience or impacts (e.g., extent of seagrass beds in Chesapeake Bay reflects salinity changes due to cc impacts as well as runoff of sediments and nutrients from watershed; floodplain extent can provide an indicator of both natural habitats and adaptive capacity to buffer against flood events; environmental flow regimes, especially that account for extreme lows and highs (i.e., increasing seasonal variability), are a good indicator of management resilience)
- Consider including a separate measurement of vulnerability and/or resilience of the river basin to climate change in the report card results. Measures for both social and ecological systems' resilience are highly recommended. For social systems, a measurement of adaptive capacity, i.e. capacity to manage uncertainty and extremes (Cook. 2012) and for ecosystems, a measure of the resilience as a function of the state of the entire river basin system, including infrastructure and ecosystem ability to bounce back from shocks and maintain services in the long run.

4. Communicating results

- Consider inclusion of messages about building river basin resilience and adaptation measures
- Final product Options:
 - Option 1 – Climate change indicators incorporated into categories of river basin health as appropriate based on climate risk;
 - Option 2 – Maintain river basin health indicators as per usual development + add in a separate scoring on vulnerability of the river basin as a whole
 - Option 3 (**preferred**) - Climate embedded in each of the categories + vulnerability scoring

Allen, C. R., G. S. Cumming, A. S. Garmestani, P. D. Taylor, and B. H. Walker. 2011. *Managing for resilience*. *Wildlife Biology* 17:337-349.

Cook, J., S. Freeman, E. Levine, and M. Hill. 2012. *Shifting Course: Climate Adaptation for Water Management institutions*. WWF, Washington, DC.

Palmer, M. A., D. P. Lettenmaier, N. L. Poff, S. L. Postel, B. Richter, and R. Warner. 2009. *Climate Change and River Ecosystems: Protection and Adaptation Options*. *Environmental Management* In press.

Working across trans-boundary river basins



Trans-boundary river basins have historically been a source of political tension. When two or more nations are forced to share a body of water, there is invariably a host of potential issues to overcome. In order to develop a sustainable plan to assess the health of a river basin, and then to manage it, stakeholders may need to overcome:

- language barriers
- different management goals
- difficulties with sharing data
- issues with trans-boundary navigation
- liability issues with regard to pollution
- differing water security needs
- geopolitical difficulties which may de-incentivize international cooperation
- differing cultures and cultural goals
- unequal power relationships and/or financial status



Figure 6.6 Danube River basin is the most international river basin in the world, extending over all or part of the territories of 18 countries. Source: WWF

Strategies to work across boundaries

Fortunately, there is historical precedent for establishing international agreements to sustainably managing trans-boundary water resources. The most successful agreements have used a variety of strategies to assess and manage river basin health. Some of these strategies include:

- Ensuring that all parties involved are sensitive to one another's hydrologic needs. This is one of the most crucial elements of any negotiation, and serves as the keystone to building any dialogue.
- The creation of task forces to coordinate efforts between parties. This strategy was used to great effect in negotiations regarding the Danube River watershed which involved 17 different European riparian states.
- Within a task force, the creation of 'expert sub-groups'. The riparian states of the Danube River watershed had two of these groups: one for data management and one to function as an early warning system for environmental issues.
- It is also helpful to include the public in discussions when possible. The Danube River Protection Convention (DRPC, 1997) was atypical (but effective) in its use of input from the public and NGOs.

- River basin-wide negotiations tend to be more effective than bilateral water resource negotiations, or negotiations that only deal with a portion of a river basin. For instance, during discussions of water allocations in the Ganges River between India and Bangladesh, India insisted on separate negotiations with each of its international rivers. In this way, it was able to open discussions with Nepal regarding Ganges tributaries without considering Bangladeshi concerns.
- Proactive and continuous 3rd party involvement is often a highly effective strategy. Part of the success of the Indus Water Treaty (IWT, 1960) is attributed to the participation of the World Bank, which helped mediate the dispute by providing staff, proposals, and \$900 million in funding to address Pakistan's final concerns.

CASE STUDY

South Caucasus Region Trans-boundary Report Card

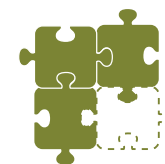
Despite the intrinsic difficulties in negotiating trans-boundary waters, these negotiations can also provide unusual opportunities for collaboration and cooperation. For instance, when the U.S. State Department was attempting to mediate relations between Armenia, Azerbaijan, and Georgia, they discovered an area of common ground—the Kura-Araks River Basin. The river basin is highly necessary to each country, but had become heavily contaminated by chemical, industrial, radioactive, and agricultural pollutants. Compounding the issue, relations between Armenia and Azerbaijan had been politically unsettled since 1988, resulting in open hostilities between the two countries that only ended when a ceasefire was brokered in 1994. Despite the ongoing military and political disputes between the two nations, negotiations regarding the Kura-Araks River Basin were allowed to continue (and are still continuing today) and a report card provided the mechanism that all three countries could work together on. This indicates that, although political differences may prove to be obstacles, they are not insurmountable when negotiating trans-boundary water resources, and a report card provided that foundation.



DPRC. 1997. Convention on co-operation for the protection and sustainable use of the Danube river. 21997A1212(03) (31997D0825). Issued by International Commission for the Protection of the Danube River.

IWT. 1960. Indus Water Treaty. Ministry of Water Resources, Government of India

Insufficient data



A challenge in developing report cards is having sufficient quality and quantity of data to adequately represent the health of a river basin. Report cards are data-driven products, but having a lack of data doesn't mean a report card should be avoided. In fact, the extent and breadth of the lack of data may only become apparent when a report card process is started. As such, beginning the report card process will provide you focus on what indicators should be monitored if they are not already, providing a framework for prioritizing monitoring and information gathering resources.

Even in well studied, information-rich river basins, data will be lacking or insufficient to adequately represent the values or threats that stakeholders consider to be very important. This situation, once again, represents an opportunity to highlight this deficit of information and leverage new efforts to acquire this data as shown in the case study on the Mississippi River Watershed Report Card. Strategies to overcome shortages in data, include:

1. Searching for global datasets
2. Sourcing remote sensing information
3. Using modeled information
4. Seeking professional judgment

CASE STUDY

Mississippi River Watershed Report Card

An example of addressing insufficient data is the Mississippi River Report Card. Early in this project, there were a number of indicators identified to assess transportation (stoppages and maintenance), water supply (water supply stress index), and recreation (access) that had insufficient data to calculate scores for those indicators. And yet, these indicators were considered important and were thus included in a preliminary results report card (Figure 6.7). Instead of receiving a colored score, they were assigned a gray color to highlight the insufficient information.

This approach allowed these indicators to be included, despite a lack of information, which led to discussions on why this data was missing, could the data be collected, and/or could these indicators be replaced with other suitable indicators? Ultimately, information for the indicators were found or substituted with indicators that did have sufficient data.

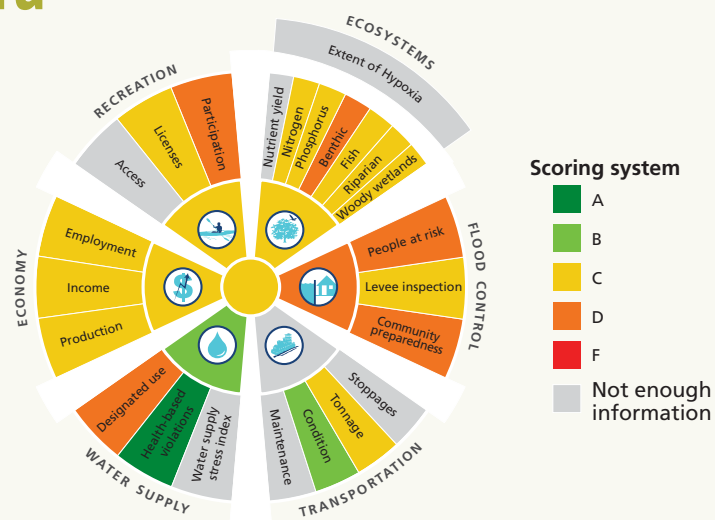


Figure 6.7 Preliminary results of the Mississippi River Watershed Report Card.

Mobilizing civil society



We discussed earlier in this Guide the importance of identifying, engaging, and broadening key stakeholders in the report card process.

Ultimately, the report card is only as effective as its findings are understood and implemented. Effectively mobilizing civil society for improved river basin health depends upon the strategic engagement of its stakeholders. Among the stakeholders initially chosen to participate should be those who recognize a larger public good that needs to be served in the river basin, who have experience in communicating information, and have experience in taking action. The following questions can help to identify those stakeholders that can help with mobilizing civil society:

- Which stakeholders have ongoing relationships with the media?
- Which stakeholders have relationships and credibility with the relevant public officials who could implement the findings of the report card?
- Which stakeholders are willing to engage in new partnerships and collective action with other stakeholders to address shared goals?
- Which stakeholders have the capacity to further train others in the community about the findings of the report card?

Answering these questions will go a long way to help in mobilizing civil society to address the issues raised by your report card.

Take care in identifying local leaders who are interested in implementing solutions that broadly improve river basin health rather than exacerbate narrow conflicts. For instance, a preferred response to an indication of water scarcity would be greater commitment to source water protection and natural resource management rather than a new battle for allocation of water resources among stakeholders.

In any given river basin there are multiple challenges to the people, nature, and economy of that region. For people to meaningfully respond to so many challenges, they need tools to identify the primary issues and to get a sense of how those issues can be addressed over time. They need a way of seeing a sense of proportion and priority so that when they are mobilized they can be more effective. Report cards and the process of developing and disseminating them can help mobilize civil society in a more focused and informed manner for the greater achievement of river basin health.

Adapting to external impacts or influences



It goes without saying that every report card project is affected by external factors that determine how report cards are designed and executed. In some cases, these external influences can present what seem like overwhelming obstacles. But there are always ways to adapt to the many things that get in the way of your report card project. You will need ways to adapt to changing influences from these external factors.

As report card projects unfold, important changes in the ecosystem or in the social, political, and economic environments can happen. Sometimes these events require us to adapt parts of our report card project. For example, an important event like a powerful storm, extreme temperatures, or drought can occur during the process that requires some adjustment to the project. Adjusting to accommodate these types of events may require unplanned time and resource expenses, but ignoring them could make the report card lose relevance. Similarly, the political climate can change quickly, requiring an adjustment in priorities or emphasis in order to keep some community sectors engaged.

Strategies for adjusting to unforeseen change

The following are some guiding principles for adapting to these types of challenges.

- **Adopt an attitude of flexibility.** Expect that things will come up that require a change of course or response in the report card process. Quickly responding and adapting to account for new realities can make a big difference in project momentum.
- **Respond quickly.** Don't overreact, but also don't ignore things that come up because they present difficult questions. It is better to address them quickly and openly so that they don't become larger problems.
- **Power through.** Understand that things come up that are challenging and sometimes the challenges can seem overwhelming, but with persistence and adaptability the project will be completed.

CASE STUDY

Indian River Lagoon, Florida

During the process to create the preliminary report card for the Indian River Lagoon in northeastern Florida in the U.S., there was a particularly devastating algal bloom that released toxins, caused a depletion of oxygen, and led to a very large fish kill. This event occurred well after a workshop was hosted to create the reporting framework and discuss the relevant stories in the report card, and immediately prior to the completion of the report card framework newsletter. Although very damaging to the ecosystem, our initial newsletter had not planned to discuss algal blooms since they were infrequent. Revising the report card framework and newsletter to include a response to the algal bloom was a bit overwhelming, especially since we were so close to completing the project. But the algal bloom was such a significant event that it could not be ignored in the report card, and we had no choice but to adapt our project to include it. We made minimal changes to the newsletter, but added a 1-page flyer that comprehensively and visually described the bloom event and the devastation it had on habitat and wildlife in the Indian River Lagoon (Figure 6.8).

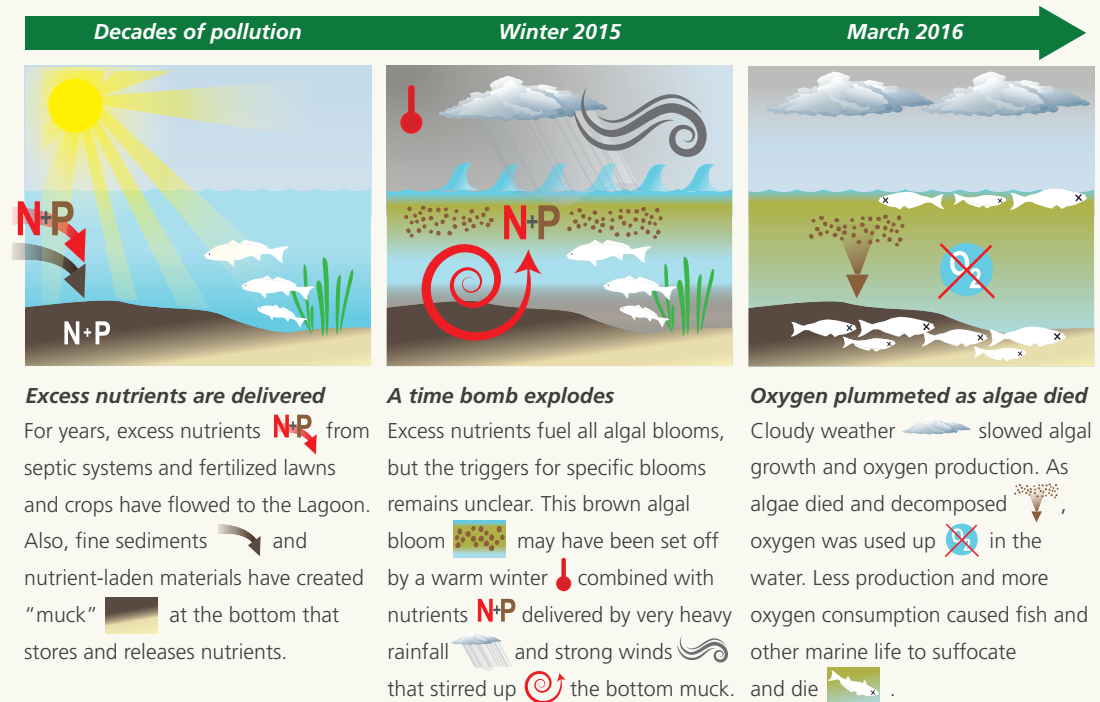


Figure 6.8 Conceptual diagram explaining the sudden and catastrophic algal bloom and subsequent fish kill of more than 32 tons in the Indian River Lagoon.

Maintaining momentum



As report cards are repeated over time, there is the possibility that momentum could be lost. Losing momentum can result from gradual changes in report card grades, despite sometimes considerable effort and investment in river basin restoration. A 'quick-fix' in environmental management is very rare, even once funds are secured and remediation is underway or completed.

Strategies to overcome losing momentum

1. Highlight what has happened in the past year

Indicators of river basin health take time to respond to a legacy of degradation, subsequently leading to gradual changes in report card grades. Not seeing the subtle changes in report card grades often results a loss of momentum for the endeavor, which we have named "report card fatigue". Additionally, pressures can often build over time (i.e., with population growth) indicating that stable grades are in fact a sign of improvement. Acute changes can come as a result of large events, such as storms and/or floods, and shift grades markedly in one particular year. The resilience of an ecosystem can be demonstrated by grades 'bouncing' back the next year, as shown in the Moreton Bay Report Card case study.

2. Update indicators

Updating indicators once a report card has been established is not a trivial activity, but can help keep the report card fresh and up-to-date as issues change. Changing indicators can often mean a change in report card scores, solely as a result of the methodology and not a reflection of the environment. However, changing indicators does play a role in the evolution of a report card, in response to

CASE STUDY

Moreton Bay Report Card

This graph shows the variation in scores over 13 years for the Moreton Bay Report Card, Queensland, Australia. For the past 14 years, there was very little change in the grade, except for a short dramatic drop in the grade due to a significant flood event in 2009 (Figure 6.9). Maintaining a relatively steady grade was an achievement in itself as the region was one of the fastest growing regions in the world, and a more drastic decline was likely averted due to management actions. The steady grades however for the first 7 years could have become a little repetitive, however the annual report card release was associated with a river festival, award ceremony, and new stories about the bay, which maintained peoples interest.

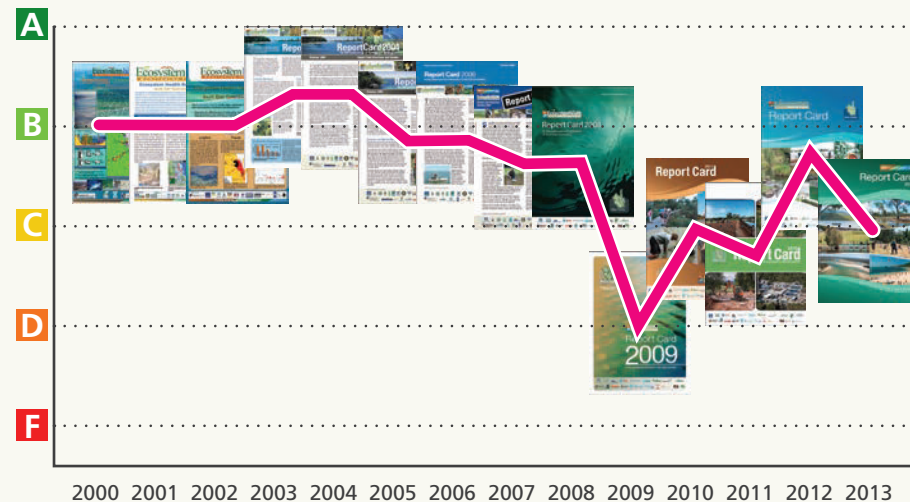


Figure 6.9 Graph of Moreton Bay Report Card grades from 2000 to 2013.

changing management priorities and new threats to the environment. In Moreton Bay, Australia, an indicator developed and used to map and track sewage nitrogen became redundant after significant investment to upgrade sewage treatment plants in the region led to drastically reduced nitrogen levels. New indicators were chosen that focused on diffuse inputs to the system, once point source inputs were effectively managed.

3. Anticipate delays in reporting

Delays in report card release (i.e., mid-2016 release of the 2015 report card) have been an inherent feature of report cards which can make them feel a bit out-of-date or not current. Delays due to laboratory analysis and reporting, quality checking, and publishing of data, combined with a general requirement to have 12 months of data, has made 'real-time' reporting of scores difficult. Nonetheless, the contemporary need for rapid information and the new monitoring technologies is making real-time reporting possible. Future report cards autonomous sensors in the environment could deliver real-time report card scores, updated at any desired time interval, or provide live rolling 12-month mean/median scores to smooth out variability inherent in environmental monitoring.

4. Continue community engagement

Keeping the stakeholder community of resource managers, scientists, resource users, and the general public involved is a challenge. But there are various approaches to attempt to re-engage them.

- Integrate citizen science into development of the report card scores (e.g., using a mobile application on personal devices to collect information or having an network of citizen scientists collect data throughout the river basin year-round.
- Hold a photo competition where the public can submit images from the report card region, with the winning photo featured on the front cover of the report card publication (Figure 6.10).
- Request input (or content contributions) from the public on what features they would like deeper discussion to be included in the upcoming report card.
- Include a piece within the report card that is a response to the grades from managers, scientists, and/or the public.

CASE STUDY

Chesapeake Bay Report Card

An eNewsletter announcement to all subscribers, many of whom were stakeholders.

Do you have great photos from around the Chesapeake Bay? We want to see them!

Submit your photos from 2012 weather events, water quality, or that fish that you caught, to win \$250 and your photo on the cover of the 2012 Chesapeake Bay Report Card.



Figure 6.10 2012 Chesapeake Bay Report Card photo contest call for submissions.



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