

Global Scenarios in Historical Perspective

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Main Messages

Scenarios are plausible, challenging, and relevant stories about how the future might unfold, which can be told in both words and numbers. Scenarios are not forecasts, projections, predictions, or recommendations. They are about envisioning future pathways and accounting for critical uncertainties.

The process of building scenarios is about asking questions as well as providing answers and guidance for action. It is intended to widen perspectives and illuminate key issues that might otherwise be missed or dismissed. By offering insight into uncertainties and the consequences of current and possible future actions, scenarios support more informed and rational decision-making.

Scenarios address real-world questions of systems dynamics, policy choices, technological evolution, and consumption and production patterns. They reflect the modern worldview that the future is not preordained but rather is subject to human actions and choices. Yet the age-old drive to ponder the possibilities for our collective future, and to draw relevant lessons for how to live today, remains.

The international commitment to sustainable development that has emerged in recent decades gives the study of the future a new urgency and direction. Global scenario analysis has evolved rapidly over the past 10 years in response to this challenge. Although maintaining the long-term resilience of the world's ecosystems is fundamental to sustainable development, ecosystem dynamics themselves have not yet been central to this research. Adding such a focus is a primary aim of the Millennium Ecosystem Assessment scenarios. This chapter sets the historical context and point of departure for the ecosystem outlook.

This chapter reviews the historical context of scenarios, beginning with brief sketches of early scenario activity, from its post-World War II origins up to about a decade ago. While heterogeneous, these studies all take a global perspective in attempting to link social, economic, and environmental issues. The literature can be split into two largely nonoverlapping streams—quantitative simulation and qualitative narrative. Scenario analysis as a professional undertaking first surfaced with strategic planning and war games during the early years of the cold war. But the direct antecedents of contemporary scenarios lie with the future studies of the 1970s. At this time, scenario analysis was also first used as a corporate strategic management technique. After a considerable lull during the early 1980s, a second round of integrated global analysis began in the late 1980s and 1990s, prompted by concerns with climate change and sustainable development. The first decades of scenario assessment paved the way by showing the power—and limits—of both deterministic modeling and descriptive future analyses. A central challenge of contemporary global scenario exercises is to unify these two aspects by blending the replicability and clarity of quantification with the richness of narrative.

Today, scenarios are being applied in an expanding array of business, community, policy, and research contexts with highly varied aims—better management, consciousness raising, conflict resolution, policy advice, and research. Scenarios can be forward-looking, exploring how futures might unfold from current conditions and uncertainties, or backward-looking, beginning with a normative vision of the future and asking whether there is a plausible path to it. Scenario building can include the active engagement of targeted audiences through participatory processes and game playing, deliberation among expert scenario panels, and quantitative simulations by modeling groups.

Scenarios relevant for the MA process are those that have a public policy and scientific orientation. The ideal attributes for such scenarios are: integra-

tion across social, economic, and environmental dimensions; regional disaggregation of global patterns; multiple futures that reflect the deep uncertainties of long-range outcomes; and quantification of key variables linked to ecosystem conditions.

The following global scenario building exercises after 1995 were considered for building the MA scenarios: Global Scenarios Group, Global Environment Outlook, Special Report on Emissions Scenarios, World Business Council for Sustainable Development, World Water Vision, and the Organisation for Economic Co-operation and Development. A scan of these studies suggests great variation in the way each exercise was structured. Yet beneath the diversity, the scenarios are rooted in a common set of archetypal visions of the future—worlds that evolve gradually, shaped by dominant driving forces; worlds that are influenced by a strong policy push for sustainability goals; worlds that succumb to fragmentation, environmental collapse, and institutional failure; and worlds where new human values and forms of development emerge.

In the coming years, the enrichment of global scenarios, often through participatory processes, will define an important agenda for policy analysis, scientific research, and education. Improving environmental scenario building will require the enhancement of the role of ecosystems in both scenario narrative and quantification. Narratives will need to more richly reflect ecosystem descriptors, impacts, and feedbacks. Models will need to simulate ecosystem services and ecosystem dynamics, including feedbacks from ecosystem processes to ecosystem services and human well-being.

2.1 Sustainability and the Future

Since ancient times, speculation about human destiny has infused culture through myth and religious cosmology. Prophetic tales told of what is to come, of apocalypse and resurrection, often conveying moral messages for the here and now. These stories gave voice to the powerful impulse to give meaning to the human condition and to act worthily. In a sense, they were the first scenarios.

Of course, where ancient mythology sought to divine the workings of spirits, gods, and cosmic forces, contemporary global scenarios are a good deal more prosaic, harnessing the imagination to the secular insights of the social and natural sciences. They address real-world questions of systems dynamics, policy choices, technological evolution, and consumption and production patterns. They reflect the modern worldview that the future is not preordained but rather is subject to human actions and choices. Yet the age-old drive to ponder the possibilities for our collective future, and to draw relevant lessons for how to live today, remains.

Basically, scenarios are plausible, challenging, and relevant stories about how the future might unfold, which can be told in both words and numbers. Scenarios are not forecasts, projections, or predictions. They are about envisioning future pathways and accounting for critical uncertainties. The process of building scenarios is about asking questions as well as suggesting answers and guidance for action. It is intended to widen perspectives and illuminate key issues that might otherwise be missed or dismissed.

The international commitment to sustainable development that has emerged in recent decades gives the study of the future a new urgency and direction. The essence of

sustainability is to harmonize economic development with social goals and environmental preservation. At its core is the moral imperative that current generations should pass along an undiminished world to their descendants. To a large degree, sustainability is a challenge to think about the long-range future and, in so doing, to rethink the present. Sustainable development brings the question of the future to the strategic forefront of scientific research, policy deliberation, forward-thinking organizations, and the concerns of citizens.

The challenge of sustainability poses fundamental questions: How might global development evolve over the coming decades? Are we currently on a sustainable path? What surprises could deflect the global system in novel directions? How do environmental, social, and economic processes interact, dampening or amplifying change? How do global and sub-global processes interact? What actions, policies, and value changes can best ensure a sustainable future?

By offering insight into uncertainties and the consequences of current actions, scenarios support more informed and rational decision-making. Global scenario analysis has evolved rapidly over the past 10 years in response to this challenge. Although maintaining the long-term resilience of the world's ecosystems is fundamental to sustainable development, ecosystems have not yet been central to this research. Adding such a focus is a primary aim of the Millennium Ecosystem Assessment scenarios. This chapter sets the historical context and point of departure for the ecosystem outlook. It sketches early scenario efforts in Section 2.2, introduces key concepts in Section 2.3, reviews recent global scenario studies in Section 2.4, and draws lessons for ecosystem scenarios in Section 2.5. The rationale and methods used in the MA scenarios are addressed in subsequent chapters of this volume.

2.2 Scenarios Then

To provide historical context, we briefly sketch scenario activity prior to 1995. (See Box 2.1.) While heterogeneous, these studies all take a global perspective in attempting to link social, economic, and environmental issues. The literature can be split into two largely nonoverlapping streams—quantitative modeling and qualitative narrative. This dualism mirrors the twin challenges of providing systematic and replicable quantitative representation, on the one hand, and contrasting social visions and nonquantifiable descriptors, on the other hand.

Scenario analysis as a professional undertaking first surfaced with strategic planning and war games during the early years of the cold war, as popularized by Herman Kahn and his colleagues (Kahn and Wiener 1967). But the direct antecedents of contemporary scenarios lie in the future studies of the 1970s. These responded to emerging concerns about the long-term sufficiency of natural resources to support expanding global populations and economies. This first wave of global scenarios included ambitious mathematical simulation models (Forrester 1971; Meadows et al. 1972; Mesarovic and Pestel 1974) as well as speculative narrative

(Kahn et al. 1976). At this time, scenario analysis was first used at Royal Dutch/Shell as a strategic management technique (Wack 1985), an effort that spawned a small industry of consultants working with major corporations to broaden perspectives on how to position the firm in a changing world (Schwartz 1991). At the same time, the French “prospective” school of strategic scenario analysis evolved a sharp critique of conventional techniques and a rich conceptual framework for exploratory future assessments (Godet 1987).

After a considerable lull during the early 1980s, a second round of integrated global analysis began in the late 1980s and 1990s, prompted by concerns with climate change and sustainable development. These included narrative scans of alternative futures (Burrows et al. 1991; Milbrath 1989), an optimistic analysis by the Central Planning Bureau of the Netherlands (1992), a pessimistic vision by Kaplan (1994), and a consideration of surprising futures (Svedin and Aniansson 1987; Toth et al. 1989). The long-term nature of the climate change issue spawned countless world energy scenarios, the most important of which were those of the Intergovernmental Panel on Climate Change (Leggett et al. 1992), which generally explored technological change and economic policy within a conventional “business-as-usual” framework.

The first decades of scenario assessment paved the way by showing the power—and limits—of both deterministic modeling and descriptive future analyses. A central challenge of contemporary global scenario exercises is to unify these two aspects by blending the replicability and clarity of quantification with the richness of narrative.

2.3 Scenarios Now

Scenarios are being applied in an expanding array of business, community, policy, and research contexts with highly varied aims—better management, consciousness raising, conflict resolution, policy advice, and research. “Business strategy scenarios” explore uncertainty in a world that the business does not control in order to test the robustness of decision-making and to identify opportunities and challenges. “New conversation scenarios” explore new and unknown topics and can be used as an educational tool for wide audiences. “Groups-in-conflict scenarios” use scenario techniques to understand differences and jointly explore consequences of actions. “Public interest scenarios” aim to shape the future by articulating a common agenda and highlighting potential actions and their consequences. “Scientific scenarios” examine the possible long-range behavior of biophysical systems as perturbed by human influence.

There are many methods for scenario building. They can be forward-looking, exploring how futures might unfold from current conditions and uncertainties, or backward-looking, beginning with a normative vision of the future and asking whether there is a plausible path to it. The approach to generating scenarios can include the active engagement of targeted audiences through participatory processes and game playing, deliberation among expert sce-

BOX 2.1

Selected Global Scenarios to 1995**Modeling-based**

Meadows et al. (1972). *The Limits to Growth* report and the ensuing controversy surrounding its results was a seminal moment in global modeling. A systems dynamics model was used to assess the limits of the world system and the constraints these limits place on human numbers and activity. The model was global, with five sectors: population, capital, agriculture, nonrenewable resources, and pollution. Results were presented for 14 scenarios with varying assumptions on technical progress, social policy, and value changes from 1900 through 2100. The report emphasized that present trends will lead to major crises; however, concerted effort could alter these trends.

Mesarovic and Pestel (1974). *Mankind at the Turning Point* was a follow-up project to *Limits to Growth*, aiming to provide a more regionally disaggregated analysis. The Mesarovic/Pestel Model, or World Integrated Model, organized the world into 10 regions. Instead of a unified systems dynamics approach, WIM used five different linked sub-models for economy, population, food, energy, and environment. The model featured an interactive mode that allowed choices to be entered during a model run. The report underscores an impending global crisis and the need for significant societal changes.

Leontief (1976). *The Future of the World Economy* relied on an input-output model to analyze the impact of prospective economic policies for the United Nations. It tracked economic flows among 15 world regions. The report focused on a relatively optimistic scenario in which the income gap between industrial and developing countries decreases by one half by the year 2000. The report concluded that the limits to sustained economic growth and accelerated development are political, social, and institutional, not physical. However, this growth would require very large capital investments in developing regions and significant political, social, and institutional changes.

Herrera et al. (1976). *Catastrophe or New Society? A Latin American Model* emphasized sociopolitical rather than physical issues. It relied on the so-called Bariloche Model, an optimization model with four global regions and five sectors (agriculture, nutrition, housing, capital goods, and other) that ran for a 100-year period from 1960. The simulations addressed such questions as “what future global order would be best for humankind?” It asked how a human-oriented global society could grow, meet basic human needs, and manage resources wisely. This exercise was unique for its time in its explicit normative purpose of defining a future that the authors considered desirable and examining pathways for getting there.

Barney (1980). The *Global 2000* scenario assumed that existing trends would continue into the future. The analysis relied on a set of linked models to project global changes in population, natural resources, and the environment. The model covered 11 sectors, including population, economy, climate, technology, food, fisheries, forestry, water, and energy. The report argued that a projected global population of 10 billion by 2000 and 30 billion by 2100 would be dangerously close to Earth’s carrying capacity and would lead to persistent global poverty.

Central Planning Bureau (1992). In *Scanning the Future*, the Dutch Central Planning Bureau considered four scenarios through the year 2015—global crisis, balanced growth, European renaissance, and global

shift—using a macroeconomic model. The global crisis scenario assumed an overall economic decline. The European renaissance and the global shift scenarios projected economic stagnation in some regions and rapid economic expansion in others. All scenarios were optimistic compared with *The Limits to Growth*. In fact, all the scenarios projected significant convergence between rich and poor regions by the beginning of the twenty-first century.

Narrative-based

Kahn et al. (1976). *The Next 200 Years* presented an optimistic scenario in response to the pessimistic *Limits to Growth*, which was receiving considerable publicity at the time. The basic message of the scenario was that the world could vastly expand its population and economic scale and remain far from the natural limits for most resources. The authors also discussed the possibility of considerable human activities occurring in outer space.

Robertson (1983). *The Sane Alternative* presented five futures: business as usual; disaster; authoritarian control; hyper-expansionist; and sane, humane, and ecological. The latter scenario incorporated significant changes in the direction of human activities and policies, emphasizing the need for development in psychological and social spheres rather than economic and technical growth. The author argued that the future is likely to be a mix of all five scenarios.

Burrows et al. (1991). *Into the 21st Century* examined three scenarios: a pessimistic scenario, a piecemeal scenario, and an optimistic scenario. The pessimistic scenario explored what the future might be like if present trends continue unchecked. The piecemeal scenario assumed a determined but fragmented attempt to find solutions to environmental and social problems. The optimistic scenario featured dramatic changes in attitudes and values toward altruism, cooperation, and ecology. The authors argued that the holistic approach, together with an appropriate planet management system, is the only way to solve growing problems, and that we must act urgently lest the world reach a point of no return soon.

Kaplan (1994). *The Coming Anarchy* presented a dark vision of a dramatic increase in demographic, environmental, and social stresses worldwide. The author argued that the current critical situation in West Africa is a premonition of the future. He underscored the critical links between environmental and social stresses, foreseeing surging populations, spreading disease, resource degradation, water depletion, air pollution, and rising sea levels. These stresses will cause mass migrations and, in turn, incite group conflicts. This was later expanded into a book (Kaplan 2000).

Svedin and Aniansson (1987). *Surprising Futures* presented the results of a workshop of social and natural scientists that explored a range of “surprise-rich” futures through the year 2075. Four alternative scenarios were developed: the big load, the big shift, history lost, and hope regained. These explored, respectively, dominant trends, a shift toward new centers of power such as China and India, a future of crises, and environmentally and socially balanced world development. The workshop participants generated numerous variations on these scenarios along with hypothetical “future histories.” Quantitative sketches were presented in Toth et al. (1989).

nario panels, and quantitative simulations by modeling groups.

For this report, we focus on the subset of environmental global scenario projects that have a public policy and scientific orientation, since these are of greatest interest to the MA. The ideal attributes for such scenarios are *integration* across social, economic, and environmental dimensions; *regional disaggregation* of global patterns; *multiple futures* that reflect the deep uncertainties of long-range outcomes; and *quantification* of key variables linked to ecosystem conditions. We briefly expand on each of these.

2.3.1 Integration

Integration is needed because multiple anthropogenic stressors have an impact on the environment or lead to changes in the provision of ecological services. These stressors (or direct drivers) include pollution, climate change, hydrological change, resource extraction, and land degradation and conversion. In turn, these direct drivers result from long causal chains of indirect socioeconomic drivers, such as demographic, economic, and technological developments. Finally, changing patterns of human values, culture, interest, and power set the conditioning framework (or ultimate drivers) for unfolding socioecological systems. To capture this nexus of interactions, a systemic framework is required that includes key economic, social, and environmental subsystems and links. (See Figure 2.1.)

2.3.2 Regional Disaggregation

Such systems can be meaningfully defined at different scales—global, regional, national, and local. A planetary panorama reveals global economic, cultural, and environmental phenomena, and becomes more critical as global connectivity increases. A regional perspective brings the problems of acid rain, water allocation, trade, and migration into focus. A national viewpoint sheds light on policy, environmental, and security issues. A local standpoint is needed for detailed assessment of land change patterns, biodiversity, and ground-level pollution.

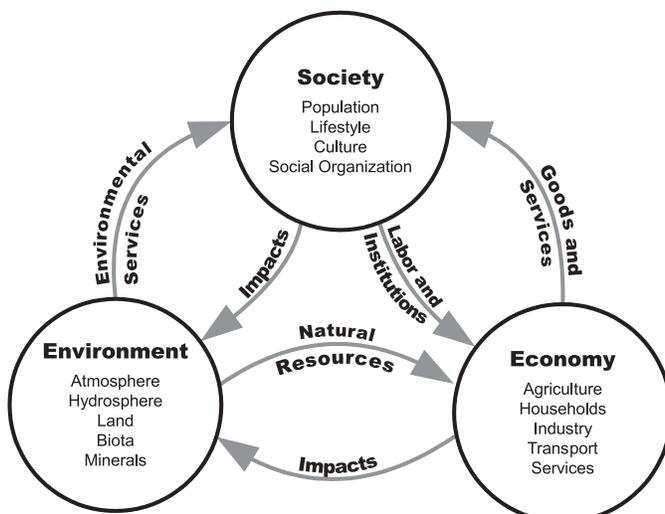


Figure 2.1. The Socioecological Society System and Its Components

These different spatial scales provide mutually enriching windows of perception into a unitary world system. Globalization links these different scales through processes that increase economic, cultural, social, and geopolitical interdependence. In particular, the factors that directly affect ecosystems are conditioned by far-flung global influences—patterns of production and consumption, the character of economic globalization, cultural influence, migration, and global environmental change. Ecosystem futures are an aspect of the wider question of global futures.

One day, perhaps, scenario-building techniques will evolve to allow analysts to seamlessly zoom across levels, representing each spatial unit as an interacting component of an integrated global system. But in these early years of this analytic discipline, the state-of-the-art is far more modest—the disaggregation of the global system into a single layer comprised of major multinational regions.

2.3.3 Multiple Futures

Since the issues that need to be considered in the context of sustainable development or the long-term provisioning of ecological services embody multigenerational concerns, and since certain ecological consequences only become visible over long time periods, the scenario outlook must span at least several decades. The MA horizon is 50 years. Over such an extended time frame, current trends can evolve in unexpected ways, all the while subject to new phenomena, events, and human influence. At critical thresholds, the planetary socioecological system can branch into unique pathways. Thus, global outlooks that do not consider a broad range of plausible long-range visions are incomplete.

Three distinct sources of indeterminacy are *ignorance*, *surprise*, and *volition* (Raskin et al. 2002). *Ignorance* refers to limits of scientific knowledge on current conditions and dynamics. Even if the global system were deterministic in principle, this classic form of uncertainty would lead to a statistical dispersion over possible future states. *Surprise* is the uncertainty due to the inherent indeterminism of complex systems, which can exhibit emergent phenomena and structural shifts.

Volition refers to the unique uncertainty that is introduced when human actors are internal to the system under study—the future is subject to human choices that have not yet been made. Moreover, the very process of ruminating on the future can influence these choices. Through this reflexivity, this double role of humans as observers and actors, scenario studies become internal to the story they tell to the degree they alter awareness, behavior, and the future.

Alternative global futures can result from the accumulation of gradual incremental changes. Or perhaps a threshold of instability will be crossed in which the global trajectory bifurcates into very different possible outcomes. Massive unexpected events could change the course of development—a world war, a pandemic, a large-scale act of terrorism, a systemic economic breakdown, abrupt climate change, a technological wildcard, and so on. The exploration of multiple futures is fundamental to the scenario enterprise.

2.3.4 Quantification and Narrative

In view of this complexity and uncertainty, scenario analysis requires approaches that transcend the limits of conventional deterministic models of change. Predictive modeling is appropriate for simulating well-understood systems over sufficiently short times (Peterson et al. 2003). But as complexity increases and the time horizon lengthens, the power of prediction diminishes. Quantitative forecasting is legitimate only to the degree the system state can be well specified, the dynamics governing change are known and persistent, and mathematical algorithms can be devised to validly represent these relationships.

These conditions are violated when it comes to assessing the long-range future of socioecological systems—state descriptions are uncertain, causal interactions are poorly understood and may change by unknown ways in the future, and nonquantifiable factors are significant. Probabilistic forecasts of a given future state, or a spectrum of possible states, are simply not feasible when structurally unique futures can emerge from current conditions and trends, and novel behavior can be expected. To take but one example, the combined effects of abrupt climate change, geopolitical conflict, and global economic instability could drive the planetary system into a new state that exhibits historically unprecedented institutional and biophysical processes.

The development of methods to blend quantitative and qualitative insight effectively is at the frontier of scenario research today. (See Figure 2.2.) The scenario narrative gives voice to important qualitative factors shaping development such as values, behaviors, and institutions, providing a broader perspective than is possible from mathematical modeling alone. Narrative offers texture, richness, and insight, while quantitative analysis offers structure, discipline, and rigor. The most relevant recent efforts are those that have sought to balance these.

2.4 Major Studies

The catalogue of recent global scenarios encompasses hundreds of greenhouse gas emissions projections (IPCC 2001),

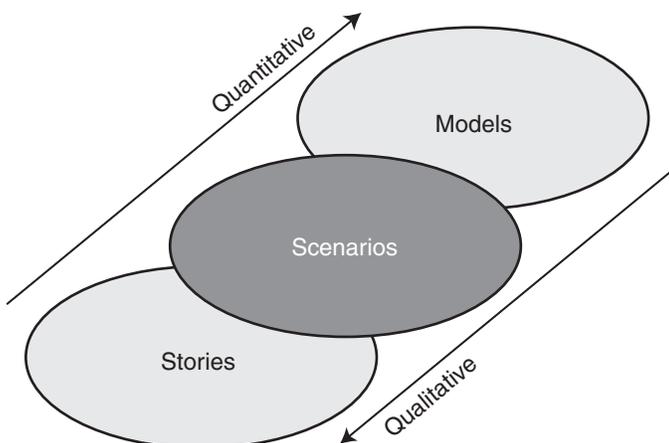


Figure 2.2. Scenarios, Models, and Stories (Nakićenović et al. 2000)

regional and national scenarios (Raskin 2000), and sectoral outlooks on energy, food, economy, demography, and technology (Glenn and Gordon 2002). But only a few studies have the comprehensive scope and analytic detail to satisfy the criteria of integration, regionalization, multiple futures, and quantification. We introduce six major efforts below—a subset of global exercises that have a scientific and public policy orientation—and summarize their salient features in Table 2.1.

2.4.1 Global Scenario Group

Convened in 1995 by the Stockholm Environment Institute, the Global Scenario Group is an independent, international, interdisciplinary body that has been developing integrated global and regional scenarios (Raskin et al. 1998, 2002; Gallopín et al. 1997). The GSG scenario narratives are quantified with the use of the PoleStar System, a transparent tool for synthesizing global data sets, organizing sectoral linkages, and introducing assumptions (Raskin et al. 1999). This work has been used by a number of international assessments, including several discussed below.

2.4.2 Global Environment Outlook

The United Nations Environment Programme's third Global Environment Outlook placed greater emphasis than previous editions on integrated global and regional scenarios (UNEP 2002). The scenarios were developed through a lengthy collaborative process that began with four of the GSG scenarios, which were then refined through a series of regional and global meetings (Raskin and Kemp-Benedict 2002), with input from the IPCC's Special Report on Emissions Scenarios. The emphasis of the process was on refining the narratives and giving them regional texture. A consortium of modeling teams elaborated on different aspects of the scenarios (Potting and Bakkes 2004).

2.4.3 Special Report on Emissions Scenarios

The IPCC's Special Report on Emissions Scenarios (Nakićenović et al. 2000) was a significant advance over prior IPCC scenarios. Its purpose was to develop a wide range of emissions scenarios as input to ongoing climate change research. A set of alternative social visions was linked to assumptions on the main driving forces of human-induced climate change, and the implications for future energy-related and land-use emissions were analyzed. Based on its mandate, the SRES scenarios did not include policies for greenhouse gas mitigation in the scenarios and thus only simulated emissions in the absence of such policies. Six modeling groups analyzed each family, thus giving a wide range of outcomes for each storyline. An open process solicited participation and feedback. Several modeling groups went on to publish variants of the SRES scenario that do include climate policy (Morita et al. 2001).

2.4.4 World Business Council for Sustainable Development

The World Business Council for Sustainable Development constructed a set of three scenarios to engage the business community in the debate on sustainable development

Table 2.1. Description of Selected Global Scenario Studies since 1995 and Their Structure (Raskin, in press)

Study	Horizon	Regions	Focus	Scenario Structure
GSG	2050	11	Environment; poverty reduction; human values	<ol style="list-style-type: none"> 1. <i>Conventional Worlds</i>: gradual convergence in incomes and culture toward dominant market model <ol style="list-style-type: none"> a) <i>Market Forces</i>: market-driven globalization, trade liberalization, institutional modernization b) <i>Policy Reform</i>: strong policy focus on meeting social and environmental sustainability goals 2. <i>Barbarization</i>: social and environmental problems overwhelm market and policy response <ol style="list-style-type: none"> a) <i>Breakdown</i>: unbridled conflict, institutional disintegration, and economic collapse b) <i>Fortress World</i>: authoritarian rule with elites in “fortresses,” poverty and repression outside 3. <i>Great Transitions</i>: fundamental changes in values, lifestyles, and institutions <ol style="list-style-type: none"> a) <i>Eco-Communalism</i>: local focus and a bio-regional perspective b) <i>New Sustainability Paradigm</i>: new form of globalization that changes the character of industrial society
GEO-3	2032	6	Environment	<i>Markets First; Policy First; Security First; Sustainability First</i> (correspond, respectively, to 1a, 1b, 2b, and 3b above)
SRES	2100	4	Climate change	<i>A1</i> : rapid market-driven growth with convergence in incomes and culture <i>A2</i> : self-reliance and preservation of local identities, fragmented development <i>B1</i> : similar to <i>A1</i> , but emphasizes global solutions to sustainability <i>B2</i> : local solutions to economic, social, and environmental sustainability
WBCSD	2050	n.a.	Business and sustainability	<i>FROG!</i> : market-driven growth, economic globalization <i>GEOpolity</i> : top-down approach to sustainability <i>Jazz</i> : bottom-up approach to sustainability, ad hoc alliances, innovation
WWV	2025	18	Freshwater crisis	<i>Business-as-usual</i> : current water policies continue, high inequity <i>Technology, Economics, and the Private Sector</i> : market-based mechanisms, better technology <i>Values and Lifestyles</i> : less water-intensive activities, ecological preservation
OECD	2020	10	Environment in OECD countries	<i>Reference</i> with policy variants (e.g., subsidy removal, eco-taxes)

Key: GSG Global Scenario Group, GEO-3 Global Environment Outlook, SRES Special Report on Emissions Scenarios, WBCSD World Business Council on Sustainable Development, WWV World Water Vision, OECD Organisation for Economic Co-operation and Development

(WBCSD 1997). The focus is on the scenario narratives, which span a broad spectrum of possible futures. For each narrative, the authors present a set of challenges to business and lessons to be drawn. The scenarios were developed in an open process involving representatives from 35 organizations.

2.4.5 World Water Vision

The World Water Vision was conducted by the World Water Council to increase awareness of a rising global water crisis (Cosgrove and Rijsberman 2000). The WWV presents three global water scenarios that focus on issues of water supply and demand, conflict over water resources, and water requirements for nature (Gallopín and Rijsberman 1999). While only a subset of water-related issues and variables were quantified, the scenario narratives extend beyond issues specific to water, including lifestyle choice, technology, demographics, and economics. Some of these additional themes were explored quantitatively in background studies.

2.4.6 Organisation for Economic Co-operation and Development

The *Environmental Outlook* of the Organisation for Economic Co-operation and Development developed a base-

line scenario based on development projections to 2020, complemented by several policy variants (OECD 2001). The *Outlook* examined drivers of environmental change, specific sectors that put the greatest pressure on the environment, and resulting environmental impacts. The focus of the *Outlook* is the critical environmental concerns facing OECD countries, but the study is global in scope. Global economic patterns were modeled using the OECD’s JOBS model. These drivers were then used as inputs to the Pole-Star System to assess potential environmental impacts in the scenarios.

2.4.7 Study Outputs

Two of the studies—GSG and SRES—stand out as presenting both a broad range of scenario visions and a wide set of quantitative indicators. Table 2.2 summarizes the kinds of outputs provided by these studies, including drivers of environmental change, resource requirements, and environmental stressors. The Table also references the IMAGE 2.2 model, which has been used to update and expand the SRES scenarios (RIVM 2001; Alcamo et al. 1998), providing input to GEO-3.

A scan of these studies suggests great variation in the way each exercise was structured. Yet beneath the diversity, the

Table 2.2. Variables Included in Scenario Simulations by GSG, IPCC-SRES, and IMAGE

Variable	GSG	IPCC-SRES	IMAGE
Demographics			
Population	X	X	X
Distribution	urban/rural		age and sex
Poverty	X		
Economics			
GDP	X	X	X
Sectors	X		X
Income distribution/poverty	X		
Agriculture and forestry			
Diets	X		X
Yields	X		X
Livestock practices	X		X
Inputs	X		X
Timber production	X		X
Fish production	X		
Cropland degradation	X		X
Water			
Withdrawals	X		
Resources	X		
Stress	X		
Energy			
Requirements by fuel	X	X	X
Production	X	X	X
Land use			
Built environment	X		gridded
Cropland	X	X	gridded
Grazing/grassland	X	X	gridded
Forest	X	X	gridded
Plantation	X	X	gridded
Pollution/waste			
Air	GHGs; SO _x	GHGs; SO _x	GHGs; SO _x ; NO _x ; VOC
Water	X		
Toxics	X		
Solid waste	X		

Key: GSG Global Scenario Group, SRES Special Report on Emissions Scenarios

scenarios are rooted in a common set of archetypal visions of the future—worlds that evolve gradually, shaped by dominant driving forces; worlds that are influenced by a strong policy push for sustainability goals; worlds that succumb to fragmentation, environmental collapse, and institutional failure; and worlds where new human values and forms of development emerge. The scenarios from the various studies are mapped into a common framework in Table 2.3, using the GSG scenario structure as a template. Thumbnail sketches of narratives used in the GSG, SRES, and WBCSD studies are presented in Box 2.2.

2.5 The Past as Prelude

Over the past decade, global scenarios of increasing sophistication have influenced the policy discussion of sustainable development, sharpened perspectives, and broadened awareness. But they have yet to focus directly and systemat-

ically on the role of ecosystem conditions and management as a critical component of the global future, nor have they fully taken ecosystem dynamics into account. The scenario experience to date provides a useful point of departure for injecting this dimension. To do so, storylines must be enriched with an ecosystem perspective, and quantifications expanded to include measures of ecosystem condition.

The recent global scenario literature covers an immense array of detailed findings, conclusions, and lessons, far more than can be summarized here. But some broad lessons can be drawn that cut across these diverse studies. For example, collectively they suggest that a global future that excessively relies on a “market forces” vision of economic globalization and on the consumer society as the model for successful development would be a perilous basis for global development. The risk is that social polarization, persistent poverty, and environmental degradation would undercut sustainability by eroding social cohesion, ecosystem resilience, and the global economy. Then, rather than mitigating current tendencies toward global polarization and conflict, a full descent into a fragmented “fortress world” or other unpleasant possibilities becomes a real danger.

The studies tend to find great scope for “policy reform” scenarios for reducing such risk. The ambitious social and environmental goals articulated in such high-level international appeals as *Agenda 21* (UN 1993) and the Millennium Development Goals (UN 2000) are seen as feasible, at least in principle. A host of specific actions could accelerate the deployment of nature-sparing technology, alleviate poverty, and reduce social tension. But the reform strategy is problematic in practice. It requires mobilizing a comprehensive

Table 2.3. Comparing Selected Global Scenarios after 1995

GSG	SRES	WBCSD	GEO-3	WWV	OECD
Conventional worlds					
Market forces	A1	FROG!	Markets first	B-a-u	Reference
Policy reform	B1	GEOpolity	Policy first	Technology and economics	Policy variants
Barbarization					
Breakdown	A2				
Fortress world			Security first		
Great transitions					
Eco-communalism	B2				
New sustainability paradigm		Jazz	Sustainability first	Lifestyles and values	

Key: GSG Global Scenario Group, GEO-3 Global Environment Outlook, SRES Special Report on Emissions Scenarios, WBCSD World Business Council on Sustainable Development, WWV World Water Vision, OECD Organisation for Economic Co-operation and Development

BOX 2.2

Narrative Sketches

Global Scenario Group. GSG scenarios are organized into three classes—*Conventional Worlds*, *Barbarization*, and *Great Transitions*—with two variants for each class. *Conventional Worlds* envisions the spread of dominant values and development patterns with the gradual convergence of developing regions toward rich-region patterns. In the *Market Forces* variant, powerful global actors advance the priority of growth, liberalization, and privatization. In the *Policy Reform* variant, concern over environmental deterioration, social conflict, and economic instability leads to comprehensive government action for sustainable development. The *Barbarization* class of scenarios envisions the eventual deterioration of civilization, as crises overwhelm the coping capacity of both markets and policy reform. The *Breakdown* variant spirals toward unbridled conflict and institutional collapse. The *Fortress World* variant features an authoritarian response to this threat, with elites in protected enclaves and an impoverished majority outside. The *Great Transitions* class depicts fundamental changes in the global development model. Human values emphasize ecology, dematerialized lifestyles, and strong social solidarity. Regions pursue diverse strategies building on unique cultural, ecological, and institutional attributes. The *Eco-Communalism* variant is a highly localist vision that emphasizes regional self-reliance. The *New Sustainability Paradigm*, highlighted by the GSG (Raskin et al. 2002), would build a more humane global civilization rather than retreat into localism.

Special Report on Emissions Scenarios. In the SRES notation, “A” and “B” signify little and high commitment to sustainable development, respectively, and “1” and “2” signify regional integration or fragmentation, respectively. Thus, A1 is an integrated unsustainable world of rapid economic growth, stabilizing populations, rapid technological change, and convergence among regions. The scenario has three variants that assume

different energy mixes. A2 is a fragmented unsustainable world in which regions and nations stress self-reliance and preservation of local identities with relatively high population growth, slow income convergence, and heterogeneous local development patterns. B1 is a regionally convergent world with global population peaking in mid-century and declining thereafter, as in A1. B1 is also an integrated sustainable world that features a rapid shift to a service economy and clean technologies, and the pursuit of global solutions to economic, social, and environmental problems (excluding climate change). B2 is a fragmented sustainable world in which regions and nations pursue plural models of development with diverse local initiatives that balance economic, social, and environmental goals.

World Business Council for Sustainable Development. *FROG!* begins as a business-as-usual scenario, where economic growth is the major concern and action on sustainable development is weak. However, the reliance on technology does not deliver environmental or social health, and eventually increased inequity and unrest threaten basic survival. In *GEOpolity*, a new global consensus welcomes technocratic solutions, sanctions, and more direct control of the market to ensure environmental preservation and social cohesion. New global governance institutions are created, and governments become rejuvenated as focal points in shifting the structure of the economy toward sustainable development. *Jazz* is an innovative world of ad hoc alliances of diverse stakeholders, experimentation, adaptation, and a dynamic global market. Government activity is largely at the local level, as ad hoc global governance institutions address particular problems, and environmental and social goals are achieved largely out of corporate self-interest and partnerships among nongovernmental organizations, governments, consumers, and businesses.

array of incremental adjustments to gradually counteract underlying trends that are highly unsustainable. The plausibility of such scenarios rests on the difficult task of providing an account of how the necessary political will would emerge for such a massive effort.

In view of these difficulties, many of the studies go on to explore scenarios that include more fundamental transformations of the underlying values and institutions of development. Several find that an eventual transition toward a form of global development based on “sustainability first” may be both the necessary and desirable condition for ensuring an ecologically sound and humane global future. This alternative paradigm draws attention to institutional and value innovations. Multiscale, adaptive, and democratic governance processes include the constructive engagement of civil society in balancing economic, social, and environmental concerns. Human values come to emphasize qualitatively rich lifestyles, encompassing material sufficiency, a strong sense of human solidarity from local to global levels, and an ecological sensibility.

In the coming years, the enrichment of global scenarios, often through participatory processes, will define an important agenda for policy analysis (EEA 2001), scientific research, and education. This will require the enhancement of the role of ecosystems in both scenario narrative and quantification. Narratives will need to more richly reflect

ecosystem descriptors, impacts, and feedbacks. Models will need to simulate ecosystem services within global assessment frameworks. Previous global scenario studies are the prelude and platform for beginning to address these challenges.

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