A FRAMEWORK FOR DEVELOPING FORESIGHT IN NATURAL RESOURCE MANAGEMENT

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Abstract. This paper describes a fundamental framework for anticipating and influencing the future that has been used to prepare professional futurists at the University of Houston for more than 35 years. The overview of the framework addresses how futures researchers organize information about changes in the world (e.g., by defining the domain, or scope, of the forecasting topic and identifying drivers of future change). Specific techniques to develop foresight, including environmental scanning and trend analysis, are discussed. The paper summarizes the three kinds of futures typically explored: the probable future, plausible alternatives, and preferable futures, whether centered on individuals, organizations, or society at large. Plausible futures are among many aspects of futures forecasting where scenarios can be used. Definitions and descriptions of scenarios are provided. The process of developing scenarios is illustrated, and their purpose in the forecasting framework is presented.

INTRODUCTION

Writer William Gibson reportedly quipped, "The future is already here—it's just not evenly distributed."[1] Assuming Gibson is correct, how does one gain access to the knowledge about the future that is already here? Some disciplines rely on quantitative modeling to project the current and past state of the world environment forward in time. Because these models are driven by known data, their predictions about the future meet the standards of reliability and internal consistency, hallmarks of sound scientific research. Unfortunately, most of these predictions fall short of realization beyond a window of 2 or 3 years due to unanticipated factors. To better anticipate the future and manage its inevitable uncertainty, some have turned to the forecasting methodologies employed by futures research. The U.S. Environmental Protection Agency (EPA) defines futures research as "a platform to engage in strategic conversations to better understand uncertainty and shape a sustainable future" (U.S. EPA 2005: 1). Futures research relies more heavily on qualitative modeling to forecast what is probable, to anticipate possibilities, and to envision what is desired. Three principles differentiate futures research from traditional forecasting methodologies. Taking the long view means looking a decade or more into the future, thinking from the "outside-in" by placing emphasis on the uncontrollable external environment, and actively seeking a diversity of perspectives. Opening doors to new insights is a key objective of futures research.

Framework forecasting is a methodology taught at the University of Houston (Houston, TX) for conducting futures research. The framework itself is an organizing technique which directs the gathering and sorting of information on the topic of interest. Once completed, the information framework serves as the foundation for generating foresight about the long-term future. This paper provides a brief overview of the University of Houston's fundamental framework for anticipating the future. The framework differentiates among three futures: the probable, plausible alternatives, and the preferred. Finally, the process and purpose for scenario development are highlighted.

FRAMEWORK OVERVIEW

Gaining access to knowledge about a future that is already here but not evenly distributed requires spending time trying to understand and give context to the changes occurring in today's world. The intelligence we gather is sorted into one of the following sections of the forecasting framework: (1) time horizon and domain definition, (2) current assessment, (3) drivers of future change, (4) uncertainties, (5) summary, and (6) information sources.

Time Horizon and Domain Definition

Good futures research is most effective when used to make better decisions in the present about the future we are trying to pursue. It can help ensure that the strategies and goals for 2020, 2025, or 2030 are informed by insights into the world we are likely to inhabit. The time horizon establishes the depth of the forecast, that

[1]William Gibson, writer, National Public Radio, August 31, 1993.

is, how far into the future the forecast will illuminate. The domain definition defines the scope of the forecast topic: what will be included in the forecast, and what will not be included. To be clear on the purpose from the outset, it is important to identify the focal issue(s) and the key question(s) to be addressed given the selected time horizon. The more precise the definition, the more focused the information search. For example, what is the future of "symviability" (ecological-cultural symbioses and intercultural symbioses) in the United States (Boyd and Zeman 2010)? Speculative statements about what might or could happen in the future for the topic of interest should be avoided.

Current Assessment

The current assessment is characterized as a snapshot highlighting essential facts, quantities, and structures about the domain, listing key players (stakeholders) who will be affected and have an interest in the possible outcomes, identifying their current interests and announced goals and plans for the future, and identifying the historical events that brought about the domain's current state. These events most likely occurred abruptly, disturbing life as we had known it. The emergence of the World Wide Web, the fall of the Berlin Wall, and the recent global recession are examples of game-changing, discontinuous events.

Drivers of Future Change

Identifying "what is driving future change" (events, trends, issues, ideas, images, and actions) is central to understanding where the future of the domain is heading. Environmental scanning is a systematic and ongoing process for detecting early signs of "what is happening and what is likely to happen" in the external environment of the domain by reviewing and analyzing current literature, Web sites, and other sources to identify and monitor change. Long-time futurists Gordon and Glenn (1994: 1) remind us that "[n]o system will be able to eliminate all uncertainty; the objective of a scanning system is simply to find early indications of possibly important future developments to gain as much lead time as possible." The intelligence gathered by scanning can be used to generate new perspectives regarding future opportunities and risks as well as to challenge established assumptions and current wisdom about the domain.

An effective environmental scanning process has the potential to generate an overwhelming amount of information. Therefore, classification and analysis of this information are essential. Common mnemonic classification methods include STEEP (society, technology, economics, environment, politics), DEGEST (demography, economics, government, environment, society, technology), and EPISTLE (economic, political, informational, social, technological, legal, environmental). A well-rounded scanning process will endeavor to explore across all relevant macro-level categories as they pertain to the domain of interest, including:

- Cultural factors such as behavior, values, and institutions that enable a society or group to develop and maintain identity; language; ethics; religion; arts; aesthetics; and recreation;
- Demographic dynamics such as population size, rates of change, gender distribution, age structure, ethnicity, family composition, and migration;
- Economic assumptions (global-regional-local) such as growth rates, production, finance, distribution of resources (e.g., food, water, and energy) and products between regions and across sectors of society, and consumer behavior;
- Ecological factors as a source of inputs (i.e., air, water, land, energy, resources) and outputs (i.e., waste, pollution, climate change), ecosystems, and land-use planning;
- Institutional assumptions such as actions, processes, traditions, and institutions through which authority is exercised; conflict and governance; role of non-governmental organizations; and public policy;
- Science and technology assumptions such as rate of development; accessibility; role in transforming structure of production; nature of work; use of leisure time; advances in cyber-, nano-, bio-, and information/communication technologies; and transportation;

Table 1.—U.S. Environmental Protection Agency's system for ranking the importance of environmental scanning hits

Ranking Criteria for Scans	Minimum Allowable Ranking Value	Maximum Allowable Ranking Value
Novelty	1 = old hat	5 = never been seen before
Scope	1 = affects almost nobody	5 = affects everybody
Severity	1 = slight effect	5 = human fatality, ecological disaster
Visibility	1 = of little interest	5 = of great interest
Timing	1 = 20+ years into the future	5 = imminent
Probability	1 = little chance of happening	5 = already an issue or certain to happen
Organizational Relevance	1 = no authority to act	5 = full authority to act

- Social factors such as human development (i.e., such basic needs as health, education, security, identity, and freedom), lifestyles, and beliefs.

Following discovery and classification, scanning hits (information that indicates a possible or plausible change in the future) are graded or ranked according to their perceived importance and relevance. The highest ranking hits are coded into the framework; others are dismissed. Table 1 shows the ranking scheme devised by the EPA to grade a scanning hit across seven criteria of importance to this agency (U.S. EPA 2005).

Over time, drivers of future change may evolve or multiple drivers interact. When they do, trends take shape. A trend is a statement about the direction of change (i.e., more, less) in those forces shaping the future, usually gradual, long-term, or cumulative. A trend does not have to be dynamic, however; it can be stable and continuous through time (i.e., a constant) or it may oscillate in recognizable patterns (i.e., a cycle). Demographic and economic trends are particularly good candidates for extrapolation using basic mathematical projection techniques. EPA's futures handbook (U.S. EPA 2005: 12) offers the following advice for analyzing trends:

- Identify and state the trend. Give the trend a name and a verb. State the direction of change. For example, "The U.S. population grew by at least 10 percent during the 1990s."
- Document for credibility. Researchers must validate trends just as they must validate data in their scientific research, using numbers, graphs, and verifiable documentation.
- Explore potential countertrends. Identify countertrends that may reduce, reverse, or alter the course of the original trend. For example, if one trend states that the U.S. population is aging steadily, whereas another trend states that hundreds of thousands of young immigrants are moving to the United States each year, the first trend is weakened by the second.
- Generate implications. Identify the implications of the trend for the future of the environment. Will this trend affect the research being done now, or the research planned for later? To avoid bias, explore implications and actions in a group setting. Consider implications that are (a) obvious, (b) possible, and (c) speculative. Explore how different parts of an organization might be affected and how they could better prepare for potential implications.
- Determine options. Identify the research needs or how to develop more knowledge in a particular area. Once the researcher has adequate knowledge, identify what individuals or organizations can do now to avoid a bigger problem later. Describe the appropriate actions, the obstacles to achieving these actions, and the risks associated with inaction.

Uncertainties

Uncertainties arise from non-trend drivers of future change such as potential events and actions, emerging issues, and new ideas and images. Uncertainties have the potential to hijack the expected future and are, therefore, the core around which alternative futures

scenarios are woven. For example, the World Economic Forum's Global Risks Report 2011 identified six global uncertainties as high in both likelihood and potential impact: climate change, extreme energy price volatility, economic disparity, fiscal crises, geopolitical conflict, and global governance failure. These uncertainties are likely to be connected to and impact most domains.

Information Sources

This section of the framework is a record of resources important to the researcher's domain, such as written and electronic publications, Internet sites, domain-specific organizations, and experts in that domain. To keep the forecasting framework up-to-date, the analyst will periodically return to these resources.

WHAT FUTURE?

In futures research, a wide range of methods may be used to generate the probable future. This baseline forecast is primarily data-driven, describing the difference between the present and the expected or most likely future for the domain of interest. The baseline forecast is built upon a coherent and internally consistent set of assumptions about key driving forces and their relationships. It extrapolates current conditions, known trends, stakeholders' announced plans and goals, and experts' projections in the field forward to the selected time horizon. As an extension of the present, the baseline assumes no disruptions. Nevertheless, plausible alternative futures which are data-driven with a touch of imagination, embrace the reality of disruptions and uncertainties. Alternative futures scenarios are generated with at least one plausible uncertainty at their core. Preferred futures, the third kind of futures, are value-driven and used in action planning by individuals or organizations to bring about a desired future. Visioning and strategic planning are the tools used to influence the course of the future.

Even with the most rigorous approach, the forecast may miss the target. Why? Erica Orange, vice president of the futures consulting group Weiner, Edrich, Brown, says, "In order to learn new things and become truly objective about the future, you first have to begin forgetting—by discarding no longer useful information. Change gives information, knowledge, expertise a short shelf life" (quoted in Weeks 2010). Forecasts are improved by challenging underlying assumptions and by continuously updating the information framework through environment scanning.

SCENARIO DEVELOPMENT

What are scenarios? The United Nations Environment Programme (2002: 320) definition states, "Scenarios are descriptions of journeys to possible futures. They reflect different assumptions about how current trends will unfold, how critical uncertainties will play out and what new factors will come into play in alternative environments." According to Zurek and Henrichs (2007), scenarios are not facts, predictions, forecasts, or speculation, but a means to create projections and to explore environments characterized by uncertainty and complexity. In "Environmental Futures," Alcamo (2008) lists six types of environmental scenarios, each with a distinct purpose:

- Exploratory scenarios start in the present, have a set of assumptions on policies, and identify key driving forces;
- Anticipatory scenarios start in the future with a prescribed vision (optimistic, pessimistic, or neutral) and work backward in time to visualize how that future could emerge;
- Reference scenarios describe the (default) future state in the absence of additional, new, and focused environmental policies;
- Policy scenarios describe a future state in the presence of additional, new, and focused environmental policies;
- Qualitative scenarios describe possible futures in primarily non-numeric formats; and
- Quantitative scenarios describe possible futures in primarily numeric formats (models).

Another distinction is between inquiry-driven and strategy-driven scenarios. In essence, inquiry-driven scenarios estimate and assess alternative future states of the environment, while strategy-driven scenarios focus on strategy development, evaluation, and planning to improve environmental quality and achieve a triple bottom line: ecological-social-economic sustainability.

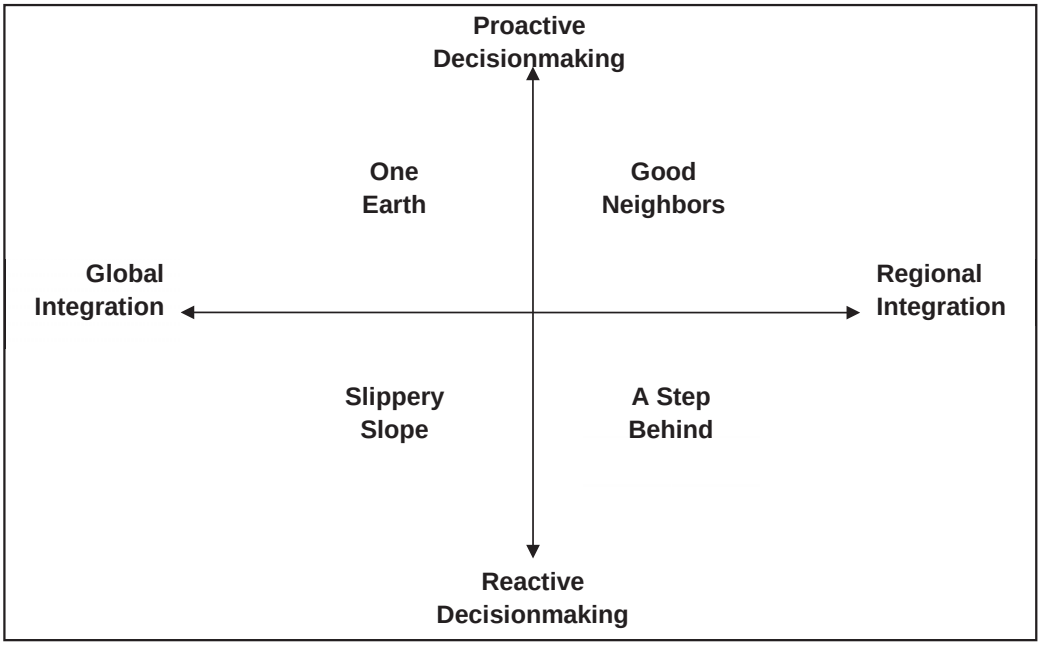

Figure 1.—2-by-2 scenario matrix.

Several international organizations have been active in developing global environmental futures scenarios. The Millennium Ecosystem Assessment, an interdisciplinary framework involving more than 1,360 experts worldwide, analyzed the conditions, trends, and services provided by the world's ecosystems as well as envisioning possible solutions to restore, conserve, or enhance the sustainable use of the ecosystems (Millennium Ecosystem Assessment 2005). The Intergovernmental Panel on Climate Change has used scenarios to illustrate how alternative policy pathways may or may not achieve an environmental target (Carter et al. 2007). The World Water Council, sponsor of the World Water Vision (Cosgrove and Rijsberman 2000), advocates development of a common strategic vision on water resources and management among all stakeholders with the support of strategic initiatives and activities.

The development of a scenario is a synthesis activity focused on conceiving, formulating, and elaborating a set of scenarios. The futures forecasting framework discussed earlier is an excellent approach to gathering and organizing information that can be used for generating scenarios. One popular approach to building scenarios was developed by Peter Schwartz (1991) and is used by the strategy consulting firm Global Business Network (GBN). The GBN scenario planning process begins by brainstorming a list of driving forces of future change (e.g., trends, uncertainties, surprises) which are both highly unpredictable and highly relevant to the focal issues and the key questions identified at the onset of the foresight project. Pre-determined forces, those easily extrapolated by standard forecasting techniques, are separated from the fundamental uncertainties. Linkages between the driving forces are identified. The remaining uncertainties are prioritized to facilitate identification of the two most critical. At least two extreme but plausible outcomes for each of the critical uncertainties are described. Finally, the scenario logic that integrates the two (or more) most important drivers into one future is constructed.

A GBN 2-by-2 scenario matrix subsequently can be created. One driver is mapped onto the horizontal axis with the extreme outcomes located at either end. Likewise, the second driver is mapped along the vertical axis. Each quadrant is a scenario logic representing a provocative yet plausible outcome of the two uncertainties. The scenario matrix offers four distinct future trajectories for the domain over the time horizon, which are given titles that capture the essence of the scenario logics. Figure 1 illustrates a typical 2-by-2 scenario matrix.

Believable plot lines for the scenario logics are written as if the observer is living at the selected time horizon, say 2030. The information gathered into the framework should be filtered back into the scenario where most appropriate. In a paragraph or two, how and why that "world" came into being are described. Embellishing the scenario script with interesting characters, specific facts, dates, events that occurred, and conflict or surprising developments deepens the reality. Scenarios should be written in a format that is convincing and sufficiently absorbing to draw the reader in. To give the scenario a deeper sense of future reality, scenarios are sometimes cast into an artifact of the times dated at the time horizon, such as an editorial blog, a letter addressed to a special-interest group, a news podcast, or a day-in-the-life video.

Recall that good futures research is most effective when used to make better decisions in the present about the future we are trying to pursue (or avoid). Forecasts of long-term futures are generated based on the information gathered into the framework. Scenarios are a means to summarize the main drivers, external conditions, and key uncertainties at play and to describe a set of plausible futures for a domain of interest. Scenarios are platforms for rehearsal. If decisionmakers assess the implications of each scenario based on the original focal issue and key questions, then the robustness of goals and strategies can be tested against the range of future possibilities. As a final step, decisionmakers need to develop a monitoring plan to identify specific leading (early warning) indicators that the future is, in fact, resolving itself toward one or another of the alternative futures. With sufficient advance warning, users of forecasts are well-positioned to side-step the obstacles and seize the opportunities that lie in the future.

CONCLUDING COMMENT

A fundamental question for environmental planners, managers, and policy-makers is how they might benefit from futures research. Futures research offers a variety of techniques and tools for identifying and exploiting the uncertainties that underlie unpredictability in traditional forecasting. Since the objective is not to improve predictive power but rather to open doors to new insights, the methodologies long employed by futurists should be welcome additions to the toolkit of scientists concerned with environmental management and policy.

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