

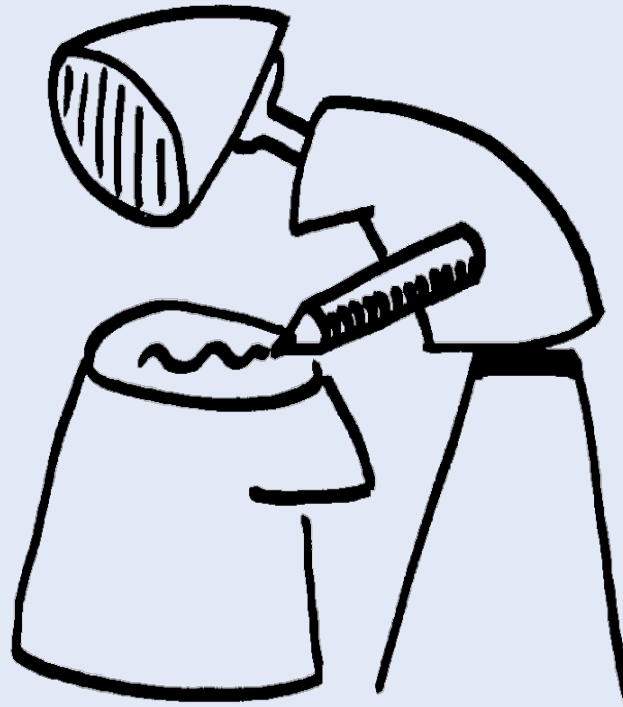
Scenario Thinking & Global Change

CCIS Webinar 2: Scenarios – Narratives & Numbers

6 May 2020

Dale S. Rothman

University of Denver



Change mental maps

(Mosselman)

Outline

- I. Thinking about the Future in a Structured Fashion
- II. Scenarios – A Brief Overview
- III. Some Nuances
- IV. Concluding Thoughts

Three Premises and a Corollary

- I. Our understanding of the world is, and likely will always be, incomplete
- II. The world is non-deterministic: we have some control in shaping the future
- III. The world is non-nihilistic: we prefer some futures over others

(after Daly and Farley 2010)

What Makes Thinking about the Future Difficult

- Ignorance

Our understanding is limited

- Surprise

The world is filled with the unexpected and the novel

- Volition

Human choice matters

(after Raskin 2002)

“Human beings are rarely passive witnesses of threatening situations. Their responses to threats may be unwise, but they inevitably alter the course of events and make mockery of any attempt to predict the future from extrapolation of existing trends.”

(Dubos 1983)

Types of Incertitude

		Knowledge About Outcomes	
		High	Low
Knowledge about Likelihoods	High	Risk	Ambiguity
	Low	Uncertainty	Ignorance

(after Karlsson 2005 and Stirling and Scoones 2009)

third dimension from a policy perspective – Decision Stakes

(Funtowicz and Ravetz 1992)

Reasons for Thinking about the Future in a Structured Fashion

To better imagine the future

- to illuminate potential problems and bring them into focus
- to share understanding and concerns
- to uncover assumptions and rigorously test them

To better consider our options in shaping the future

- to identify alternative choices
- to explore these alternatives in the face of incertitude

Criteria for Thinking about the Future in a Structured Fashion

- Salience:
 - relevance to issue at hand
- Legitimacy:
 - how and by whom analysis is undertaken
 - how insights/lessons derived
- Credibility:
 - rigor of analysis
 - defensibility of insights

(after Cash et al 2002)

Scenarios – What they are

Histories of the Future

- *“a hypothetical sequence of events for the purpose of focusing attention on causal processes and decision points.”* (Kahn 1965)
- *“archetypal descriptions of alternative visions of the future and paths to these, created from mental maps or models that reflect different perspectives on past, present and future developments.”* (Rotmans and van Asselt 1997)
- *A plausible description of how the future may develop based on a coherent and internally consistent set of assumptions about key driving forces (e.g., rate of technological change, prices) and relationships.* (https://www.ipcc-data.org/guidelines/pages/glossary/glossary_s.html)

Scenarios vs. Sensitivity Analysis

Scenario analysis

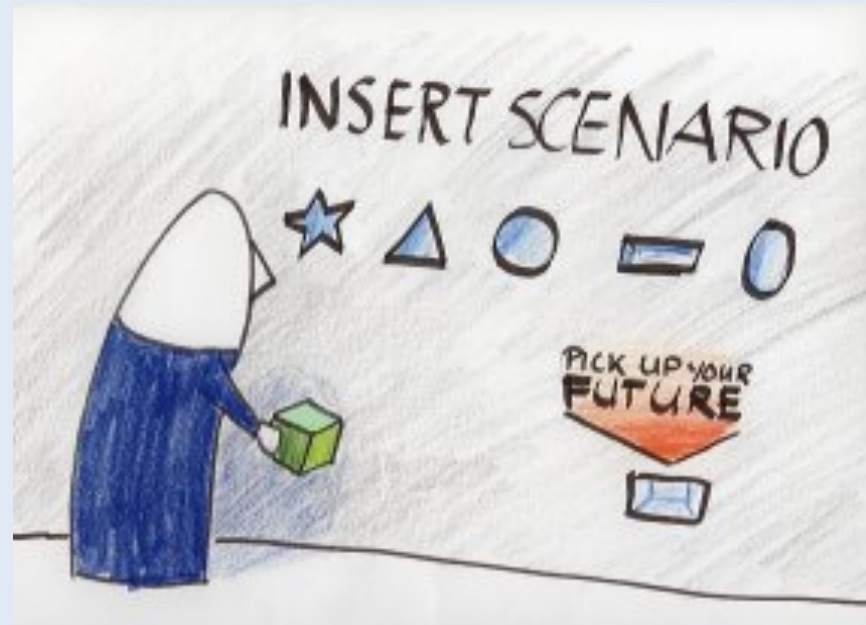
- identify key driving forces and uncertainties
- consider packages of internally consistent assumptions about key uncertainties
- trace out various paths into, or back from, the future

Sensitivity analysis

- identify key driving forces and uncertainties
- estimate probability distributions for key uncertainties
- explore the changes in one or more outputs from a single best guess projection to the variation in one or more of the uncertainties

Scenarios – What they are not

No Predictions Please



(Mosselman)

“It is now generally accepted that scenarios do not predict. Rather, they paint pictures of possible futures and explore the differing outcomes that might result if basic assumptions are changed.” (UNEP, 2002)

“This sort of model is an attempt not to predict the future but to illustrate the basic dynamic tendencies of a complex system under alternate policies.” (Meadows, et al., 1973)

However, . . .

Conditional Predictions

*“The claim that **scenario analysis*** is a non-predictive approach to the future does not imply the lack of inclusion of conditional predictions in the analysis. It does however require that the general purpose of the analysis is not to predict the most likely future state of the system but to assess the feasibility and desirability of different outcomes.”* (*backcasting in original)

(Robinson 2003)

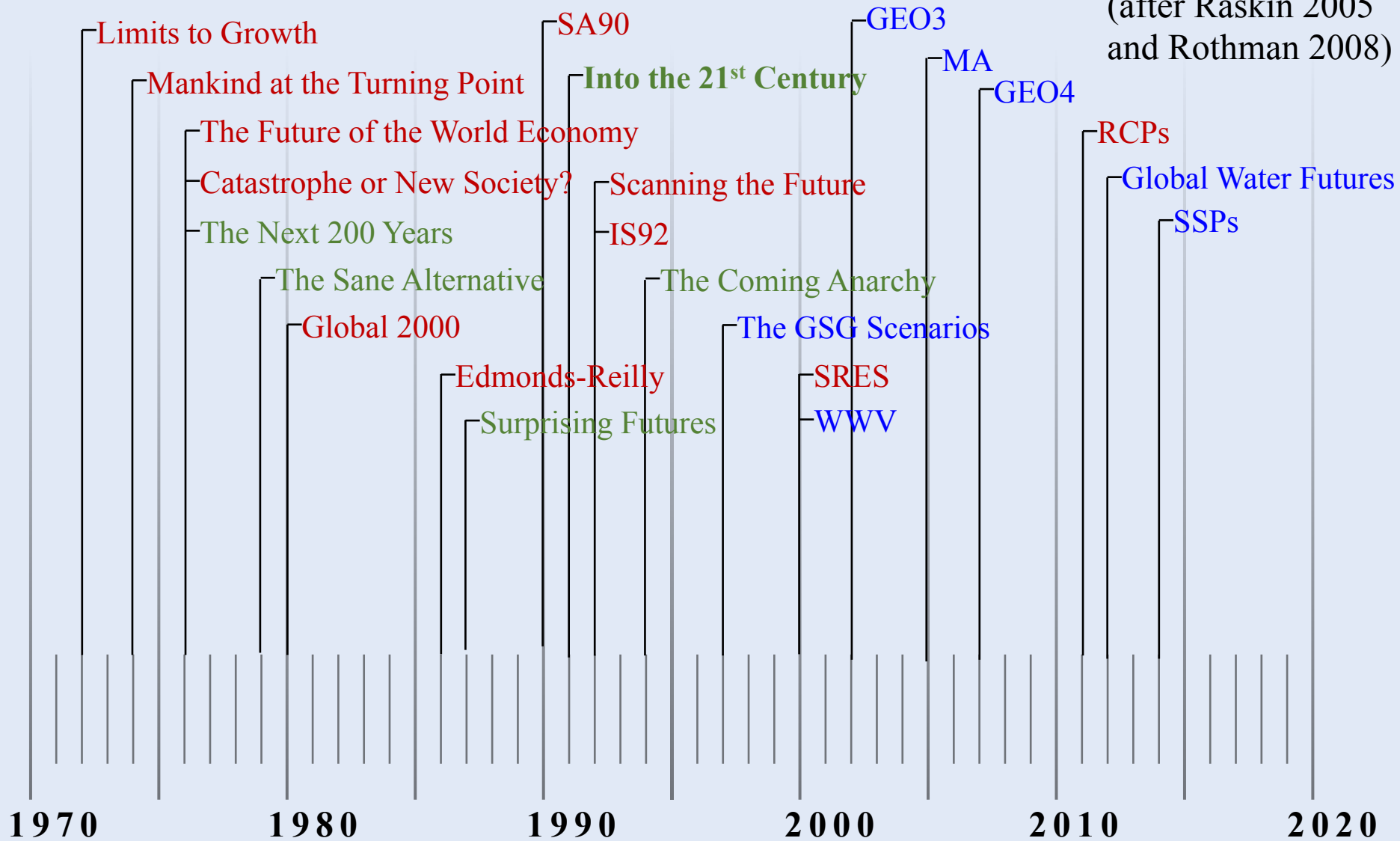
Origin of Current Use of Scenarios

Some Highlights

- Scenarios as part of theater production.
- Military planning in the Second World War
- Post-war moved into civilian domain in 1950s and 1960s
 - US: through Herman Khan at the RAND corporation and Hudson Institute (e.g. Khan 1965)
 - France: “La Prospective” (see Godet 1993)
- “What if” storytelling developed by Shell under Pierre Wack and Ted Newland in 1970s (see Wack 1985a,b)
- 1972: Limits to Growth (Meadows, et al 1973) brings in global modeling
- 1990s: Offshoots of Shell, e.g. the Global Business Network (The Art of the Long View (Schwartz 1991)) helps to reach broader audience

Selected Global Change Scenarios

(after Raskin 2005
and Rothman 2008)



Multiple Baselines?

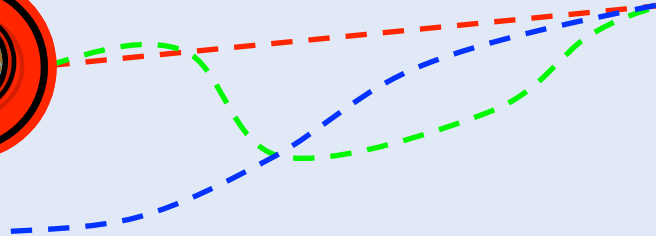
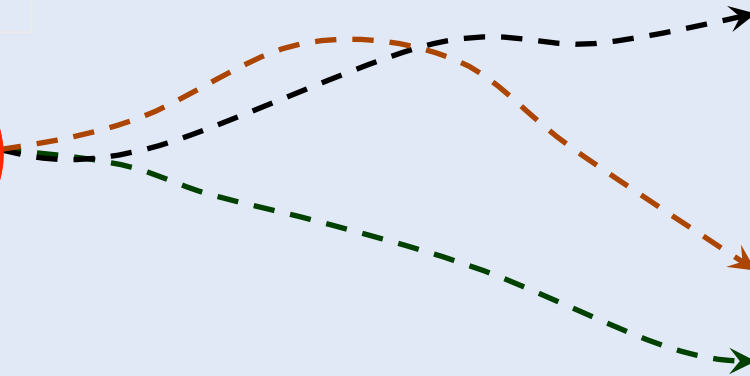
“These considerations strongly suggest the need to work on the basis of several baseline scenarios . . . (which) represent quite different and internally consistent patterns of development due to the long-term consequences of current decisions and current behaviors. . . .These would not be simply scenarios with high, medium or low versions due to various assumptions regarding exogenous parameters”

(Hourcade and Robinson 1996)

Exploration and Backcasting

Exploration

Where might we be headed ?



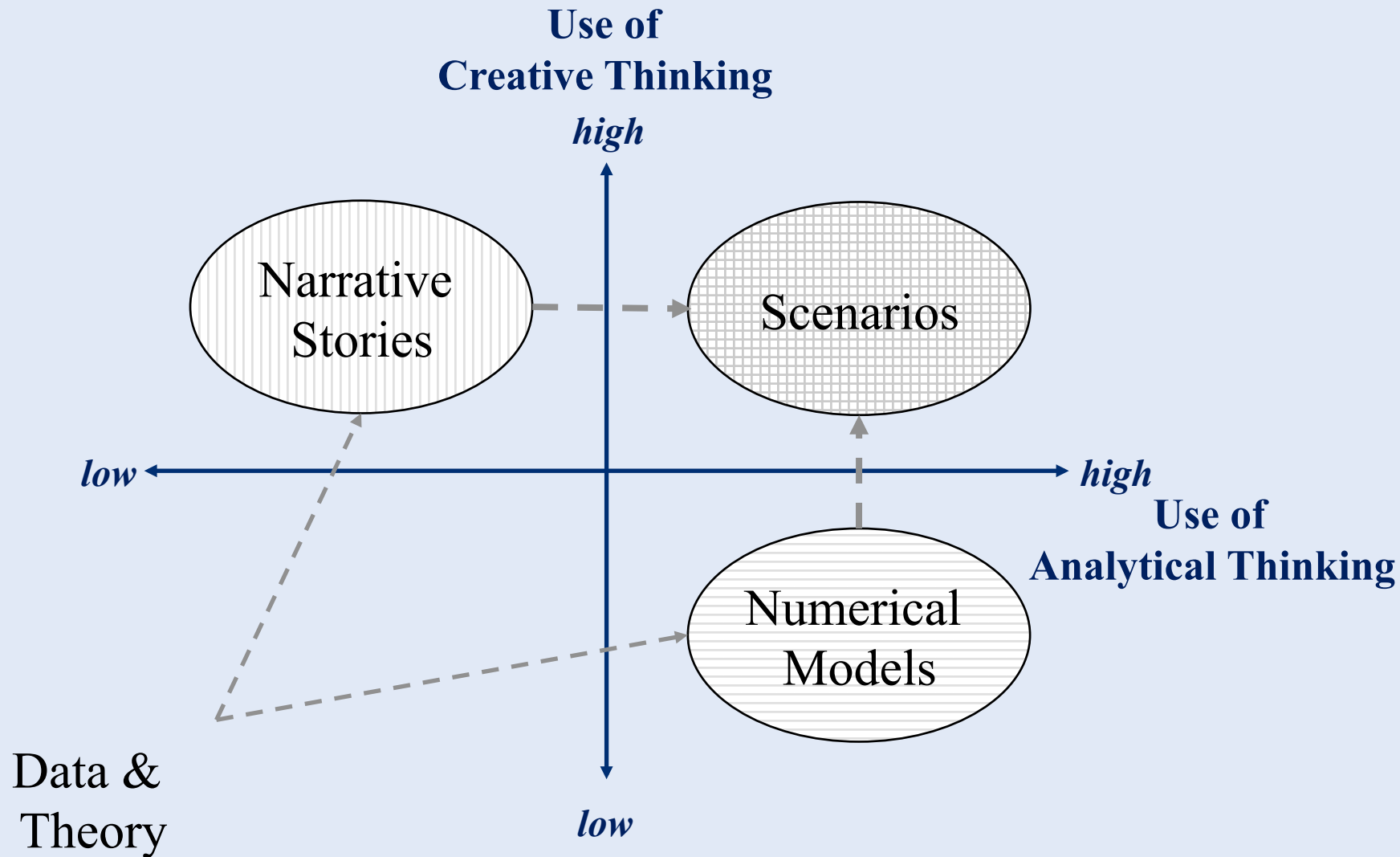
Backcasting

How do we get to (avoid) desirable (undesirable) futures?

Baseline vs Policy

- Baseline scenarios
 - Describe future developments in which no new policies or measures are implemented apart from those already adopted or agreed upon
- Policy scenarios
 - Consider new policies or measures additional to those already adopted or agreed upon

Narratives and Numbers



(after Ghanadan and Koomey 2005)

Narratives & Numbers

	Advantages	Disadvantages
Narratives	<ul style="list-style-type: none">• can represent views and complexity of many different interests• can explore relationships and trends for which few or no numerical data are available• can more easily incorporate human motivations, values and behavior	<ul style="list-style-type: none">• tough to identify or test underlying assumptions• do not provide numerical information
Numbers	<ul style="list-style-type: none">• can provide greater rigor, precision and consistency• assumptions are explicit and conclusions can be traced back to the assumptions• can provide order-of-magnitude estimates of past, present and future trends	<ul style="list-style-type: none">• have limited view of the world and are often not transparent• exactness gives illusion of certainty

Three Parting Thoughts

“The test of a good set of scenarios is that, while being believable, they should act like a shock to the system, to stimulate debate and to encourage action”
(McKiernan ~2000)

“The only relevant discussions about the future are those where we succeed in shifting the question from whether something will happen to what would we do if it did happen”
(de Geus 1997)

*“...is any purpose served by attempting long-term perspectives for a region?
Yes!!! I say this not because the forecasts will necessarily be right, but
because they may stimulate helpful actions – actions that may, in fact, even
render the forecasts wrong.”*
(Agarwala 1991)

Thank You

dale.rothman@du.edu

General References

Part I

- Cash, David, William Clark, Frank Alcock, Nancy Dickson, Noelle Eckley, and Jill Jäger. 2002. “Salience, Credibility, Legitimacy and Boundaries: Linking Research, Assessment and Decision Making.” RWP02-046. Faculty Research Working Paper Series. Cambridge, MA: Harvard University, John F. Kennedy School of Government.
http://papers.ssrn.com/sol3/papers.cfm?abstract_id=372280.
- Daly, Herman E., and Joshua C. Farley. 2010. *Ecological Economics: Principles and Applications*. 2nd ed. Washington, DC: Island Press.
- de Geus, Arie. 1997. *The Living Company: Growth, Learning and Longevity in Business*. London: Nicholas Brealey Publishing.
- Dubos, René. 1983. “Technological and Social Adaptations to the Future.” In *How Humans Adapt: A Biocultural Odyssey*, edited by Donald J. Ortner. Washington, D.C: Smithsonian Institution Scholarly Press.
- Funtowicz, Silvio O., and Jerome R. Ravetz. 1992. “Three Types of Risk Assessment and the Emergence of Post-Normal Science.” In *Social Theories of Risk*, edited by Sheldon Krimsky and Dominic Golding. Westport, Conn: Praeger.
- Ghanadan, Rebecca, and Jonathan G. Koomey. 2005. “Using Energy Scenarios to Explore Alternative Energy Pathways in California.” *Energy Policy* 33 (9): 1117–1142. <https://doi.org/10.1016/j.enpol.2003.11.011>.
- Godet, Michel. 1993. *From Anticipation to Action: A Handbook of Strategic Prospective*. Paris: UNESCO Publishing.
- Hourcade, Jean-Charles, and John Robinson. 1996. “Mitigating Factors: Assessing the Costs of Reducing GHG Emissions.” *Energy Policy, Energy and Greenhouse Gas Mitigation: the IPCC Report and Beyond*, 24 (10): 863–73.
[https://doi.org/10.1016/S0301-4215\(96\)00071-7](https://doi.org/10.1016/S0301-4215(96)00071-7).
- IPCC. 2000. *Special Report on Emissions Scenarios: A Special Report of Working Group III of the Intergovernmental Panel on Climate Change*. Cambridge: Cambridge University Press.
- Karlsson, Mikael. 2005. “Managing Complex Environmental Risks for Sustainable Development Policies for Hazardous Chemicals and Genetically Modified Organisms.” PhD, Karlstad University.
https://www.researchgate.net/publication/263651305_Managing_Complex_Environmental_Risks_for_Sustainable_Development_Policies_for_Hazardous_Chemicals_and_Genetically_Modified_Organisms.

General References

Part II

- Khan, Herman. 1965. *On Escalation: Metaphors and Scenarios*. 1 edition. New Brunswick, N. J: Routledge.
- Meadows, Donella H., Dennis L. Meadows, Jørgen Randers, and William W. Behrens III. 1972. *The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind*. New York: Universe Books.
- McKiernan, Peter. ~2000. personal conversation, see <https://pureportal.strath.ac.uk/en/persons/peter-mckiernan>.
- Mosselman, Esther. Dutch artist.
- Raskin, Paul, Tariq Banuri, Gilberto Gallopín, Pablo Gutman, Al Hammond, Robert W. Kates, and Rob J Swart. 2002. *Great Transition the Promise and Lure of the Times Ahead*. Boston, Mass.: SEI, Stockholm Environment Institute.
- Robinson, John B. 2003. "Future Subjunctive: Backcasting as Social Learning." *Futures* 35 (8): 839–56.
[https://doi.org/10.1016/S0016-3287\(03\)00039-9](https://doi.org/10.1016/S0016-3287(03)00039-9).
- Rothman, Dale S. 2008. "A Survey of Environmental Scenarios." In *Developments in Integrated Environmental Assessment*, edited by Joseph Alcamo, 2:37–65. Environmental FuturesThe Practice of Environmental Scenario Analysis. Amsterdam: Elsevier.
<http://www.sciencedirect.com/science/article/pii/S1574101X08004031>.
- Rotmans, Jan, and Marjolein B.A van Asselt. 1997. "From Scenarios to Visions: A Long Way to Go. Lessons Learned from Two Decades of Scenario Development." In . Laxenburg, Austria.
- Schwartz, Peter. 1991. *The Art of the Long View: Planning for the Future in an Uncertain World*. 1 edition. New York, NY: Bantam Doubleday Dell Publishing Group.
- Stirling, Andy, and Ian Scoones. 2009. "From Risk Assessment to Knowledge Mapping: Science, Precaution, and Participation in Disease Ecology." *Ecology and Society* 14 (2). <https://doi.org/10.5751/ES-02980-140214>.
- UNEP, ed. 2002. *Global Environment Outlook 3: Past, Present and Future Perspectives*. London: Earthscan.
- Wack, Pierre. 1985a. "Scenarios: Uncharted Waters Ahead." *Harvard Business Review* 63 (5): 73–89.
- Wack, Pierre. 1985b. "Scenarios: Shooting the Rapids." *Harvard Business Review* 63 (6): 139–50.

References for Global Change Scenarios

Part I

- **Limits to Growth:** Meadows, Donella H., Dennis L. Meadows, Jørgen Randers, and William W. Behrens III. 1972. *The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind*. New York: Universe Books.
- **Mankind at the Turning Point:** Mesarović, Mihajlo D., and Eduard Pestel. 1975. *Mankind at the Turning Point: The Second Report to the Club of Rome*. London: Hutchinson.
- **The Future of the World Economy:** Leontief, Wassily W. 1977. *The Future of the World Economy: A United Nations Study*. New York: Oxford University Press.
- **Catastrophe or New Society?:** Herrera, Amílcar Oscar, Hugo D. Scolnik, Graciela Chichilnisky, Gilberto C. Gallopín, Jorge E. Hardoy, Diana Mosovich, Enrique Oteiza, Gilda L. de Romero Brest, Carlos E. Suárez, and Luis Talavera. 1976. *Catastrophe or New Society? A Latin American World Model*. Ottawa: International Development Research Centre.
- **The Next 200 Years:** Kahn, Herman. 1976. *The Next Two Hundred Years: A Scenario for America and the World*. New York: William Morrow & Co.
- **The Sane Alternative:** Robertson, James. 1979. *The Sane Alternative, A Choice of Futures*. St. Paul, MN: River Basin Pub.
- **Global 2000:** Barney, G. O. 1980. *Global 2000 Report to the President of the United States: Entering the 21st Century: V. 1 & 2*. Elsevier.
- **Edmonds-Reilly:** Edmonds, J A, J M Reilly, R H Gardner, and A Brenkert. 1986. "Uncertainty in Future Global Energy Use and Fossil Fuel CO2 Emissions, 1975 to 2075." TRO36. Washington, DC: Carbon Dioxide Research Division, U.S. Department of Energy. <https://www.osti.gov/servlets/purl/7002151>.
- **Surprising Futures:** Svedin, Uno. 1987. *Surprising Futures: Notes from an International Workshop on Long-Term World Development, Friibergh Manor, Sweden, January 1986*. Stockholm, Sweden: Swedish Council for Planning and Coordination of Research.
- **SA90:** IPCC, ed. 1990. *Climate Change: The IPCC Scientific Assessment*. Cambridge ; New York: Cambridge University Press.
- **Into the 21st Century:** Burrows, Brian C., Alan J. Mayne, and Paul Newbury. 1992. *Into the Twenty-First Century: A Handbook for a Sustainable Future*. Twickenham, England: New York Univ Pr.
- **Scanning the Future:** Central Planning Bureau. 1992. *Scanning the Future: A Long-Term Scenario Study of the World Economy 1990-2015*. The Hague, The Netherlands: SDU Publishers.
<https://www.cpb.nl/en/publication/scanning-future-long-term-scenario-study-world-economy-1990-2015>.

References for Global Change Scenarios

Part II

- **IS92:** IPCC, ed. 1992. *Climate Change 1992: The Supplementary Report to the IPCC Scientific Assessment*. Cambridge ; New York, NY, USA: Cambridge University Press.
- **The Coming Anarchy:** Kaplan, Robert D. 2001. *The Coming Anarchy: Shattering the Dreams of the Post Cold War*. Reprint edition. New York: Vintage.
- **The GSG Scenarios:** Gallopín, Gilberto C., Al Hammond, Rob Swart, and Paul Raskin. 1997. "Branch Points: Global Scenarios and Human Choice." A Resource Paper of the Global Scenario Group PoleStar Series Report no. 7. Stockholm, Sweden: Stockholm Environment Institute. <https://greattransition.org/archives/other/Branch%20Points.pdf>.
- **World Water Visions:** Gallopín, Gilberto C., and Frank Rijsberman. 2000. "Three Global Water Scenarios." *International Journal of Water* 1 (1): 16-40. <https://doi.org/10.1504/IJW.2000.002055>.
- **SRES:** IPCC. 2000. *Special Report on Emissions Scenarios: A Special Report of Working Group III of the Intergovernmental Panel on Climate Change*. Cambridge: Cambridge University Press.
- **GEO3:** UNEP, ed. 2002. *Global Environment Outlook 3: Past, Present and Future Perspectives*. London: Earthscan.
- **MA:** MA, ed. 2005. *Ecosystems and Human Well-Being: Scenarios: Findings of the Scenarios Working Group, Millennium Ecosystem Assessment*. The Millennium Ecosystem Assessment Series, v. 2. Washington, DC: Island Press.
- **GEO4:** Rothman, Dale S., Joseph Alcamo, and John Agard. 2007. "The Future Today." In *Global Environment Outlook 4 (GEO-4): Environment for Development*, edited by United Nations Environment Programme, 397–454. United Nations Environment Programme.
- **RCPs:** *Climatic Change* 109(1-2) 2011. Special Issue on the RCPs
- **Global Water Futures 2050:** Gallopín, Gilberto C. 2012. *Five Stylized Scenarios*. Paris, France: UNESCO. <https://unesdoc.unesco.org/ark:/48223/pf0000215380?posInSet=1&queryId=N-EXPLORE-ca3241c8-c9b8-42e3-bc3f-ea4896603621>.
- **SSPs:** *Climatic Change* 122(3) 2014. Special Issue: A Framework for the Development of New Socio-economic Scenarios for Climate Change Research and *Global Environmental Change* 42 2017 Special Section Articles Featuring "Quantification of the Shared Socio-economic Pathways"