One Hundred Key Biospherics

Writing in 1998, E. O. Wilson suggested that “every college student” and “every public intellectual and political leader” should be able to answer a general question linking modern science and the humanities, and identify the ways in which this linkage is important to human welfare.

Wecskaop tackles this same objective, but in an expanded and more specific way. *We submit that there exists a specific and fundamental repertoire* of information that every citizen should know about natural systems, demographics, ecology, and our planet.

The central understandings of that repertoire have been introduced in Wecskaop, and are, for convenience, collected and itemized below and in appendix two. As such, Wecskaop constitutes a quick resource for policymakers, publishers, educators, journalists, government officials, students, and every world leader.

Do any introductory biology curricula still include coenocytic fungi, sclerenchyma cells, the metanephridia of an earthworm and the latissimus dorsi muscle of a frog (none of which, in the final analysis, is of particular importance)? If so, such content needs a deep and expeditious overhaul. Virtually all students, after all, can succeed in life without ever having heard of such topics.

As a result, topics like those cited above should be deleted from introductory courses, and immediately *replaced* with core concepts, data, and understandings like those we have seen in Wecskaop (and collated in the objectives checklists below), for the concepts, data, and understandings that are assembled here literally comprise

What Every Citizen Should Know About Our Planet

1. Carrying capacities (environmental and planetary).

2. World population levels, past, present, and projected, as well as current trajectories and alternate futures.

3. Ecological services and multiple examples thereof.

4. Demographics: Births, deaths, and daily net increase.

5. Demographics: Fertility rates (births per woman per lifetime) and mortality rates (including various ways in which desirable, but unexpectedly-rapid, mortality reductions can derail demographic prognostications).

6. Limiting factors and examples thereof (such as a limited capacity to accept, cleanse, and/or recycle wastes, competition, epidemic disease, hunger, and aggression). (Note that frequently food is not the only, or even the most immediate, limiting factor.) Secondly, recalling our chapter addressing "the open-space delusion," note that "running out of space" is not listed as a typical limiting factor, because other limiting factors routinely exert their influences long before organisms exhaust even a fraction of available "open-space."

7. Negative feedback loops and their stabilizing and self-correcting effects, and multiple examples thereof.

8. The self-fueling, self-amplifying, and self-intensifying nature of positive feedback loops, and real-world examples thereof.

8. Lag-times and delayed feedbacks, and multiple examples thereof.

9. Earth's oceans and atmosphere as "thin films."

10. Unintended and unexpected consequences; together with the human propensity to error, along with multiple examples thereof.

11. Thresholds and tipping points and multiple examples thereof.

12. That we presently add approximately one billion extra persons to earth's population every 12-15 years.

13. That despite declining birth rates in Europe and most developed nations, population growth in Africa, the Middle East, and many less developed countries (LDCs) still exhibits dangerous exponential patterns, together with examples thereof.

14. That historically, population projections often underestimate actual population levels that eventually develop (due, for example, to dramatic and unanticipated successes in reducing mortality).

15. That current complacency concerning population growth over the coming decades may be unjustified due to likely advances in genomics, medicine, and life extension.

16. Overshoot and climb-and-collapse population curves like those produced in two classical studies of reindeer herds (Scheffer, 1951; Klein, 1968).

17. Numerics: With examples that underscore the enormous difference between a million and a billion, and the implications thereof.

18. Exponential mathematics: Especially the misleading, deceptive, counterintuitive, and powerful nature of an exponential progression; recognition of an exponential progression; understanding that most of the growth in an exponential progression occurs at the end of the sequence; knowing that exponential progressions can convert one cent into twenty million dollars in thirty-one days or destroy a city like Hiroshima in a matter of seconds, and correctly solve counter-intuitive riddles involving exponential and similar non-linearities.

19. Depict humanity's "hyperexponential" graph from 8000 B.C. to 2000 A.D.; compare this graph to the climb-and-collapse patterns seen, for example, in the reindeer herd studies cited in our chapters, and challenge the misimpression that our particular moment represents (demographically speaking) a condition of "business-as-usual."

20. Ecological release, including causes, unexpected causes, unexpected consequences, and examples thereof.

21. Earth's biodiversity hotspots, biogeography, emergency room conservation, and conservation biology as components of K-12 and first-semester college curricula.

22. The fragility of natural systems and multiple examples thereof.

23. The potentially calamitous dangers that can arise from lag-times and delayed feedbacks; examples thereof, and the notoriously slow and unwieldy response times of most human institutions.

24. Worldwide population projections and trajectories for the half-century just ahead and their potentially calamitous implications for the biosphere, climate, humanitarian conditions, failed states, jobs, taxes, hunger, food, terrorism, poverty, and civil disorder.

25. The *fallacy of the agricultural maximum* and the *open-space delusion*, including a cognition that: (a) no other animals ***supplement*** their biological and metabolic wastes the way that we do; (b) no other animals have ***ever*** supplemented their biological and metabolic wastes the way that we do, and that, (c) even in the ***worst*** red-tide outbreaks in the history of the world, no dinoflagellate cells have ***ever*** supplemented their biological and metabolic wastes with industrial, technological, and societal wastes the way that we do."

26. The "open-space" delusion, dinoflagellates, Easter Island, and the Scheffer and Klein reindeer studies.

27. Eight or more unwarranted assumptions that invite calamity, including assumptions of "business as usual."

An itemized objectives checklist of the core concepts and biospheric understandings that every citizen should know about our planet.

1. Contrasting exponential progressions versus arithmetic progressions; linear versus non-linear systems, and behaviors thereof
2. Carrying capacity
3. Daily births
4. Daily deaths
5. Daily net increase
6. Fertility rates (children per woman per lifetime)
7. Negative feedback loops and their self-correcting and stabilizing roles in natural systems
8. The self-fueling, self-intensifying, and self-amplifying properties of positive feedback loops, chain reactions, and cascades
9. Thresholds, limits, and overshoot (including thresholds and limits that may be known, unknown, unanticipated, or unmarked)
10. Tipping points
11. Lag-times, delayed feedbacks, and inadequate responses
12. Blunders and unintended consequences
13. Examples, mechanisms and implications of ecological release
14. Biodiversity hotspots and "emergency-room" conservation
15. Conservation biology, minimum size of ecosystems, and minimum viable populations
16. Numeric literacy; contrasting a million and a billion
17. Climb and collapse population patterns in two reindeer herds
18. Density-dependent factors (increasing impacts that arise from and with increasing densities)
19. Earth's atmosphere as an onion-skin-thin film
20. Earth's oceans as a thin film
21. Numerics: a million
22. Numerics: a billion
23. A graph of world population over the past ten millennia
24. Projections of alternate demographic futures
25. Demographic projections as underestimates
26. The misleading, deceptive, and counterintuitive aspects of exponential progressions and non-linear systems
27. The characteristic J-curve of an exponential progression
28. The power and deceptive nature of exponential progressions
29. When most of the growth in an exponential progression occurs
30. Correctly interpreting counterintuitive exponential riddles
31. *Ecological interactions*: The environment affects living things
32. *Ecological interactions*: Living things affect each other
33. *Ecological interactions*: Living things affect their environments
34. *Ecological interactions*: Living things can affect entire planets
35. Minimum viable populations and genetic bottlenecks
36. Island biogeography and a minimum critical size of ecosystems
37. Wastes as a key limiting factor, and dinoflagellate red-tides
38. Keystone species, the roles they play, and examples thereof
39. Aggression and competition as limiting factors
40. Limiting factors – Adreno-cortico-pituitary-hormonal factors
41. Competition between species and competition within a species
42. *Ecological services* 1 – Production of oxygen
43. *Ecological services* 2 – Production of food

44. *Ecological services* 3 – Pollination of flowering plants
45. *Ecological services* 4 – Medical, industrial, and pharmaceutical
46. *Ecological services* 5 – Cleansing and recycling wastes
47. *Ecological services* 6 – Biogeochemical cycling
48. *Ecological services* 7 – Moderation of climate
49. *Ecological services* 8 – Genetic and agricultural
50. *Ecological services* 9 – Colonization, succession, and recovery
51. *Ecological services* 10 – Transpiration and rainfall
52. *Ecological services* 11 – Control and suppression of pests
53. **Limiting factors** 1 – *Production and accumulation of wastes*
54. **Limiting factors** 2 – *Physical damage to the environment*
55. **Limiting factors** 3 – Aggression, competition, and war
56. **Limiting factors** 4 – Competition between species; exotics
57. **Limiting factors** 5 – Density-dependent feedbacks
58. **Limiting factors** 6 – Epidemics, sanitation, and disease
59. **Limiting factors** 7 – *Destruction or disruption of natural pro-processes and their functions*
60. **Limiting factors** 8 – Resources such as food, water, nutrients
61. **Erroneous suppositions** – The amount of "open-space" is rarely, if ever, a limiting factor
62. Biogeography and biodiversity hotspots
63. Global human impacts past
64. Global human impacts present and intensification thereof
65. Global human impacts future
66. Sample tipping points (methane, ocean acidification, etc.)
67. How ecosystems *work* (interactions, buffering, processes, feedbacks, amplifications, delays, mechanisms, etc.)
68. How our planet works (buffering, feedbacks, equilibria, biogenic effects, thresholds, tipping points, physical systems, chemical systems, albedo, Gaia hypothesis mechanisms, etc.)
69. Vulnerabilities of biological, ecological, and planetary machinery
70. Biological magnification and bioaccumulation of wastes
71. The lessons of Sri Lanka (declining death rates often offset declining birth rates, resulting in faster growth than expected)
72. Possible consequences of genomic, medical, and life extension advances
73. The lessons of genomics, *Caenorhabditis*, and similar
74. Population growth and its implications for education
75. Population growth and its implications for poverty
76. Population growth and its implications for energy consumption
77. Population growth and its implications for emigration and immigration, governance, stability, and security
78. Population growth and its implications for costs, infrastructure, humanitarian crises, pollution, and damage to natural systems
79. Population growth and its implications for terrorism, governance, anarchy, international instability, and civil disorder
80. Population growth and its implications for political stability, poverty, unrest, and failed states
81. Climate change - mechanisms, implications, and mitigation of
82. Non-sustainable forestry; collapsing fisheries, and similar non-sustainable practices
83. Carrying capacity (earth as a global vehicle and its passengers other than humans)
84. Mitigation by individuals, workshops, meetings, and symposia
85. Mitigation by governments

86. Mitigation by NGOs (non-governmental organizations)
87. Mitigation by publishers, editors, and digital venues
88. Mitigation by educators, faculty, and department chairs
89. Mitigation by producers, journalists, and documentarians
90. Mitigation by religious leaders and organizations
91. Mitigation by government officials
92. Mitigation by policymakers, elected officials, and world leaders
93. Mitigation by web and digital presentations and initiatives
94. Wecskaop topics as early chapters in course texts
95. Examples of obfuscation, disingenuities, and misrepresentations
96. Flawed and unwarranted assumptions that invite calamity
97. Why 10, 20, 30, or 40% conservation goals may not be enough
98. The Fallacy of the Agricultural Maximum
99. The Open-Space Delusion
100. Biomes and biogeography
101. Overshoot and delayed feedbacks
102. Blunders and unintended consequences

A sample application of this checklist is illustrated by a quick examination of two current college level ecology texts that happened to be conveniently available. In both texts, the glossary failed to list or define *any* of the following key terms and concepts:

- Climb and collapse (boom and bust) population cycles
- Thresholds
- Tipping points
- Delayed feedbacks (lag-times)
- The million – billion dichotomy
- Earth's atmosphere and seas as thin films
- Ecological release

Moreover, the following *additional* terms were also missing in one or the other of the two glossaries examined (in other words, 50%):

- Exponential
- Positive feedbacks, their behavior, and implications
- Negative feedbacks, their behavior, and implications

Note that both texts, which were in other ways quite excellent, failed to accord multiple key topics the conceptual priority that the concepts would seem to deserve: (a) Considering the times in which we live, and (b) As college-level texts devoted specifically to ecology. Use of Wecskaop by authors, editors, producers, news correspondents, publishers, teachers, and faculty can help us avoid oversights that obscure truly high-priority (what every citizen should know) concepts through a mistaken overemphasis on lesser concepts (such as "mark-recapture" methods, DBH (diameter at breast height) field measurements, and optimal foraging strategies.

A continuation of today's demographic tidal wave *may constitute the greatest single risk that our species has ever undertaken.*

Excerpted from
What Every Citizen Should Know About Our Planet
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Librarians: The book version of Wecskaop is available from
M. Arman Publishing, Fax: 386-951-1101

Expanded implications of this excerpt are also
addressed in additional PDFs in this collection:

- Thin Films - Earth's razor-thin atmosphere and seas (pdf)
- Numerics, Demographics, and a Billion Homework Questions
- Conservation planning - Why Brazil's 10% is Not Enough
- Eight Assumptions that Invite Calamity
- Climate - No Other Animals Do This
- Critique of Beyond Six Billion
- Delayed feedbacks, Limits, and Overshoot
- Thresholds, Tipping points, and Unintended consequencs
  Problematic Aspects of Geoengineering
- Carrying Capacity and Limiting Factors
- Humanity's Demographic Journey
- Ecosystem services and Ecological release
- J-curves and Exponential progressions
- One Hundred Key Biospheric Understandings