Appendix 4.3

The following material is Appendix 4.3 for Chapter 4 of: Fowler, C.W. 2009. Systemic Management: Sustainable Human Interactions with Ecosystems and the Biosphere. Oxford University Press

1 Principles of "ecosystem management"

Much effort has been spent in defining "ecosystem management" (Appendix 4.1, Arkema *et al.* 2006, McCormick 1999) and the principles of management in general. The list of tenets presented in Chapter 1 represents a distillation of this work (Fowler *et al.* 1999, Fowler 2002, Fowler and Hobbs 2002). The quest for sustainability has a long history (Rockford *et al.* 2008). In principle, long-term sustainability is one of the main issues facing managers who are involved in resource utilization and faced with environmental problems (e.g., Christensen *et al.* 1996, Holt and Talbot 1978, Mangel *et al.* 1996, Oliver *et al.* 1995). Wallace (1994) and other sources listed in Chapter 1 demonstrate the degree to which these principles have been translated to legal mandate. Holt and Talbot's (1978) four principles are:

1. The ecosystem should be maintained in a desirable state such that:
- **(a)** consumptive and nonconsumptive values could be maximized on a continuing basis,
- **(b)** present and future options are ensured, and
- **(c)** risk of irreversible changes or long-term adverse effects as a result of use is minimized.

2. Management decisions should include a safety factor to allow for the fact that knowledge is limited and institutions are imperfect.
3. Measures to conserve a wild living resource should be formulated and applied so as to avoid wasteful use of other resources.
4. Survey or monitoring, analysis, and assessment should precede planned use and accompany actual use of wild living resources. The results should be made available promptly for critical public review.

In 1994, these were expanded with seven principles developed at the second Airlie House meeting (paraphrased from Mangel *et al.* 1996):

1. Sustainability is inconsistent with unlimited growth of human consumption of, and demand for, resources.
2. Present and future options are to be achieved by maintaining biological diversity at genetic, species, population and ecosystem levels. Neither the resource nor other components of the ecosystem should be perturbed beyond natural boundaries of variation.
3. Assessment (including ecological and sociological effects) of resource use should precede both proposed use and proposed restriction or expansion of ongoing use of a resource.
4. Management must be based on an understanding of the structure and dynamics of ecosystems while accounting for both ecological and sociological factors.
5. The full range of knowledge and skills from the natural and social sciences must be brought to bear in dealing with conservation problems.
6. Effective conservation requires understanding and taking account of the motives, interests, and values of all users and stakeholders, but not by simply averaging their positions.
7. Effective conservation requires communication that is interactive, reciprocal, and continuous.

Similar elements of "ecosystem management" are found in the Ecological Society of America's report (Christensen *et al.* 1996) that specifies

that "ecosystem management" includes eight elements:

1. Sustainability. Ecosystem Management does not focus primarily on "deliverables" but rather regards intergenerational sustainability as a precondition.
2. Goals. Ecosystem Management establishes measurable goals that specify future processes and outcomes necessary for sustainability.
3. Sound ecological models and understanding. Ecosystem Management relies on research performed at all levels of ecological organization.
4. Complexity and connectedness. Ecosystem Management recognizes that biological diversity and structural complexity strengthen ecosystems against disturbance and supply the genetic resources necessary to adapt to long-term change.
5. The dynamic character of ecosystems. Recognizing that change and evolution are inherent in ecosystem sustainability, Ecosystem Management avoids attempts to "freeze" ecosystems in a particular state or configuration.
6. Context and scale. Ecosystem processes operate over a wide range of spatial and temporal scales, and their behavior at any given location is greatly affected by surrounding systems. Thus, there is no single appropriate scale or time frame for management.
7. Humans as ecosystem components. Ecosystem Management values the active role of humans in achieving sustainable management goals.
8. Adaptability and accountability. Ecosystem Management acknowledges that current knowledge and paradigms of ecosystem function are provisional, incomplete, and subject to change. Management approaches must be viewed as hypotheses to be tested by research and monitoring programs.

Francis *et al.* (2007) present "ten commandments" for ecosystem-based fisheries science as a basis for management:

1. Keep a perspective that is holistic, risk-averse, and adaptive.
2. Question key assumptions, no matter how basic.
3. Maintain old-growth age structure in fish populations.
4. Characterize and maintain the natural spatial structure of fish stocks.
5. Characterize and maintain viable fish habitats.
6. Characterize and maintain ecosystem resilience.
7. Identify and maintain critical food web connections.
8. Account for ecosystem change through time.
9. Account for evolutionary change caused by fishing.
10. Implement an approach that is integrated, interdisciplinary, and inclusive.

Similar lists are presented in McCormick (1999), Dale *et al.* (2000), and Fowler (2003). Other such lists are found in much of the literature referred to in work exemplified by Arkema *et al.* (2006) and Appendix 4.1. As pointed out in Appendix 4.1, a common thread behind this work is a strong tendency to retain stakeholders in their position in the top row of Figure 1.1. In this role, thought, rather than observation, is the emphasis in decision-making. The lack of objectivity inherent to this role is retained in conventional management. This is one of the most significant differences between conventional and systemic management. In converting to systemic management, the conventional role for stakeholders is brought to a halt and replaced by using stakeholders in the role of asking management questions so that the appropriate research can be carried out to answer those questions objectively (Belgrano and Fowler 2008, Hobbs and Fowler 2008).

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