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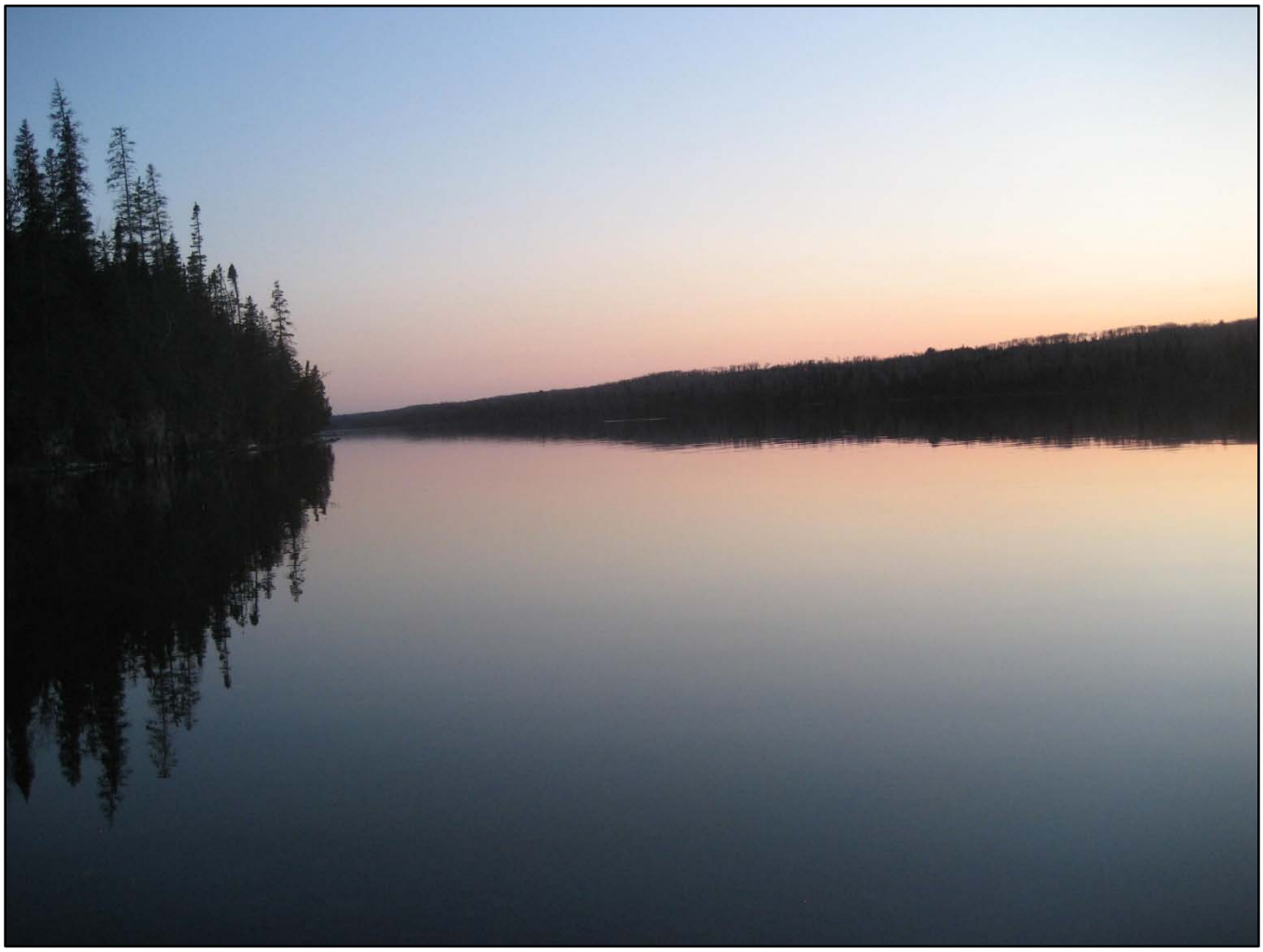
Natural Resource Stewardship and Science

A Conceptual Model to Guide Scientific, Management, and Policy Review of Contentious Natural Resource Issues

An NPS Natural Resource Stewardship Review Framework

Natural Resource Report NPS/NRSS/BRMD/NRR—2011/444



ON THE COVER
Isle Royale National Park – Lake Superior at sunrise.
Photograph by: Jenny Powers

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Abstract

Natural resource stewardship decisions are difficult for Park managers for many reasons. The combined philosophy, policy and culture of the National Park Service (NPS) emphasize avoiding or minimizing interventions that affect biological resources in Parks except when needed to restore "natural" conditions. In addition, politics and litigation can create pressure for action or inaction with respect to natural resource management. Parks struggle with the mandate of maintaining conditions and natural processes "unimpaired" and within acceptable ranges of variation that are difficult to define, in the face of local and global anthropogenic influences as well as natural ecological forces. The high value that Parks place on science to inform policy and management decisions often complicates the situation further because science does not always point to management preferences indicated by policy and tradition, and does not resolve differences in stakeholder values associated with natural resource management. Often, natural resource stewardship issues are framed as science issues when in reality the core of the issue is a values conflict that science cannot resolve.

In this paper we lay out the core logic and components of a Park-level approach to reviewing application of NPS natural resource policy, science, and management and the political climate in which they function. We regard these elements as spheres of influence; or the origins of perceived need to evaluate natural resource stewardship in a Park. We address the spheres of influence from the standpoint of reviewing how changes in any one may affect natural resource stewardship in a Park. Our goal is to provide a general framework to help natural resource managers think about comprehensive review of natural resource stewardship at the Park level. We do not provide a set of prescriptions, but instead pose questions to guide thinking and analysis.

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Spheres of Influence on Natural Resource Stewardship in National Parks

The simplest model of natural resource stewardship decision-making has three interacting spheres of influence—policy, science and management objectives as well as actions— at the core, plus the political climate enveloping all three of these spheres (Fig. 1). All spheres of influence are subject to change, by internal Park decisions and commitments, and by external research and political activity.

The relevance of a change in any sphere on natural resource stewardship as practiced in a Park (i.e., whether or not it does or should influence stewardship approach) can be determined only with reference to the broader purposes for a specific Park. That is, policy (at the Park, Agency, or Department levels), research findings (NPS sponsored or independent) and management (including management planning guided by the National Environmental Policy Act [NEPA]), need to be considered with respect to the desired future conditions (DFCs)[1] of the referent natural resource. The DFCs may be articulated in general, non-constraining terms, but fundamental objectives[2] derived from DFCs should be developed consistent with existing policy and within the bounds of understanding provided by existing science (i.e., fundamental management objectives should reflect policy and science). Neither policy nor science is static. Changes to either of these spheres of influence, or surprises in natural resource response to a management regime, could signal need for review of the situation given new information or conditions. A systematic approach to review of science, policy and management interventions would facilitate continuous improvement in stewardship, and would be part of comprehensive adaptive resource management[3].

The nature of a management response triggered by any of the spheres of influence, generally takes one of two forms:

- maintain conditions if they are currently acceptable (consistent with DFC), or
- move conditions from their current state to the desired state, given there is a gap between these that indicates need for management attention.

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[1] **Desired future conditions**: Descriptions of resources reflecting management success. They are targets for directing incremental actions and policies and provide a metric of success for managers and accountability for Congress and the public. (Unnasch et al. 2008)

[2] **Fundamental objective**: A statement about a condition (DFC) managers want to reach or maintain which is measurable with a timeframe identified for accomplishment. A fundamental objective is more specific than a DFC but not as specific as an actionable management enabling objective. Often several fundamental objectives are associated with a DFC. (Decker et al. 2011)

[3] **Adaptive resource management:** Adaptive management explicitly recognizes that there is uncertainty about the outcome of management activities, deliberately designs management plans to increase understanding about the system, implements the plan, monitors response indicators, analyzes the outcomes in consideration of the objectives and predictions, and incorporates the results into future decisions. (Unnasch et al. 2008)

Thus, a management response may be to: (a) passively maintain resources within an acceptable range of variation because no gap exists between current and desired conditions ; (b) passively allow change of a desirable kind to continue, because it is in a direction and at a rate acceptable to park managers, or (c) initiate an active intervention. If action is considered necessary, NPS policy directs managers to use NEPA analysis as the decision making tool.

Understanding current natural resource conditions is essential in any case. Such understanding typically is made possible by a combination of review of available science and analyzed experience of professional resource managers. As science and experience grow, managers' understanding of the nature of the gap and its consequences for achieving a DFC may change. New information can also lead to changing DFCs. Both of these circumstances affect the perceived need for management.

Thus, the persistently dynamic interplay of policy, science, and management and the political climate of natural resource stewardship (Fig.1) occasionally create the need for review and reassessment of a direction that a Park is taking with respect to a particular natural resource in a Park. Situations when review of natural resource stewardship is warranted include:

- when a ***change in NPS policy*** occurs or appears warranted that may affect DFCs, local application of policy, or appropriateness of current management activity or inactivity;
- when ***new developments in science*** occur that might question local application of policy, understanding of current condition, feasibility of a DFC or appropriateness of a management approach;
- when ***management outcomes are experienced that are surprising or unanticipated*** (including occurrence of unanticipated or undesirable collateral effects);
- when the ***political climate exerts an irresistible level of pressure*** on the Park (possibly indicating a change in social values regarding management of the referent natural resource).

Any of these changes could indicate need for evaluating one or all aspects of the policy, science, management triad**,** as well as an assessment of the political realities of importance to the Park. Interconnectivity of the spheres of influence argues that reviewing the adequacy and appropriateness of all of them may be valuable if a change occurs in one. In this white paper we focus on policy, science and management because these spheres lend themselves to systematic review by natural resource managers. We also include questions about the political climate with respect to policy, science and management.

Review of Policy, Science and Management – Where to start?

Given the advisability of change-induced or regularly scheduled review of policy, science and management, and recognizing the interconnectedness of these spheres of influence in natural resource stewardship, the logical question with respect to considering a review is, "where do we start?" Furthermore, if one agrees that the triad is only relevant and decipherable in the context of the overarching DFCs for a Park, then it is logical that no review of the three spheres makes sense without development of and reference to DFCs, and the fundamental objectives established for the natural resource in question. Then, depending upon which of the three spheres has changed, a manager can determine a logical starting point. Diagnostic questions for each starting point—policy, science or management—may help guide decisions about the initial focus of a review.

When policy is changing…

In the event of policy change, including new interpretations of policy, or strong belief that policy change is needed at Department, Agency, or Park levels, a policy review is warranted. Such a review would address one or more of the following four general questions:

- Does the new or proposed policy change indicate a ***need to reconsider compliance of existing Park-level policy***?
- Does the new or proposed policy change indicate a ***need to reconsider what a DFC would look like***, because new bounds (expanded or reduced) are placed on the possibilities NPS will consider valid or ideal?
- Does the new or proposed policy change affect ***appropriateness of overall management approach and specific management activities/techniques***, either limiting or expanding the set of possible alternatives?
- Does the new or proposed policy change indicate a ***need for new or improved science*** to support management of a particular resource component in the Park?

The intent of such inquiry is to initiate thought-provoking discussion between managers and eventually answer the different components of these questions. For example, when answering whether new or proposed policy or policy interpretation indicates a need for a change in DFCs managers would first begin by revisiting the current DFCs. If there are no formal DFCs identified then it indicates a need for the management team to define meaningful DFCs. Discussion of whether the new policy substantially affects the DFCs would follow. If the issue being considered is relatively straightforward then a small group of park managers (perhaps including colleagues from other Parks) may be the appropriate team to determine if DFCs are adequately defined and whether a change in policy may affect them. If the issue is large or complex with multiple viewpoints and a wide variety of potential DFCs, then a larger group of Park and Regional NPS personnel, and cooperators or stakeholders may be needed. Careful deliberation and discussion will ensure many viewpoints are considered and reasons for a specific DFC or proposed change in DFC are well grounded. Development of explicit, defensible and logical DFCs is essential for enduring natural resource management.

Answering the questions posed above through a policy review would include a compilation of relevant policies at various levels, input from managers and other experts, analysis of policy to identify implications with respect to DFC for a referent natural resource, prudent park-level

policy amendments, reconsideration of overall management approach (active, passive, laissez faire[4]) and specific techniques deployed, and sufficiency of existing science to inform management. Some of these would segue into, or at least indicate whether need exists for, science and management reviews.

More specific questions that a policy review might assess with respect to adequacy of policy in a particular natural resource situation might consider the institutional, resource, human and management dimensions of the situation. Questions that might be helpful in this assessment include:

Institutional dimension (internal)

1. Do we need more explicit interpretation of NPS policy given the current state of the science?
2. Do we need a reality check—a reinterpretation of NPS policy given current state of the world?
3. Do we need to explicitly define terms of natural resource management (e.g., What is a natural system?).
4. In an era of stagnant to declining budgets for Park operations, would a change in a Park's financial priorities be appropriate to emphasize natural resource management?
5. What are the effects of park assumptions and priorities with respect to allocation of financial resources to avoid or solve natural resource stewardship problems?

Institutional dimension (external)

1. What are NPS and Department of the Interior (DOI) authorities to manage the resource?
2. What other authorities are or may be operative?
3. What partnerships or cooperative processes are in place to facilitate needed collaborations?

Resource dimensions

1. How does global climate change influence the NPS default policy to embrace passive management?
2. What does NPS mission indicate as a DFC for natural resource stewardship? (e.g., Conditions characteristic of pre-European settlement? Is this feasible or even desirable today?).
3. Should a natural resource or ecological system currently in place and functioning (even if threatened) be replaced in an attempt to restore an historic condition and set of processes?
4. Do we need a change in NPS policy given the current state of the science?

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[4] Laissez-faire management is distinguished from passive management in that no explicit management decision has been made. In passive management there is a conscious decision not to intervene by changing the state or the ecological processes of the referent natural resource; however monitoring of the resource is often maintained. Laissez-faire management does not explicitly address management, including development of DFCs or fundamental objectives, for the natural resource.

Human dimensions

1. What are current societal values with respect to the resource? Do we need more information (research) to answer this question?
2. Does current policy reflect these values?

Management dimensions

1. What combination of wildlife, human and landscape management can form an effective and acceptable intervention strategy?
2. What practices are feasible and acceptable under current or proposed policy?

When the science is changing…

In cases where science may be revealing new knowledge relevant to natural resource conditions, processes or management activities, one should ask the following general questions:

- Is the science pointing to a ***new understanding of the current condition***? This would have implications for whether management is required and what actions are needed.
- Is the science pointing to ***new understanding of how the system works*** that indicates the need to alter the operative manager's model[5] of the system and possibly alter management actions to achieve enabling objectives[6]?
- Is the science pointing to ***a need to revisit policy adequacy or appropriateness given the current context***?

A "yes" response to any of these questions leads to the next step—an assessment of whether additional research or research interpretation is called for. That is, an assessment to determine whether the new scientific evidence is sufficient to suggest the need for actions that might be indicated by answers to the three questions identified above. The assumption here is that implications of research related to natural resources, as in most areas of science, should be approached with caution. Such skepticism is part of normal science, and arguably skepticism should be the normal policy and management response to novel, action-indicating research results. Independent replication and verification of research is undertaken routinely to reduce skepticism/elevate confidence and increase acceptance of findings by the scientific community as well as the policy and management communities. This step is prudent before changing policy or management strategy. These questions, like those shared earlier, also reflect the interconnectedness of science, policy and management.

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[5] **Manager's model:** a description of the management system from the perspective of a manager or, in most cases, a management team responsible for management of a resource. (Decker et al. 2011)

[6] **Management (or Enabling) objectives**: identify elements of the necessary conditions that enable achievement of a fundamental objective needed to reach a desired future condition; management objectives provide specific direction for actions and interventions an agency and its partners might undertake; achieving these objectives in turn *enable* achievement of fundamental objectives that in turn result in maintaining or creating a desired condition. (Decker et al. 2011)

More specific questions that a science review might assess with respect to a particular natural resource situation arise from needs to understand the resource, human and management dimensions of the situation. Questions that might be used in such an assessment include:

Resource dimensions

1. What attributes of the system are enhanced by new knowledge. Does it validate or challenge current assumptions of system function or dynamics?
2. How accurate is our technical understanding of the system and how much uncertainty are we willing to accept given a specific management goal?
3. What are the collateral[7] and subsequent effects of altering any component of the system?
4. How well do we understand the system drivers?
5. What kinds of system drivers should NPS be concerned about versus accept as part of the natural, evolutionary process at work in a park?
6. Are there outside influences (anthropogenic or otherwise) that are affecting the system?

Human dimensions

1. How does human use or presence (including research and management personnel) affect the resource? Are there significant anthropogenic effects on the system, and if so, how does one decide if an intervention is warranted to mitigate these effects?
2. What are the tradeoffs of these decisions, knowing that a mitigating measure will itself have anthropogenic effects?
3. What is our understanding of how stakeholders value the resource and the evolutionary processes?
4. Are there unique features of this natural resource that stakeholders value?
5. Are these features unique or endemic to this NPS unit?

Management intervention dimensions

1. How likely is an intervention to accomplish a goal of preserving the natural resource or system?
2. Are preserving the entire system and preserving a component of the existing system mutually exclusive outcomes?
3. How does one weigh the temporal and biogeophysical scale differences inherent in many natural resource stewardship decisions?

Preceding a science review intended to assess the adequacy of available science for informing decisions about policy or management change would be specification by decision makers of what level of confidence they require in science (research-based findings) to support making or reconsidering a policy or management decision. This is a combination of: (a) confidence in the *findings* (may require only one or may require multiple studies) and (b) acceptance of the *link* between the findings (may be one of multiple studies providing evidence) and the relevant policy

[7] **Collateral effects:** unintended impacts that occur simultaneously with implementation of primary management actions; typically the focus of mitigating actions. (Decker et al. 2011)

or management activity concerning the referent natural resource (i.e., do the scientific findings adequately support a predicted outcome of management action?). Adequate confidence in specific findings or in an accumulating body of information about a phenomenon reflects decision makers' (a) regard for the sufficiency of the science and (b) their threshold of required evidence to support decisions. Although some norms may exist, in reality both of these are variable—specific to traits of the decision makers and the importance of the natural resource in a particular context.

A science review would address sufficiency of science with respect to one or more of the questions above. That is, it would explore the extent to which new science introduced into the equation is pointing to:

- a need to reconsider compliance of existing Park-level policy with Service wide or Department wide policy,
- a need to reconsider overall management approach and specific activities because of new understanding of how the system works, or
- a need to revisit policy adequacy or appropriateness.

If any of these is indicated, then the appropriate policy makers or managers need to come to agreement about what would constitute sufficient and credible scientific evidence that would both inform and prompt changes in either policy, DFCs, or a management plan; inclusive of general approach, specific enabling objectives and associated activities. Possible people to invite to participate include: one or two natural resource managers from the referent Park, one or two natural resource managers from other Parks, and a set of impartial scientists representing the diverse disciplines relevant to the resource question. The result of a review should be a recommendation of one of the following types:

- available science provides enough basis for a decision;
- more research (replication and verification, more rigorous approach, more detailed results, etc.) is needed to achieve the threshold of confidence policy makers or managers require; or
- state of the science is neither convincing nor seen as worth further investment with respect to the natural resource management needs of the Park.

We reiterate, a science review should be preceded by (a) clear articulation of how managers understand the management system and DFC(s) under consideration and (b) unambiguous direction from policy makers and natural resource managers in the Park about standards or thresholds of confidence they require to make a decision about policy change or management interventions including general strategies and specific activities.

When <u>management</u> has unanticipated outcomes…

Management actions are loosely analogous to treatments in an experiment; actions are taken based on a belief (hypothesis or assumption) that they will yield or will avoid certain effects in the system being managed. The manager has a conceptual model in mind of how the system works, of its components and their interactions. In natural resource management, managers' models tend to reflect the coupled social-ecological system in which management occurs (e.g., the generic architecture of a manager's model is illustrated in Fig. 2). To the extent that (a)

knowledge of how a system operates is understood and (b) actions are appropriately designed, implemented and evaluated, then (c) unexpected outcomes of management actions, including not achieving expected levels of response, may indicate a need to review management approach. That is, unexpected outcomes encountered that are clearly inconsistent with the inherent model on which the manager is operating indicate the need for reconsideration of the manager's understanding of the system, the reasonableness of the objective, the technique, or the evaluation of effect (e.g., detection sensitivity, rigor of evaluation, etc.).

In the event of unexpected outcomes (including inadequate response of the resource component to management), one should ask the following questions:

- Is the management system model the Park is operating on somehow flawed (wrong, incomplete, etc.)? Do we need additional information to more accurately describe the system? This analysis may lead to new research objectives.
- Are the enabling objectives and related actions inadequate or inappropriate?
    - Are objectives too ambitious or ambiguous?
    - Have the right actions been identified?
    - Are the actions being implemented as designed?
- Is the evaluation approach taken inappropriate and are the evaluation tools being used inadequate to detect the changes occurring as a result of management?
- Are other unanticipated (collateral) effects occurring, perhaps undetected, that are hampering management accomplishment?

A "yes" response to any of these questions leads to the next step—an assessment of the management system model. A manager's model could be developed that explicitly describes the system—its components and their interactions—and that model would be scrutinized for thoroughness and for any missing assumptions or low-confidence assumptions that a qualitative sensitivity analysis would indicate to have great influence on how the system would respond to various interventions. If important assumptions are identified in which low confidence is assigned, the need for more science may be indicated.

The possibility of overly ambitious enabling objectives, where the amount of effect in a particular time frame is too optimistic, should be explored. Sometimes objectives are based on optimistic assumptions about resources that will be allocated to a particular management intervention, and may not fully materialize. Furthermore, policy constraints are sometimes misunderstood in management planning, leading to less flexibility than assumed in the design of interventions or the articulation of enabling objectives.

More specific questions that a management review might assess are quite wide ranging. They may focus on whether existing management plans and objectives with respect to the referent resource are adequate, clear and being implemented well. They may examine the need for changes in rules about research activities in the Park if such activity is affecting negatively either natural resources, Park visitors or Park neighbors. Questions that might be used in such an assessment include:

Management dimension

1. What are the Park's current natural resource management objectives and are they consistent with resource DFC(s)?
2. What is the current suite of actions, direct or indirect, being taken to manage the resource?
3. Which pieces of management are active, passive, or laissez-faire?
4. What level of management is justified for specific outcomes?
5. Is NPS policy adequate and clear enough to provide needed guidance and support for these kinds of decisions?
6. How will political versus other factors be weighed in such decisions?

Research dimension

1. What types of information would help the Park better manage the resource?
2. What kind of research endeavors does the Park value and how does it manage and prioritize these within the Park?
3. What kinds of research activity, at what levels of intensity, are (a) *reasonable* given expected value of information generated and (b) *acceptable* given effects of research activity on natural resources, natural systems, wilderness designation, visitors, and Park budget?

Human dimension

1. How will human-natural resource interactions (especially with wildlife resources) influence the management of natural resources and the human environment?
2. Is intentionally affecting the human aspects of the human-natural resource interface needed, justified, and feasible?
3. How will the Park work to change or maintain human behavior to foster appropriate human-resource interactions?

A management review would thoroughly evaluate the various possibilities for lack of expected response to management or the occurrence of unexpected response. It would start with review of the manager's model for the system being managed. If that model has not been articulated previously, then developing it would be an initial task of the review. Thus, the review team would consist of someone who can elicit the manager's system model, a NPS person who focuses on policy constraints and directions, one or two experienced natural resource managers from other Parks, and one or more technical experts who are knowledgeable about the resource of interest (these can be NPS staff or others who are not intimately involved in the specific management effort being addressed).

Political Climate

Assessment of the political pressures influencing the management environment is an on-going and very real part of natural resource stewardship for any Park. Some questions Park leadership might consider on a regular basis include:

1. How should stakeholder preferences or advocacy play a role in NPS decisions?
    a. How are stakeholder interests prioritized and reflected in Park natural resource policy and in management processes and decisions?

    b. How do Parks engage stakeholders in processes that result in durable policy and management decisions without resorting to the equivalent of managing by popular vote?
2. Is the scientific research information available to the public too narrow or too broad in scope?
    a. Which publics or stakeholders (broad or narrow group of people) are aware of the issue?
    b. What technical information (broad or narrow in scope) is available to these groups?
3. What historical or current value do constituents of the Park place on research relevant to the natural resource of interest?
    a. What "public" value, both positive and negative, do long-term and short-term research efforts focused on a Park's natural resources bring to Park management (e.g., valuable insight for policy, politics and management; notoriety with some stakeholders [e.g., scientific community, particular NGOs])?
    b. How does Park management make the tradeoff decisions between the values (as indicated above) and problems (e.g., calls for policy change or management action by external scientists or other stakeholder groups) that Park-focused research represents?
4. What is the current political support for either passive or active management with respect to the referent natural resource in the Park?
5. How should the environmental context (i.e., wilderness setting, human improved setting, residential setting) of human/wildlife interaction influence NPS decision making?

Conclusion

Reiterating the assertion in our opening paragraph, natural resource stewardship decisions are among the most difficult for Park managers because of the combined influence of NPS philosophy, policy, culture and vagaries of the political climate. The current tendency in NPS is to avoid or minimize interventions that affect biological resources in Parks. If management affects flora or fauna with "star" status from the public's perspective, external politics can be seriously complicating. Nevertheless, active management is needed in some situations to meet Park goals, and the prospects of ever greater anthropogenic effects on Park natural resources (e.g., climate change) make this a possibility for many Parks. Explicit goal statements in the form of desired future conditions and fundamental objectives will allow Parks to clearly express reasons and be held accountable for their actions. The dynamic nature of coupled human-natural resource systems and the science focused on them means that periodic review of activity or even inactivity with respect to natural resource management is prudent. Such review can be scheduled periodically or be prompted by changes in the key elements—policy, science and management. Careful review of these elements, separately or often concurrently, is a healthy, professional and principled approach to natural resource stewardship. In this white paper we have attempted to lay out the core logic and components of a Park level approach to reviews of NPS natural resource policy, science and management.

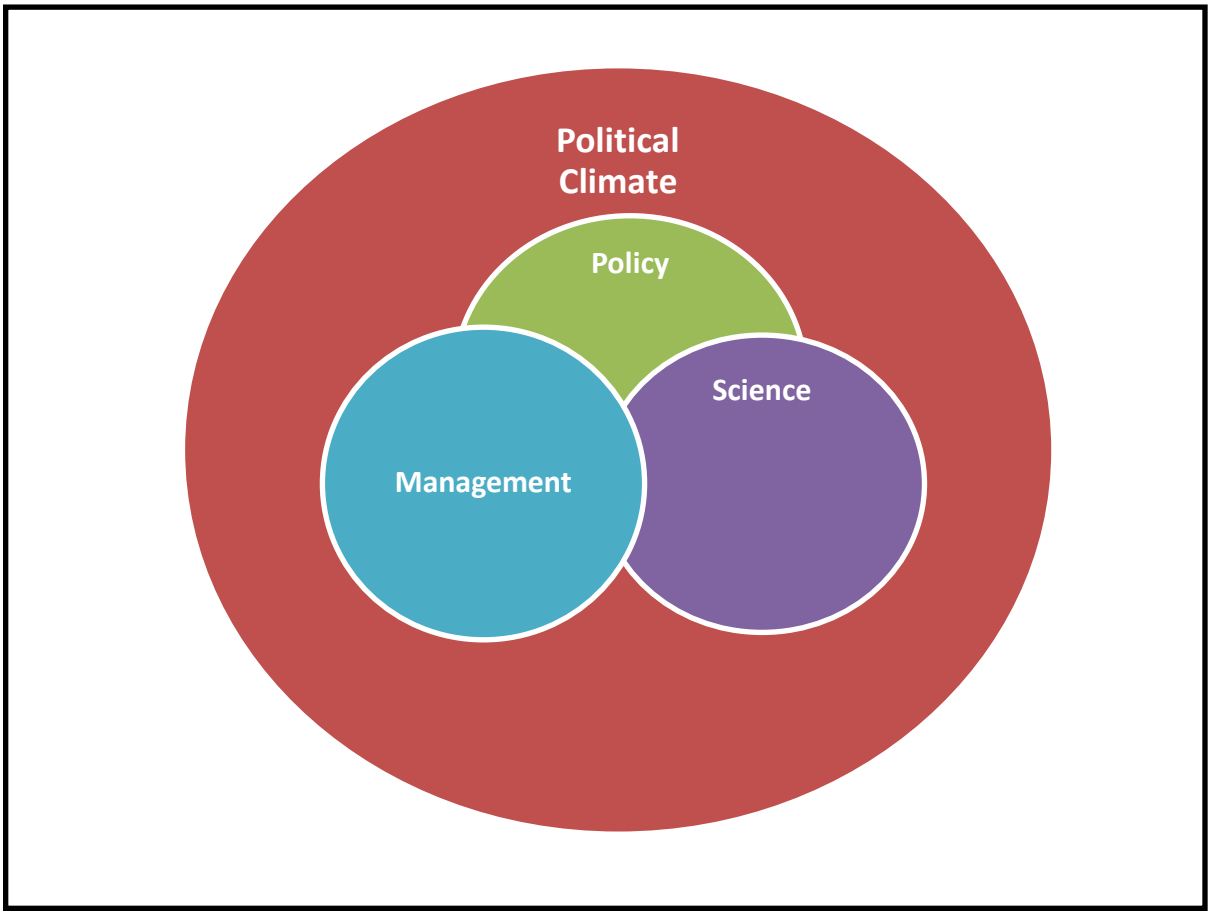

Figure 1. Spheres of Influence on natural resource stewardship

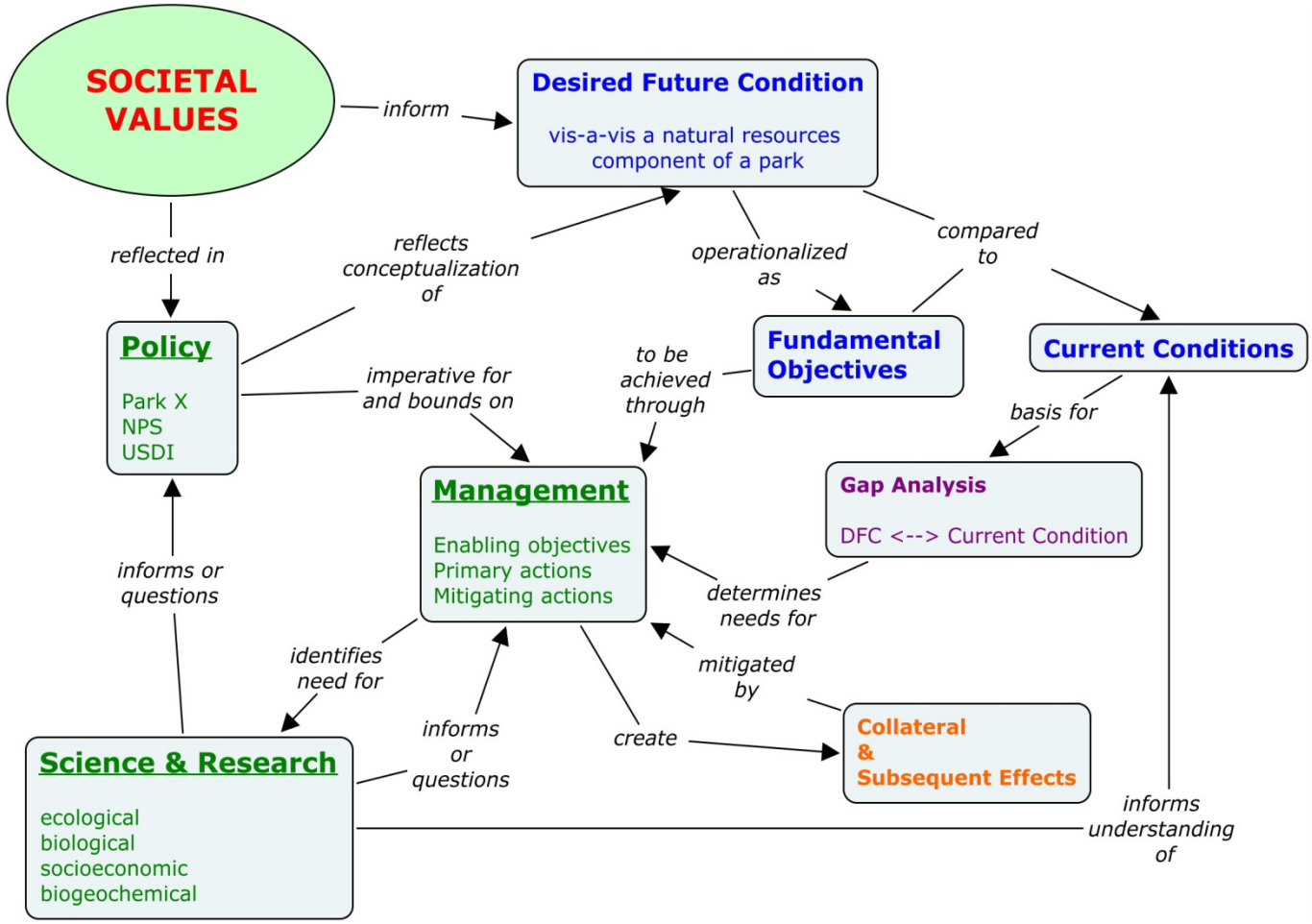

Figure 2. Conceptual manager's model

Literature Cited

Decker, D.J., S.J. Riley, J.F. Organ, W.F. Siemer and L.H. Carpenter. 2011. Applying Impact Management: A Practitioner's Guide. Human Dimensions Research Unit and Cornell Cooperative Extension, Department of Natural Resources, Cornell University, Ithaca, NY. 126 pp.

Unnasch, R.S., D.P. Braun, P.J. Comer, G.E. Eckert. 2008. The Ecological Integrity Assessment Framework: A Framework for Assessing the Ecological Integrity of Biological and Ecological Resources of the National Park System. Report to the National Park Service.

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