Interim Technical Guidance on
Defining Meaningful Desired Conditions for Natural Resources
National Park Service
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Contents

Interim Technical Guidance

This guidance is released for use by National Park Service staff as an "interim" technical guidance document. It is a working document that will be revisited in the future after NPS staff have the opportunity to use it and provide feedback. As part of the further development of this guidance, case studies will be collected and made available, along with supporting documents at http://www1.nrintra.nps.gov/brmd. The NPS Washington Office contact for this guide is Greg Eckert greg_eckert@nps.gov 970-225-3594

I. Background

In an age of unprecedented stress on natural resources and the environment, the era of managing National Park System natural resources for a vague concept of pre-Euro-American settings is over. In addition, societal values need to be better reflected in management goals, and our decisions must be sensitive to the fact that we will create environmental legacies for future managers. Managers develop goals for resources reflecting the NPS mission and the interest of stakeholders. But managers need to know if efforts to achieve these goals make a difference. They can do this by describing outcomes, or desired conditions, that reflect those goals [1, 2]. Desired conditions are descriptions of resources reflecting management success, that is, after management goals have been achieved. They are targets for directing incremental actions and policies, and provide a metric of success for managers and accountability for Congress and the public. Like goals, desired conditions have no required time element; this distinguishes them from short-term project or performance plan objectives.

Desired conditions (DCs) are defined for GPRA and other accountability requirements as well as for exercise of good professional practice. Meaningful desired condition statements require detailed descriptions of resources and quantified metrics. They also should provide the type/scale of information that supports more detailed levels of planning, such as objective setting, or as part of a response to unforeseen impacts. To be useful to managers, the public and congress, desired conditions must be measurable.

Desired condition as a concept emphasizes the fact that goals and DCs are value based. Although the origin of the term is vague, the DC concept in land management has been used since the mid 1980's[1]. The application of the DC as the standard for condition reporting has increased through implementation of the Department of Interior Strategic Plan and Office of Management and Budget accountability schemes. The NPS applies desired conditions in Foundation Documents and General Management/Program Plans, but NPS Management Policies [3] does not limit the use and application of the term. Desired condition is a useful communication tool for clarifying what we mean when we use concepts such as "natural," "pristine," or "unimpaired" as management goals. In NPS Management Policies, "natural condition" is "the condition of resources that would occur in the absence of human dominance over the landscape." But, widespread human influence on historic conditions is fact, and the dominance of human influence on global processes is omnipresent. Natural, as used in the context of "natural resources" can still be implied as a self-occurring property of the environment, i.e., it has formed and is maintained independent of human input. The other standard NPS uses for evaluating resource condition is impairment and this is based on harm to a resource's integrity. Ecological integrity is the ability of an ecological system to support and maintain a community of organisms that has species composition, diversity, and functional organization comparable to those of natural habitats within a region. An ecological system or species has integrity or is viable when its dominant ecological characteristics (e.g., elements of composition, structure, function, and ecological processes) occur within their natural ranges of variation and can withstand and recover from most perturbations imposed by natural environmental dynamics or human disruptions [4]. Ecological integrity is a concept that is metric driven and can accommodate the human role in ecosystems. The development of meaningful desired conditions in this guide is supported by an ecological integrity framework.

II. Goals and structure of the Guide

The goal for this guide is to help park managers define meaningful, measurable desired conditions to support all aspects of professional park management: planning, implementation, partnering, communication, interpretation, evaluation and reporting. The guide identifies approaches to removing barriers to the development of meaningful desired conditions. These barriers are recognition of need, the nature of the DC, the complexity of resources and the uncertainty of future environmental conditions and resource response to those conditions. To address these barriers, the guide is structured this way:

- The significance and value of defining meaningful desired conditions;

[1] An analysis of the range of terms and uses of the desired condition concept is found in Appendix A

- Concepts that identify desired conditions as value based, and part of strategic planning;
- Characteristics of a meaningful desired condition;
- Relationship to NEPA;
- Reducing complexity through focal resource identification, resource characterization and assessment of acceptable criteria for ecological integrity;
- Refinement of ecological integrity metrics and measures to incorporate human and institutional dimensions, and define an acceptable range of measures for desired conditions;
- Applications of the desired condition, such as scorecards, objective setting and as baselines for addressing uncertain resource response or global change.

This paper provides an overview for concepts and steps used to define desired conditions. Appendices provide more conceptual information and tools for assessing ecological integrity, addressing uncertainty, and examples. As this interim guide is tested in 2009, worksheets will be developed for managing information though a step-wise process for DC development. While the emphasis of this document is on natural resources, the role of cultural resources and park operations as institutional influences, and the interaction of natural resources with visitors, gateway communities and neighbors as part of the human dimension in setting of natural resource DCs are incorporated.

III. Significance of Meaningful Desired Conditions

Why should a manager invest the necessary time and effort to define desired conditions for park resources? Describing the desired condition is a purposeful effort on the manager's part to identify the future state of resource condition. This, in turn, drives management activities. Managers will find a well articulated desired condition valuable when communicating management decisions before an increasingly skeptical Congress and public. Williams [5] reflected on an important paradigm shift in land management when he suggested that desired conditions "define a picture of what is to be achieved so managers can focus their management efforts or outcomes, not outputs." Cole and Stankey [6] suggest that a specific lack of an attainable desired condition may make it impossible to recognize problems in a timely way, identify appropriate management strategies, or evaluate management effect. The NPS Organic Act of 1916 provides a broad mandate for preservation of resources, and management cannot be driven by compliance with a few specific resource mandates, such as the Endangered Species Act and pollution control laws. A clear description of management outcomes is the approach that expands the scope of decision-making to a holistic level. These are basic incentives related to professional resource management for developing meaningful desired conditions. Additional benefits are suggested below:

The desired condition facilitates planning. Just as management actions require plans, plans require a focal point for which the plan is developed. Desired conditions set the basis for the types and scope of actions developed in plans.

The desired condition facilitates learning. The exercise of defining a desired condition reveals what is known and unknown about a system and helps identify strategic information needs. Desired conditions provide the basis for 1) effectiveness

measurement [7] under adaptive management, and 2) departure points for scenario planning. Both facilitate learning about actions and stressors on resources. In addition, careful development of a desired condition can inform the need for improved policy [8].

The desired condition is a performance management tool. The Government Performance and Results Act (GPRA) requires federal agencies to develop performance management through the preparation and implementation of strategic plans, annual performance plans, and annual performance reports. Under this condition-based approach to resource management, measurable end-outcomes, in the form of desired conditions, are imperative.

The desired condition justifies actions. Competitive project funding requests require strong justifications. Project work that is based on a clear desired condition can drive a logical sequence of activities contained in funding proposals.

The desired condition provides context for assessment and monitoring data. Clearly articulated desired conditions are necessary where someone needs to know with a degree of certainty whether conditions truly are "good" "fair" or "bad;" trends are positive or negative, or if resource changes are even relevant. When DCs are in place, assessment and monitoring have greater focus and serve the role of providing feedback that an important management threshold has been crossed and when further investigation or a management action is warranted.

The desired condition supports civic engagement and partnering. The human dimension is perhaps the biggest driver in defining the DCs, as it refers to the process of assigning value to resources. Natural resource managers bring an understanding of ecological values to this process. But the NPS is also responsible for managing public resources to reflect public values. Some of these values are articulated in the laws and policies that guide management. Desired conditions reflect these laws and policies, as well as managers' beliefs and assumptions about the management context. Articulating these operating premises can help identify the agency's role in conserving the resource, as well as the limits and bounds within which managers operate. Clearly articulated DCs can improve public understanding of the management context, ensuring more informed public input. Engaging a more informed public can 1) create partnership opportunities when the public identifies areas over which they have jurisdiction and 2) identify misperceptions on the part of managers. Systematically developed DCs can be used to resolve conflicts among competing goals, facilitating partnerships with other land managers to efficiently address large scale issues such as natural processes and threats. For example, Natural Resource, Cultural Resource and Fire specialists met together and jointly developed desired conditions as a vehicle to generate a common vision to coordinate the respective program actions in Fire Management Planning Workshops in 2002-03. Why managers should invest resources into defining DCs is summarized in Table 1.

- Provide a basis for professional resource management;
- Facilitate planning;
- Facilitate learning;
- Basis for performance management;
- Justify actions;
- Provide context to research, assessment and monitoring data;
- Build consensus for partnering and civic engagement.

Table 1. Benefits of a well defined, meaningful desired condition statement.

IV. Key Concepts in Defining Meaningful Desired Conditions

Desired conditions become meaningful, in part, by reflecting key concepts in natural resource management, such as complexity and the dynamic nature of resources, the role of human and institutional dimensions, and strategic thinking. Desired conditions also need to be distinguished from other management concepts such as reference conditions and natural conditions.

Desired conditions are not simply "conditions"

The term desired "condition" is limiting because resources are dynamic, incorporate a range of characteristics, and these characteristics exist within a range of variation. Metrics and measures[2] need to include concepts of resource behaviors or trajectories [9] and dynamics [10]. These ideas are developed in Appendices B and C. The use of the term "desired conditions" throughout this document will incorporate these concepts.

Management targets emerge from human, resource and institutional dimensions

Desired conditions emerge from three dimensions, or areas of influence. They are Resource, Institutional and Human. A model, modified from Schenborn [11] shows the desired condition emerging from the interaction of the dimensions in response to the accumulation and flow of information across the three dimensions (Figure 1).

[2] In some NPS documents, "indicators and standards" are terms used for placing numeric or categorical values on goals. In natural resource management, however, the term "standard" is used with some caution in the context of desired conditions. Numerous regulatory standards exist for natural resources, but they often are generated in the context of public health protection, and often represent the lower range of tolerable conditions. "Measures" is used instead of "standard." Also, "metrics" is used in lieu of "indicators" as the latter represents only one of several stages of measure development.

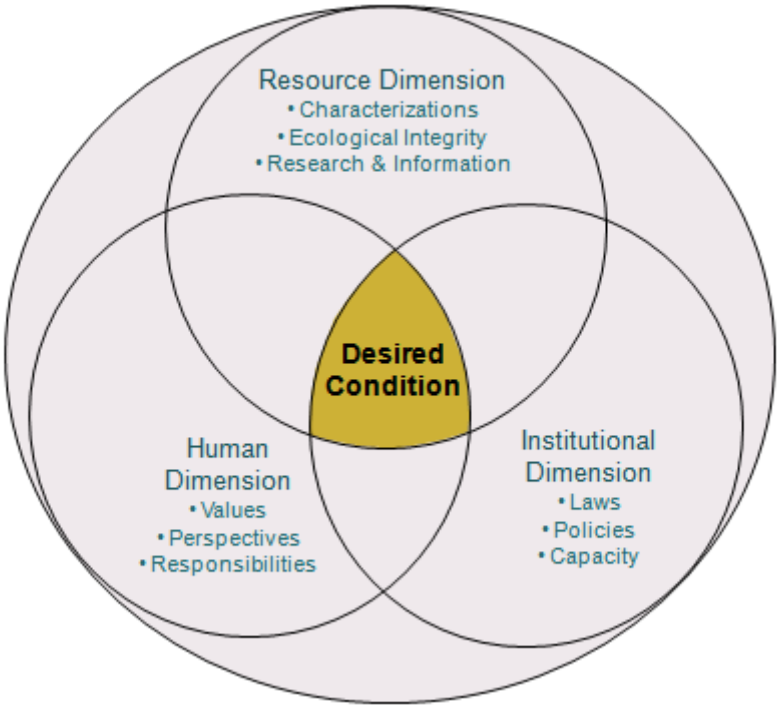

Figure 1. Desired condition dimensions. The outer circle indicates that the three dimensions, Resource, Human and Institutional, constantly interact with each other, while areas of overlap among circles show that more specific relationships among dimensions. The shaded area in the diagram is where a manager seeks to find the optimal solutions when management for one dimension without consideration of others would have unacceptable detrimental impacts. This requires tradeoffs among the three dimensions. Applying goal hierarchies can help identify points of agreement among the 3 dimensions. Key ecological attributes and their range of variation can be used as a currency for resolving differences. These tools are discussed in Appendices C and D.

In this model, the Resource Dimension includes the resource condition, data, models, concepts and working knowledge of the resource. It includes the role of natural resources as "life support systems" for society [12]. The assessment of the resource dimension focuses on boundaries of high ecological integrity and impairment, and potential ecological thresholds that exist within those boundaries. The Resource Dimension can be characterized using an ecological integrity framework. Steps to assess ecological integrity are found in Appendices C and D.

The Institutional Dimension includes laws, policies, assets and public sector responsibilities. NPS mandated responsibilities to implement the Organic Act and establishing legislation of parks are included here. Managers also will need to investigate other applicable, relevant or appropriate requirements including laws, regulations and policies. For example, when addressing a wilderness area of the park, compliance with the Wilderness Act is mandatory. Compliance with legal requirements establishes guides for the manager as s/he faces the question, "what ought I manage this resource towards?" An extensive list of other laws and policies that should be considered is found in Appendix B of the NPS Planners Sourcebook.

One aspect of an NPS manager's Institutional Dimension are Director's Orders. Director's Order 75 (Civic Engagement and Public Involvement) directs managers to extend interactions with stakeholders beyond the formal public participation process of NEPA and other laws. A rapidly emerging field of study and application in natural resource management is the human dimension of resource management, described here. The Human Dimension includes values, interests, beliefs, norms, perspectives, information assets and responsibilities of players for whom the agency manages. Human dimensions encompass how and why people value resources, the benefits people seek and derive from those resources, and how people affect and are affected by resources and resource management [13]. While natural and cultural resources have physical attributes, the meaning assigned to those attributes is determined collectively by society [14, 15]. Nash applied this idea to wilderness, which he described as a "state of mind" [16]. Often, diverse stakeholders assign a variety of meanings to resources, resulting in controversy.

Understanding the range of stakeholder perspectives and incorporating their input into NPS decision-making is important for three reasons. First, NPS is a public land management agency, meaning that resources are managed in trust for the benefit of current and future generations [17]. NPS has a responsibility to ensure that management incorporates the desires of the public, within bounds set by law and policy (which also reflect public values) and the physical constraints of natural systems.

Second, natural resource problems are more than complex, they are "wicked" or "messy" [18-21]. Complex, or technical, problems are comprised of many interrelated components whose relationships are hard to identify and understand but are governed by predictable natural laws. In addition, a complex problem is defined by all stakeholders in approximately the same way. They have technically correct solutions that reach noncontroversial (i.e., broadly recognized and shared) societal goals. Messy problems, while fundamentally complex, do not have a single "correct" formulation of the problem. Rather, "The definition [of the problem] is in the mind of the beholder, and how that person chooses to explain the problem determines the scope of the search for a resolution" [18]. As noted by Rittel and Webber [22], the process of problem formulation often *is* the problem. Including stakeholders throughout the decision-making process ensures that they and managers understand: (a) each others' formulation of the problem, (b) problem elements to be addressed by management, and (c) probable outcomes. Without explicit problem formulation, stakeholders and managers run the risk of using the same language to describe different phenomena, resulting in public input unrelated to actual management concerns.

Finally, NPS natural resource issues often occur on ecosystem or landscape scales that reach beyond the administrative boundary of a park. Management success often will rely on coordinated, or at least not contradictory, actions by stakeholders with jurisdiction over adjoining resources. Including these stakeholders early and often in the decision-making process can yield creative solutions that might otherwise be overlooked because they rely on outside entities for implementation. Often, external stakeholders share resource concerns and a collaborative approach to management can realize greater long-term benefits [23]. These stakeholders may be potential partners.

The NPS Planners Sourcebook (page 51) provides a guide to engaging stakeholders in the planning process and can be used as a guide for target development also. One consideration is that stakeholder engagement should occur early in the development of goals and management targets, as this is the level that will attract the broadest set of ideas as a broader share of stakeholders will be able to work at this level [7]. Further support in identifying and working with stakeholders and in incorporating stakeholder perspectives and preferences, within the bounds of the NPS mission and other congressional directives, is available through the NPS Biological Resource Management Division.

The Institutional and Human Dimensions are driven by values and their influences on resource integrity can be positive or negative. They can conflict with each other. As an example, forest management policies across the nation are described as "a crazy quilt of single purpose laws and years of case law precedents some of which are applied in contradictory ways [24]."

The development of the desired condition from the 3 dimensions is iterative as information flows among the dimensions. As an example, advances in knowledge about resource dimensions through science periodically informs human and institutional dimensions, just as human dimensions periodically inform the institutional dimension through elections – clear messages of higher level needs and values. Shifts in values, laws and knowledge will be major factors in revisiting a desired condition. This model is dynamic, and individual dimensions are not equal to the others in every protected area management circumstance. "The degree of overlap of dimensions varies with the complexity of issue under consideration, the extent of our knowledge of the resource, the concerns or polarity of stakeholders, and the authority of the agency [11]." The dynamic nature of this model emphasizes the applicability of the management target concept for the National Park System. Some units are established for "pristine" conditions and "primitive" experiences, reflecting the least amount of human intervention. But in other cases, such as historic sites, the establishing legislation (an element of the institutional dimension) is more detailed about the state of natural resources. Another example is found in NPS planning. In some management zones, the resource dimension is dominant in its influence on the desired condition. In others the human dimension, in the form of visitor use, or perhaps a wildland-urban interface zone, has greater influence on the desired condition. Each dimension can be assessed independently for specific purposes. For example, the resource dimension can be developed in the context of ecological integrity by the NPS Vital Signs or Natural Resource Assessment programs. The development of ecological integrity criteria for the resource dimension before the development of goals for management zones in a GMP would greatly enhance the meaning of those goal statements. But the ecological integrity assessment cannot be used as a desired condition without considerations of goals of human and institutional dimensions, and conducted in an open, transparent process. The desired condition becomes the optimal condition that a manager can assemble given the environment of competing goals.

Desired conditions as a Component of Strategic Thinking

Rogers and Bestbier [25] suggest that the desired condition can be lost in the murkiness of goals, mission statements and objectives and strategies. Strategic thinking is a process by which the mission, strategies, goals, objectives, tactics and projects for an organization are identified and selected. The premise of strategic thinking is to show that managers act with a purpose. [11]. Steps to taking a strategic thinking approach include:

1. Conceptualize what you will achieve in the park context
2. Articulate what you will achieve in the park context
3. Plan – actions, monitoring / evaluation, & communication
4. Implement - actions, monitoring / evaluation, & communication
5. Analyze
6. Communicate to key internal and external audiences
7. Apply learning
8. Iterate [11]

Goal and vision statements provide the conceptualization in defining the subject of interest and state intention, such as "maintain," or "achieve." Clearly established goals are the basis for defining desired conditions [1, 2, 25-28]. The desired condition describes the subject of interest in a way that it can be evaluated. Clear or meaningful goals include specific identification using standard nomenclatures for resources, and the scale of the resource or impact. The DC elaborates on the goal, and in doing so, sets criteria for objective setting.

Objectives are vital to strategic thinking steps 3-8, and are distinguished from goals by being project- or operations-based, as they include a time frame to go along with being specific, measurable, achievable and results-oriented. Through strategic thinking, managers clearly see that objectives are achieved or not, and how the accomplishments of objectives contributes to the achievement of goals through DCs. Goals, DCs and objectives are described, with related terms in Table 2. Note that higher levels of strategic thinking form the basis and justification for lower levels, while successes at lower levels cumulatively contribute to the achievement of higher level goals and missions.

The number of desired conditions to be defined reflects the number of goals that require evaluation. This does not have to be intimidating as the number of goals across a park tends to be limited to broad zones or resource categories, in addition to goals developed in response to specific impacts. Adopting hierarchical approaches to defining goals and DCs will support the development of goals and DCs for unforeseen impacts. The information base for nested resources will already be in place. The selection of focal resources as described in Appendix C is another approach managers can take to ascertain the appropriate number of resources and scale of resources that require desired condition statements. More information on applying scale concepts, and approaches to identifying the appropriate scale of resources are found in Appendices B and C.

	Strategic Thinking Hierarchy		Synonyms or Related Terms	Description
Higher levels provide context and justification for lower levels ↓	Mandate	Lower levels support the accomplishments of higher levels ↑	Charter	Legal Authority
	Mission		Vision	Brief, broad statements of purpose
	Mission Strategy			A general approach to achieving a group mission
	Goals		Fundamental Objectives	Statements of intent
	Goal Elements			Specific components of goals, e.g., natural resources and wildlife
	Sub-goals and elements			Usually not designated specifically, but vital to clarifying broad goals
	Desired Conditions		Desired Future Conditions	Detailed, measurable descriptions of what a resource will look like after management goals have been achieved.
			End Outcomes	An expression of the character of resources that a manager works toward over the long-term.
			Management Targets	Descriptions of the intended result, effect, or consequence that will occur from carrying our a program or activity. They are generally long-term, ultimate measure of success of strategic effectiveness.
	Goal Strategies			General approaches to achieving desired conditions and goals.
	Project and Program Objectives		Intermediate Outcomes	Targets for time-limited, specific activities. Characterized by being SMART: specific, measurable, achievable and results oriented and time-limited.
			Performance Measures	
			Outputs	Short term building blocks that directly or indirectly lead to the achievement of goals and desired conditions.
			Enabling Objectives	

Table 2 A strategic thinking hierarchy indicating the relationship of desired conditions with missions, goals and objectives. Note that higher level components of the hierarchy are broad but need to direct the development of specific lower levels. The achievement of higher levels is determined by accomplishments at lower levels, but only if they are clearly tied to upper levels. The desired condition serves as a critical fulcrum in this process.

Desired condition relationship to other condition concepts Desired conditions, to be useful, must be distinguished from other management concepts. These include those related to resource condition such as "natural," "optimal," "impaired," and "integrity." Desired conditions also must be distinguished from "historic," "reference," and "current" conditions. Desired conditions can be "natural," that is, free from human dominance. For example, in backcountry zones, management focus is on the resource dimension with few competing goals. While many parks will seek to manage natural resources towards natural conditions, the actual examples of "natural" conditions, a difficult to measure and value-based concept to begin with [29], are increasingly difficult to identify. "Optimal" is not defined by the NPS but may be construed as a synonym for "natural." But as described previously, optimal condition is synonymous with desired condition in that it represents the condition that a manager ought to manage for given conflicting needs as long as the resulting condition results from a process that yields the greatest benefit across all party's objectives.

Impairment is a critical threshold for NPS resource management as identified in the Organic Act of 1916. NPS defines impairment as actions that "would harm the integrity of the park resources or values, including opportunities that otherwise would be present for the enjoyment of those resources or values." [30] Guidance on impairment is found in the Interim Technical Guidance on Assessing Impacts and Impairment to Natural Resources [30]. So, no NPS resource should be managed for, or DC set for thresholds of impaired conditions.

While high integrity and impaired conditions provide boundaries for the desired condition, historic conditions provide the foundation for understanding the resource. The resources we see in parks today reflect the initial conditions and combinations of resource and process interactions over time. Historic conditions also tell us about limiting factors of ecosystem development, such as climate, soil chemistry and landscape position. DCs for natural resources in NPS units should not go beyond the bounds of the historic range of variation to a point where artificial systems are envisioned. Some DCs have been heavily biased towards historic conditions, leaving managers working towards static, and inappropriate conditions. This problem has been addressed by incorporating the historic range of variation (HRV) of resource or process variables, while realizing that this, too, is limiting for a desired future condition. One difficulty in using the historic condition is determining which time periods are appropriate to apply to management. Decisions on these questions may be resource by resource. For example, NPS fire programs evaluate the historic range of variation of fire regime characteristics across 1,500 – 2000 years, while the Nature Conservancy, focused on rarity of biological communities, conserves unique fens that have emerged since the introduction of cattle by Europeans in the northeastern U.S. Historic condition and the range of variation of resources are discussed further in Appendices B&C.

Reference conditions are mental constructs, actual sites or their written descriptions, or combinations of each, that serve as models [31] for resource planning, and later for its evaluation. These models provide examples of how a system works - their parts and key processes. Reference conditions can be used as a surrogate for time, when it is difficult to evaluate historic conditions [32]. It is a common practice in restoration projects to select "reference conditions" as a desired condition. Caution is advised, as the application of the term "reference condition" is often arbitrary and the ecological state of "reference conditions" can vary, and without analysis, may not reflect what is desired by managers. Reference conditions, like current or desired future conditions need to be evaluated by a common framework and metrics, such as ecological integrity, resiliency, or sustainability. Reference conditions are discussed further in Appendix D. When applying reference conditions to park resources, the goal structure and resulting land use of those reference areas must be considered to evaluate the compatibility of the reference conditions with park goals.

Desired conditions relate to long term goals, and the current condition of a resource may not reflect desired outcomes at all. The current condition is a snapshot in time, so cannot fully represent the range of variation of resource elements and processes. While current condition should not be accepted as a *de facto* desired future condition, current condition

may represent changes to the historic condition that are irreversible, such as the loss of upper soil horizons, or a park's status as a "green island" in an urban landscape. Like the resource dimension, future conditions for the human and institutional dimensions may differ from current condition. For example, stakeholder behavior threatening resources such as social trails, illegal ORV trails, anchoring boats on coral heads, or feeding wildlife do not have to be accepted and incorporated into DCs. Or, as an example of overlap of both the human and institutional dimensions: laws/policies that have historically not been enforced and have become a tradition that stakeholders now believe is a right, such as beach driving and ORV's, snowmobiles, or people feeding wildlife.

The comparison of desired and current conditions drives management strategies. These in turn are achieved by accomplishing a number of project or program objectives. Solid understandings of past actions - manifested in the current condition - are necessary to define a plausible desired condition (See Figure 2).

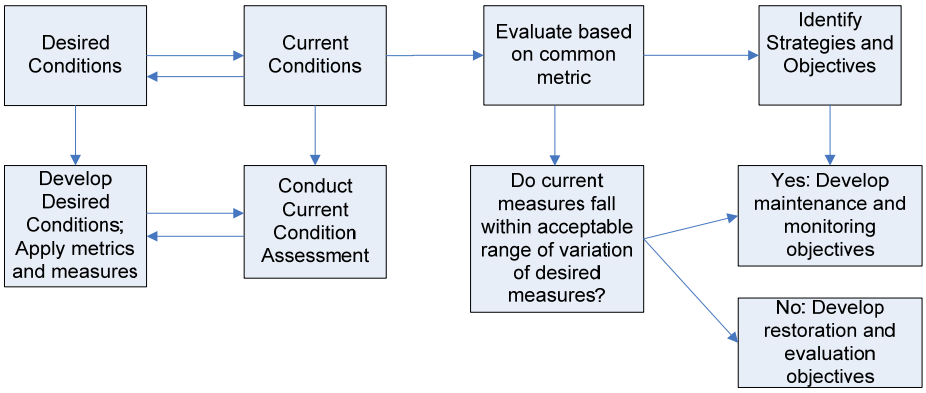

Figure 2 A simple model showing the relationship between desired and current resource conditions. In this case, strategies for management actions are based on whether current conditions reflect desired conditions or not.

Conditions for natural resources should be assessed with a common framework. For NPS, ecological integrity is appropriate because 1) is cited as the metric in the NPS definition for impairment and 2) a gradient of ecological integrity can be established for the evaluation of action alternatives. As proposed in the NPS Ecological Integrity Framework, this gradient contains 2 key threshold levels that produce condition zones of "acceptable," "potential concern," and "impaired." If one considers only the resource dimension on this gradient, the DC should be well above the threshold for acceptable. Many requirements under the institutional dimension capture resource integrity near the threshold of acceptable and potential concern as a limit of acceptable change. Some institutional requirements could direct an impaired condition. The Human Dimension can represent the widest range along the resource integrity gradient as factions exist that would prefer near-zero human influence in parks, while others would prefer few limits to human activity in parks. If we consider the "influence" of the human and institutional dimension on natural resources as being a gradient of positive to negative, the desired condition will fall somewhere above impaired zone (Figure 3).

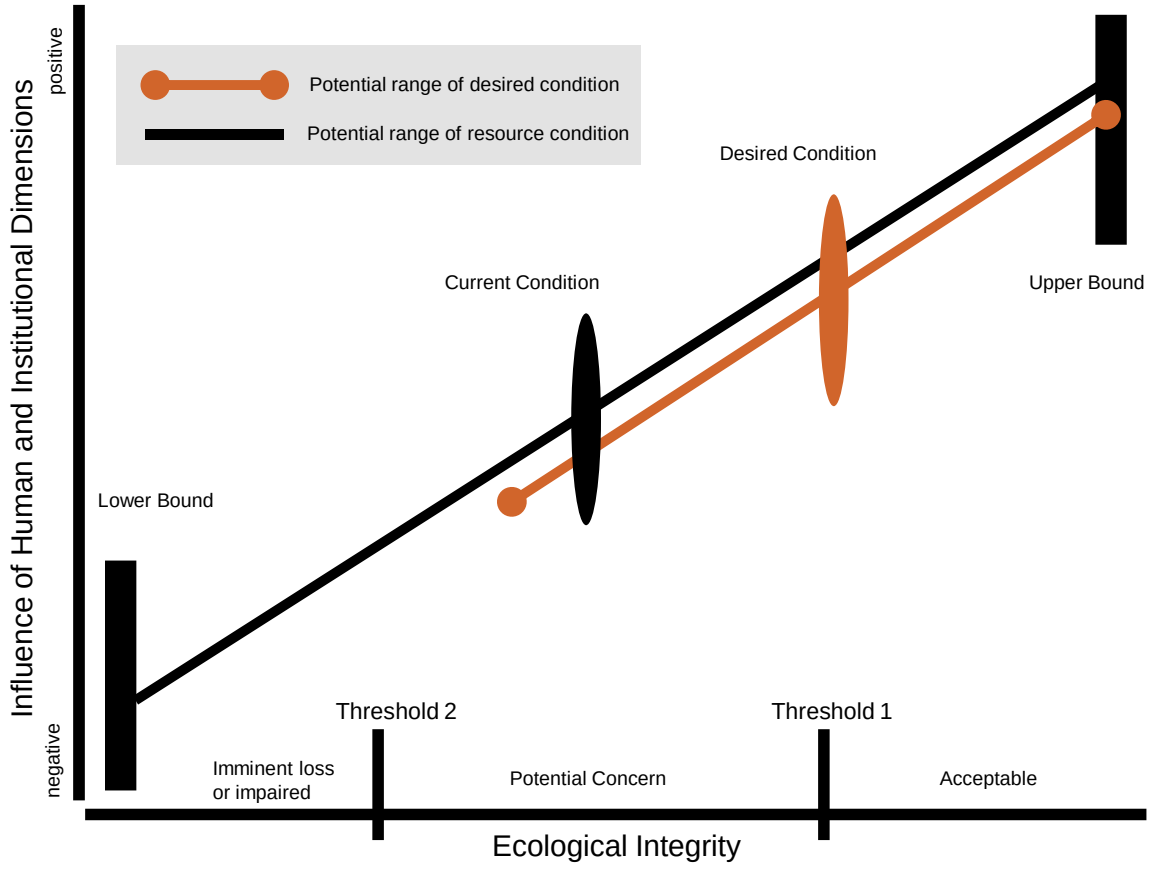

Figure 3 Desired condition relationship to ecological integrity is influenced by human and institutional dimensions. National Park natural resources are not "managed to" the threshold of being impaired. On the contrary, they are managed with the intent of being fully functional. In many cases, however, compromises are made to ecological integrity of these resources to satisfy requirements of cultural resource mandates, or societal desires.

V. Characteristics of Desired Conditions

Desired conditions describe the physical things; plants, streams, valleys, etc., and related processes that stakeholders, including park managers, want to see on lands or waters. They describe "what" the resource condition will be, not "how" it is managed.
As rules of thumb, desired conditions:

- describe what we want
- describe *conditions and/or processes* as they are expected to exist in the future under expected scenarios
- build on historic conditions
- include structural compositional and functional descriptors, a *dynamic range of conditions,* and process rates, and the amount of fluctuation within those ranges
- apply to a specific *management unit* or *resource context*

- address the *spatial, temporal and ecological scale* issues relevant to focal resources
- establish a *framework and purpose* for subsequent management actions & projects; translate into operational objectives which are achievable within management constraints
- need to be both *realistic and achievable, but normally not in the short term*
- are based upon a *documented analytical framework* that identifies and supports underlying assumptions
- include *measurable benchmarks* for operational objectives, including hypothetical ecological and management thresholds
- make use of *existing condition* assessments, particularly in the surrounding landscape, and the ability of the park managers to influence landscape conditions over time
- take account of *irreversible ecosystem changes and limitations* imposed by park boundaries or other variables
- identify *expected outcomes* that are derived from goals

Desired conditions do not:

- *prescribe or compel* specific management actions or projects
- imply that *compulsory actions* or conditions must ensue
- *merely document* current conditions or predict trends based on current conditions and passive management
- focus only on *removal or mitigation* of ecosystem stressors
- focus on specific *outputs (i.e., number of acres treated for invasive plants)*
- focus only on a *single point* in time or be constrained by short term possibilities.

(from the files of L. Laing)

Other characteristics and considerations

Desired conditions are more than an absence of stressors A manager gains credibility when he can clearly state what he is managing towards. Emphasis on the removal or reduction of stressors (contaminants, invasive species, etc.) without an understanding of what is actually desired can result in poor prioritization of resources. Stressors are identified as alterations of system attributes [33] and can be included as objectives or indicators. Stressors can emerge or be prioritized differently over short periods of time. It is better to let desired conditions tell the story of what we want, not what we do not want, over the long term.

Follow scientific principles Desired conditions contribute to communicating a decision process for the responsible management of public resources. While decisions are influenced by law and opinion, managers should be sure that they, their partners and all

stakeholders are informed by current scientific and management paradigms. Science-informed management begins with an understanding of scientific principles and concepts. These contribute to the "operational paradigms" of defining desired conditions [25], such as ecological integrity, adaptive management and monitoring. A primer on key Ecological Principles related to desired condition definition is found in Appendix B.

Multiple scales and levels of resource organization need to be addressed Resources should be assessed and managed at multiple scales or levels of organization [9, 34]. Once resources are identified, the level of organization within which the resource of interest resides should be determined, and then interactions with resources and processes at higher and lower levels of organization should be considered. An example of resource hierarchy is found in Figure 4

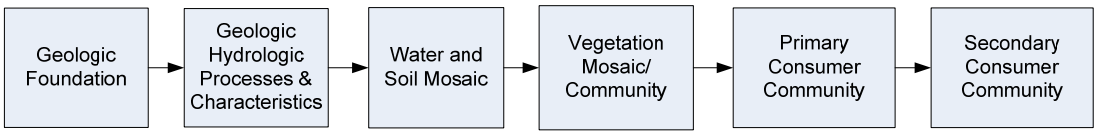

Figure 4 Use relationships among scales for resource analysis. An impact perceived by a manager may be focused on plant community shifts, but a science-informed analysis and response would include the dynamics of groundwater, soil erosion and parasite influences on herbivores (courtesy C. Mitchell).

Attributes at one level are influenced through "top-down" and "bottom-up" controls. When developing the attributes and conceptual models for focal resources, consider attributes at organizational levels above and below the selected resource. For example, if a river is a focal resource, finer level attributes, or nested resources such as species assemblages and keystone species, and broader level resources, such as watershed attributes (vegetation cover, bedrock controls, branching patterns) would complement direct attributes of the river, such as flow rates and meander characteristics.

Desired conditions are set for long-term management When developing desired conditions; consider the temporal scale of dynamic resources [1]. Desired conditions should be written with a 20 – 50 year time frame in mind, even with concerns of significant global change influences (Appendix E). The relationship between time and level of organization should be considered in setting DCs. For example, geologic change typically occurs over tremendously long periods of time, normally in undetectable increments, and may not be within the scope of management considerations. Yet, they may also occur as a major, cataclysmic event. Under the latter scenario, a complete revision to condition description is warranted. As another example, soil nitrogen is very dynamic in that it operates under such short seasonal cycles that direct management is not plausible. In these cases, managers should focus on higher levels of organization to identify attributes that exist and function within relevant time frames. The NPS Fire Program, through the development of successional models of plant communities, has successfully demonstrated the incorporation of temporal elements into its LandFire models by considering temporal characteristics of historic fire regime.

V. Relationship to NEPA

The concept of a "desired" condition implies a value-oriented decision process; therefore it should be a public process addressing a public trust resource, and not limited to the realm of scientific analysis. Public servants managing public lands are given a level of responsibility to make decisions as technical experts. But they also have responsibilities to understand public values, and socio-economic perspectives are core elements of planning and evaluation efforts across many agencies and initiatives.

The National Environmental Policy Act requires that agencies consider the environmental impacts of major federal actions significantly affecting the human environment (42 USC § 4332). Major federal actions are defined to include such things as policies, plans, programs and specific projects (32 CFR 1508.18). The development of management targets, as defined in this paper, does not clearly fall into one of the categories described above. To clarify environmental compliance requirements of the development of desired conditions and their measures, Director's Order 12 was reviewed to determine what level of NEPA analysis may be required. It seems likely that the development of desired future condition statements fall into a category that is routinely excluded from NEPA review (i.e., Categorical exclusion 3.3 G "… guidelines of a …technical … nature, the environmental effects of which are too broad, speculative, or conjectural to lend themselves to meaningful analysis and which will be subject later to the NEPA process, either collectively or case-by-case.") If management targets are developed as part of a General Management Plan or Implementation Plan then NEPA would be triggered based on those plans and implementation of activities to achieve the management targets. Without some type of plan to achieve the management targets, however NEPA review should be deferred until it can be developed as part of a particular plan or project. This includes analysis of condition measures that may be developed for monitoring and assessment, for later consideration in desired condition development, or management decisions.

None of this suggests exclusion of stakeholders. Stakeholders should play a significant role in management target development. NPS DO 75 directs civic engagement even when not required by law and good practice is supported by the order.

VI. A process for defining desired conditions

A specialist will use a number of information sources and frameworks, and may develop a preferred order of referral to these tools. In many cases, some information sources will be developed while others are lacking. A suggested process to define meaningful DCs from goals is summarized in Figure 5. An alternative approach has been applied in South African park planning. Using this approach, activities of the planning process are separated into 1) **circumscribing the decision making environment** (setting ones value system or operating principles, understanding the context in which future activities would take place, and setting a vision for the system); 2) **Understanding the system to be managed in STEEP terms**. (**S**ocial, **T**echnical, **E**nvironmental, **E**conomic, **P**olitical). Vital attributes, Threats, constraints, determinants are considered for each aspect of STEEP. Planners then add Values to this to make it V-STEEP (this approach has been found to be useful in helping managers categorize their thoughts and activities); and 3) defining **where we want** to go by developing goals (K. Rogers, personal communication). As can be seen, the desired condition analysis here is used as a way to fine tune goals as well as objectives. The concepts and approaches presented here are

developed in appendices C and D of this guide. Managers also are strongly encouraged to review examples of desired conditions also found in the appendices.

Situation analysis

A situation analysis identifies the context of goal setting. For example, the scope and resource addressed in a foundation document will reflect higher level goals of the NPS mission across a park. Desired conditions defined for wetlands with 3 rare species in response to an oil spill will reflect goals and analyses relevant to more specific resources. If the situation is a resource assessment or status and trend monitoring, emphasis will be placed in the resource dimension analysis by technical specialists, leaving later incorporation of the human and institutional dimensions to park decision-makers. Different situations may dictate the formality of public notice and comment. Regardless, stakeholders should be identified in this first step. Categories of work likely to be identified through situation analysis are listed below. Managers should note that an effort to identify DCs for focal resources across a park, as described in Appendix C, would bring efficiencies to addressing these categories.

- Planning, such as GMPs
- Status and trend monitoring or resource assessments
- Performance measures identified in the DOI Strategic Plan,
- Situations where Foundation Documents lack specificity,
- Restoration targets for widespread, or systemic degradation of a resource,
- Fire Management Plans that address all burnable vegetation,
- Prioritization of competing park management program goals, and
- Natural Resource Damage cases.

Goal Analysis

An analysis of directives following a strategic thinking approach identifies the resource and general direction for the resource condition. A goal analysis also identifies competing goals. Managers can evaluate the need to identify sub-goals and elements where goals are vague and resource categories too broad for either effective operation and/or development of meaningful attributes. A preliminary identification and analysis of all applicable, relevant or appropriate requirements should be made early in the process, and goal structure of the human dimension analysis should occur here. The use goal hierarchies facilitates the identification of compatible and conflicting goals or sub-goals, the establishment of priorities and the development of objectives that can support multiple goals (Appendix D).

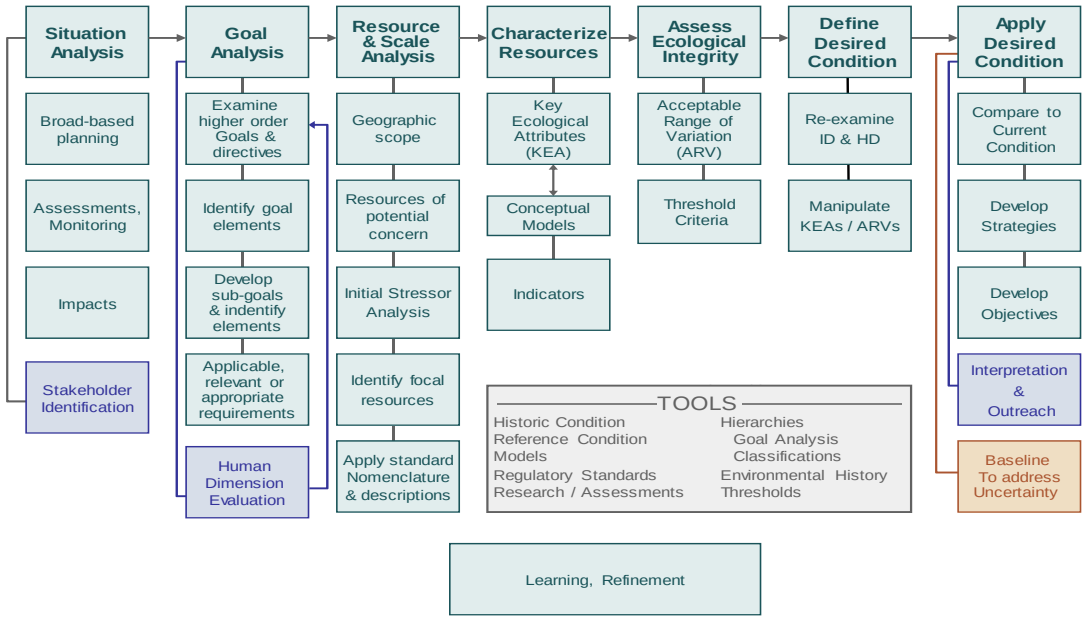

Figure 5 A process for defining desired conditions. This approach begins with general levels of information and iteratively develops specifics, whether the information reflects the human, institutional or resource dimensions. Specialists will likely develop "do-loops" where they refer back to some categories in the process. Key activities for the human dimension are shown in blue boxes. Applications to use the DC to address uncertainties are highlighted to stress the value of defining DCs now. The variety of information sources and frameworks are identified under tools.

Focal Resource and Scale Analysis

Two issues are addressed here. First is the manager's need to know that a majority of park resources are addressed in a suite of DCs. Second is the need to identify the appropriate resources and scale of resources in response to an impact. That is, to avoid pitfalls of species-focused response when broader community level work is appropriate, or an inappropriate spatial scale when evaluating fire severity. Appendix C provides an approach to identifying the scope of project or impact, a preliminary listing of resources or potential concern, initial stressor analyses and identification of focal resources.

For broad resource categories such as vegetation or GPRA land health goals that address total park acreages, use resource classifications to identify a suite of tessellated resources that extend across the park. These resources are later assessed ecological integrity criteria and desired conditions.

Focal resources should be clearly identified, and spatially delineated, using descriptive characteristics and standard nomenclatures from soil surveys, vegetation and other resource classifications (Appendix D). Scale consideration should include the extent of a species range, major controlling processes such as limestone formations or fire regime, landscape spatial patterns such as matrix, patch or linear systems, or logistical limits to

effective management. Scale analysis also needs to include human and institutional scales. A global change (GC) analysis should be incorporated as part of the irreversible condition analysis. Identify GC factors such as altered precipitation regime and temperature averages and extremes, using available models and trend data. Identify potential shifts in resources and limits to our current understanding of the resource response to these changes.

Characterize focal resource

Develop conceptual models and key ecological attributes (KEAs) for focal resources. Key ecological resources are components of a resource's biology, ecology, or physical environment that are so critical to the resource's persistence, in the face of both natural and human-caused disturbance, that its alteration beyond some critical range of variation will lead to the degradation or loss of the resource within decades or less. This includes the role of key ecological drivers, such as fire regime or soil geochemistry, that create shifts in resource types. Be sure to identify KEAs that respond to global climate change factors, such as altered precipitation and warming. Use these attributes to identify indicators. Identify measurable field indicators for the KEAs. Note that more than one indicator per KEA is preferred, but that no indicator should address more than one KEA. Concepts and steps to characterize focal resources are found in Appendix C.

Assess Ecological Integrity

Instead of focusing on a single acceptable measure of these indicators, define values that describe that range of variation of measures for an acceptable condition of ecological integrity (ARV). These are the measures for the focal resource. The upper bound and Threshold 1 of ecological integrity found in Figure 3 represent limits on resource dynamics imposed by the physical environment and some of the stabilizing feedback loops found in species-species interactions and species-environment interactions. Fluctuations of resource KEAs are manifestations of these feedbacks, and are reflected as the range of variation for that KEA. Use information from sources such as regulatory standards, resource classification, reference condition approaches, best professional judgment and models. Evaluate the goal structure, or contextual framework, from which measures from these sources are generated. Goal structures should be similar to this of the NPS unit. Continue to assess criteria for ecological integrity by using Threshold 1 as a performance criterion between acceptable condition and a range of values that represent potential concern, including those induced by global change. Criteria for impaired conditions should also be defined during this phase and this performance metric is noted as Threshold 2. Note that as global climate shifts large scale drivers of ecosystems, these drivers will represent a new set of bounds for processes under which new combinations of species will exist. Details on assessing ecological integrity are found in Appendix C&D. Appendix D also includes a discussion on applying regulatory standards for resource/resource attributes such as sound, air and water quality.

Define the Desired Condition

The development of ecological integrity criteria gives managers a solid foundation of the boundaries of the resource dimension of a focal resource. Specialists can use these metrics to further define the desired condition in the context of the human and

institutional dimensions. These can be evaluated alongside goal hierarchies for Institutional and Human Dimensions, developed earlier in the process. These can be presented in tabular form and cross-referenced along with a breakdown of focal resources and their KEAs. The KEAs can act as a currency for this analysis, as stakeholders and policy documents do not normally go into the detail of indicators[3] [7]. Identify any issues or characteristics of the focal resource that are outstanding in that they are only identified under one dimension and choose, with stakeholders, to elaborate this in other dimensions. For example, a concern of stakeholders is not addressed by existing policy, or has not been examined sufficiently by resource scientists. Decide if this issue needs to be developed further, or set aside for further evaluation.

At this point, identifying the optimal combination of the three dimension of a DC will require negotiation, and conflict resolution tools will be applied. Simple surveys of stakeholder perspectives will not suffice. Identify compatibility or conflict among KEAs. Then, evaluate preliminary descriptions of ARVs from the 3 dimensions. Do Institutional and Human Dimensions differ from ARVs defined for the Resource Dimension? For example, Institutional influences direct conditions reflecting a specific time period. These conditions will be static in terms of succession or range of variation of attributes. Nonetheless, they can have a reasonable level of ecological integrity. Managers can designate a desired condition of a modified state, where the natural resource has crossed an institutional threshold. This state will have its own set of KEAs and ARVs. This is commonly found in eastern battlefield sites. Without park designation, these open areas would now be forest. Instead, they can be managed as grasslands and a set of KEAs based on native, persistent grasslands can be applied.

Frame adjustments to ARV measures among the 3 dimensions according to frequency, intensity, magnitude, duration and timing of activities. These are ways that ARVs of individual KEAs can be manipulated to achieve compromise among the 3 dimensions. Assess whether modifications of the ARV for a single KEA affect other KEAs. For example, if fire in the wildland urban interface is managed for lower intensity by increasing fire frequency and altering forest structure, how does this affect forest edge characteristics? Finally, after applications of Human and Institutional Dimensions, ask if the resource remains within an acceptable level of ecological integrity. If not, review requirements of the Institutional and Human Dimension in the context of ecological integrity criteria. Are the components of the 2 dimensions still appropriate or outdated? Are they sufficient for an ARV to occur within administrative boundaries? Or were policies developed outside of the context (i.e., a species, location, park context, or scale) of the focal resource? Choose ARV measures for a DC that are more oriented to the

[3] Measures for the ARV may become critical analysis points with stakeholders later in the development of the DC. For example, there may be consensus among park neighbors that fire behavior is a KEA, but the actual value on an indicator such as flame height can bring varying responses among stakeholders. Similarly, when the EPA evaluates options for waste site remediation, stakeholders are often less concerned about how the site is cleaned than how clean it will become. So, the actual measures are key, but they often are tied to KEAs by how the KEAs are classified or perceived by stakeholders, as "safe" levels or "unsafe," or "beneficial" or "detrimental" levels of a KEA.

Resource Dimension's integrity criteria. Then, among strategies to achieve a DC, include adjustments to policies, or stakeholder perceptions. For example, human and institutional dimensions based on societal values for irrigation water and federal programs to reclaim arid-lands led to the establishment of a dam upstream of a park. Flow regimes in the park are restricted due to dam management. A desired condition of a native plant community along the streamside would be a willow-cottonwood riparian ecosystem under the resource dimension. A compromise with the other dimensions by incorporating landscape scale limitations, would lead to management for xeric shrub systems along the river. To select the most convenient condition would not be appropriate to what the resource ought to be managed towards.

VIII. Applying Desired Conditions, including the role of desired conditions under the uncertainty of global change

As presented in Figure 2, the most basic application of desired conditions is to provide context to current condition assessment and to initiate management strategies and related project objectives. This, in turn, provides the basis for DOI and other accountability (reporting) requirements to promote performance management. These are often captured in resource condition scorecards [7] or matrices such as the NPS Natural Resource Summary Table. An example of a widely used scorecard is found in The Ecological Integrity Assessment Framework.

Desired conditions can be used as context for understanding trend data. Desired conditions and can also be applied to approaches for dealing with uncertainties in natural resource management, such as resiliency thinking, scenario planning and adaptive management (Appendix E). Finally, a review of significance and benefits of defining a meaningful desired condition from Section III of this guide indicate other applications of the desired conditions.

IX. Closing

Achievement of Desired Conditions requires program resources

The desired condition articulates what NPS ought to manage resources toward. While some schools of thought maintain that goals and desired conditions are not necessarily meant to be achieved, managers work incrementally towards these ends through achievement of performance measures and intermediate outcomes. Achievement and accountability cannot be assumed simply because desired conditions are defined. Financial resources must be available to accomplish this work. If adequate resources are not available, the desired condition cannot be achieved; but it at least provides justification to request the necessary resources.

Maintaining or working towards desired conditions

A DC can be current conditions. Where this occurs, complacency is not a management option. Status and trend monitoring performs the valuable task of fine tuning our understanding of the acceptable range of variation of KEAs, and this may lead to change management strategies. Managers also need to be aware of emerging threats, particularly shifts in key attributes driven by global change, including climate, societal perspectives

and needs, biological invasions, land use alteration, contaminants and catastrophic events. No resource will be immune to invasive species and other external stressors that directly or indirectly cross protected area boundaries. Increasingly, managers will actively implement prescribed disturbance or modify the intensity or extent of processes in order to maintain the current condition as the desired condition.

Revisiting a Desired Condition

National Park Service General Management Plans operate on approximately 25-year cycles. This is a reasonable period to assess goals and DCs. Managers should ask: Are NPS, unit, or societal goals the same as when the DC was developed? Have laws or regulations changed? Are strategies and objectives to achieve or maintain targets still feasible? That is, has the park unit landscape context been altered to a point where broader processes do not function as envisioned in the target? Have other KEAs crossed thresholds to a point that they cannot be restored? Has research increased our understanding of historic and acceptable ranges of variation? In a DC revision, this type of questioning and situation analysis should be provided in a structured process to engage the public this way:

- Identify the resource and present the existing DC, its KEAs and ARV criteria;
- Identify changes in the Resource, Institutional or Human Dimensions, and their influence on management goals;
- Identify the need to change, based on clear points such as significant changes in the understanding of the resources, and also examine, over time, whether the "full implications of goal have not been clearly understood"

Meaningful desired condition statements are useful and necessary tools for science-informed and accountable resource management. Managers must recognize that development of desired conditions will take time, but that it will be worth their investment and not be seen as another administrative requirement. Similarly, goals and targets should be set for high standards of resource integrity, and desired conditions should support the development of strategies that may only have hope of success over the long term. This is preferable to settling for perceived limits of success in the near term.

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