Appendix J—MCDS Overview

Summary of Multi-Criteria Decision Support Process Used in Developing the Giant Sequoia National Monument Draft EIS

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The International Society on Multiple Criteria Decision Making defines Multi-Criteria Decision Making (MCDM) as, "The study of methods and procedures by which concerns about multiple conflicting criteria can be formally incorporated into the management planning process" (RFP Evaluation Centers 2009). RFP Evaluation Centers (2009) offer further background on this decision process:

> **Decision Theory.** Decision analysis looks at the paradigm in which an individual decision maker (or decision group) contemplates a choice of action in an uncertain environment.The theory of decision analysis is designed to help the individual make a choice among a set of pre-specified alternatives. The decision making process relies on information about the alternatives. The quality of information in any decision situation can run the whole gamut from scientifically-derived hard data to subjective interpretations, from certainty about decision outcomes (deterministic information) to uncertain outcomes represented by probabilities and fuzzy numbers. This diversity in type and quality of information about a decision problem calls for methods and techniques that can assist in information processing. Ultimately, these methods and techniques (MCDM) may lead to better decisions.

A variety of Multi-Criteria Decision Support (MCDS) methods have been developed over the past 30 years. The method used in the development of the Giant Sequoia National Monument Plan, as implemented in the software package Criterium Decision Plus (CDP) by InfoHarvest (1993), is an adaptation of the Analytical Hierarchy Process (AHP) (Saaty 1992). The AHP methodology was first introduced by Saaty in 1980, and it remains one of the most popular and widely used MCDS methods in the world today. Although the mathematics underlying the AHP are rather esoteric, the popularity of the AHP is largely a consequence of the fact that the concepts and principles behind it are relatively easy to understand and apply, even in the context of large, complex planning processes such as the Giant Sequoia National Monument Planning process. Ease of understanding is especially important in the very public context of the Monument Plan, because, if well implemented, MCDS can be a valuable tool for communicating effectively between the interested public and the interdisciplinary planning team. Consequently the method used in support of the Giant Sequoia National Monument planning process is called SMART. SMART (Simple Multi-Attribute Rating Technique) was developed by Ward Edwards in 1980s (Von Winterfelt and Edwards 1986) and is based on Utulity Theory. It uses the same hierarchical structuring as AHP but the underlying matchematics is much more straight forward, and its relationship with AHP is well studied (Kamenetzky 1982, Triantaphyllou 2000).

SMART and AHP involve the process when making a decision to consider a number of options or alternatives that can best satisfy an objective or a goal. One way to achieve this is to select from these alternatives when they are compared against one another with respect to a set of factors or criteria. In SMART, the broader criteria are grouped at the highest level with subcriteria groped below which further define each parent criterion. Structuring the important elements to a decision is essential in the decision-making process.

On the Sequoia National Forest, a third-party neutral facilitator hired by the U.S. Institute for Environmental Conflict Resolution interviewed stakeholders and Forest Service staff over the course of a year to understand issues and develop goals for the Giant Sequoia National Monument management plan. Identified goals (that is, criteria) formed the basis of a decision process or framework for evaluating alternatives. These sometimes competing goals include: protecting individual objects, protecting ecosystems, managing fire processes, fostering socio-economics, increasing enjoyment of the monument, reducing cost, creating a compelling

plan, and complying with the law. Each of these goals was further refined through a series of meetings and workshops to describe the key components of each goal (that is, sub-criteria). Workshops included: Sequoia National Forest leadership team meeting in August, 2008; four public meetings with the Sequoia Monument Recreation Council (now called the Giant Sequoia National Monument Association), focusing primarily on the goal "increase enjoyment of the monument;" and three public meetings focused on vegetation management. For example, the goal to foster socioeconomics was refined to include the sub-criteria: gateway economic development, diversity of opportunities, protecting communities from fire, connecting people to place, strengthening partnerships, and research, inventory and analysis (Decision framework dated June 15, 2009).

The decision framework is essentially a multi-criteria decision support tool used to evaluate each alternative based on its performance (ratings) on the criteria and the relative importance of those criteria (values) to the decision. The use of a multi-criteria decision support tool is not new and has been used by decisionmakers in a variety of situations to assist in reaching the best decision given complex and often competing criteria (Edwards 1997, Saaty 1992b).

Running concurrently with the scoping period was a public opportunity to use the online Values and Interest-Based Explorer (VIBE) model (See the Public Involvement section of Chapter 1 of the draft EIS). The table below shows the decision framework for the scoping period. Opportunity for comment on the decision framework was further extended to stakeholders through four additional public meetings held in April 2009.

Table 80 Decision Framework from General Scoping

Goal	Criteria	Sub-criteria
What matters to you?	Protect individual objects	Geology (spires, domes, caves)
		Individually named giant sequoia
		Individual historic objects
		Individual threatened and endangered species
	Protect ecosystems	Mixed conifer
		Mixed conifer emphasizing groves
		Oak
		Caves
	Manage processes	Air quality (including effects on plants)
		Fire process
		Species shift
		Climate change
	Increase enjoyment of the Monument	Promotes diversity of users
		Promotes diversity of uses
		Provides access
		Protects resources
		Connects people to others and across generations
		Connects people to the land and its history
	Foster socio-economics	Supports gateway economic development
		Provides a diversity of opportunities
		Strengthens partnerships, enjoys broad support
		Protects communities from fire

Goal	Criteria	Sub-criteria
		Protects human health
		Supports connection of all to place
	Reduce cost of development and implementation	Develops effective research, inventory, and analysis
		Is cost-effective to administer
		Monitoring is cost-effective
		Course-corrects
	Create compelling plan	Strengthens partnerships (agency)
		Creates/reinforces identity of the Monument
		Is practical and believable
		Works cross-boundary
		Engenders strong support from community
		Attracts resources
		Holds Forest Service accountable
	Comply with the law	Meets Endangered Species Act requirements
		Meets Clean Air Act requirements
		Complies with other statutes
		Satisfies the MSA
		Complies with the Clinton proclamation
		Meets Forest Service rules and regulations
		Is consistent with other applicable plans

The results of these general scoping efforts are summarized below (Fox Mediation and InfoHarvest on behalf of the U.S. Institute for Environmental Conflict Resolution, June 2009). A website will be used during the comment period for the draft EIS (www.ecr.gov) and will allow the public to compare the alternatives considered in detail based on their values, interests and beliefs.

The following table shows the values people entered using the VIBE over the scoping period that was open last March 2009.

Table 81 Results of Comments Registered on Framework Criteria (VIBE)

Criteria	Value Scale					
	All That Matters	Really Matters	One Thing That Matters	Does Not Much Matter	Could Hardly Care Less	Is a Sideboard
Protect individual objects	6	21	41	9	3	1
Protect ecosystems	8	41	25	5	1	1
Manage processes	4	27	34	12	3	1
Increase enjoyment of the Monument	7	40	25	6	2	1
Foster socio-economics	3	18	36	15	8	1
Reduce cost of development and implementation	5	19	36	16	3	2
Create a compelling plan	3	28	37	7	5	1

After the Sequoia National Forest interdisciplinary team analyzed public comment, preliminary alternatives were developed. Also, based on the comments received, several changes were proposed to the decision framework including: adding hydrology as a process; establishing fire as a criterion; and refining sub-criteria for "create a compelling plan" (shown in the table below) (U.S. Institute for Environmental Conflict Resolution, June 2009). Preliminary alternatives and the updated decision framework were shared in public meetings held on June 18, 19, and 20, 2009.

Table 82 Decision Framework for Draft EIS Scoping Period

Goal	Criteria	Sub-criteria
What matters to you?	Protect individual objects	Geology (spires, domes, caves)
		Individually named giant sequoia
		Individual cultural resources
		Individual threatened and endangered species
	Increase ecosystem health	Diversity of flora and fauna species
		Resilience to disturbance
		Mixed conifer
		Mixed conifer emphasizing groves
		Hardwoods (oak and savanna)
		Caves
		Hydrologic systems
	Manage/allow fire	Increase efforts to restore natural fire processes
		Protect objects out WUIs, groves, and at-risk habitat
		Protect objects in WUIs, groves, and at-risk habitat
		No "unwanted" fire
		Minimize impacts of air quality on people
		Effect on aesthetics (scenery)
		Protect human safety outside WUI
		Protect human safety in WUI
	Increase enjoyment of the Monument	Enjoy the objects of interest
		Promote diversity of users
		Promote diversity of uses
		Provide access
		Connect people to others and across generations
		Connect people to the land (places)
	Foster socio-economics	Support gateway economic development
		Provide for diverse economic opportunities
		Protect communities from fire
		Support connection of all to place
		Is cost-effective to administer, research, and monitor
		Develop cost offsets

Goal	Criteria	Sub-criteria
	Create a cost-effective plan	Is cost-effective to administer, research, and monitor
		Develop cost offsets
	Create a feasible plan	Engender individual support
		Engender broad community support
		Provide clear Forest Service Requirements
	Comply with legal requirements	Mediated Settlement Agreement analysis obligation
		Proclamations (Bush and Clinton)
		Laws, regulations, and policies

Preliminary ratings and rationale were developed for the alternatives after the public meetings in June (See table of 2009 GSNM Rating and DEIS Plan Alternatives version 6.3). As the analysis of alternatives progressed, the decision framework criteria and subcriteria were revisited by members of the interdisciplinary team. The Forest Supervisor decided that the June version was the decision framework to use, so there are only a few minor refinements to criteria and subcriteria between the June and current decision frameworks. In contrast, the ratings and associated rationale that are being used for comparison of the alternatives described in the Draft EIS have been modified or filled in substantially since those in the June version. The current version of ratings and rationale are shown in the current VIBE located at http://gsnm.ecr.gov/.

The Science Consistency Review conducted in April 2010 to review how the Draft Environmental Impact Statement and Draft Management Plan are linked to science included an analysis of the use of MCDS to support the planning process for the Giant Sequoia National Monument to date. The reviewer, Keith M. Reynolds, Research Forester at Pacific Northwest Research Station, developed three questions to address how the MCDS was applied in the planning process so far:

1. Is MCDS used appropriately?
2. Is MCDS used effectively?
3. Are the MCDS process and results adequately documented in appropriate planning documents?

According to Dr. Reynolds, the interdisciplinary team has used the MCDS appropriately and effectively up to this point in the planning process. The process and results have been adequately documented in the draft EIS.

References

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