

United States
Department of
Agriculture

Forest Service

FS-771

September 2003

Science Consistency Reviews

A Primer for Application



United States
Department of
Agriculture

Forest Service

FS-771

September 2003



Science Consistency Reviews

A Primer for Application

James M. Guldin, David Cawrse, Russell Graham, Miles Hemstrom, Linda Joyce, Steve Kessler, Ranotta McNair, George Peterson, Charles G. Shaw, Peter Stine, Mark Twery, and Jeffrey Walter

Guldin is project leader, Southern Research Station, U.S. Department of Agriculture Forest Service, Hot Springs, AR; Cawrse is resources staff officer, Shoshone National Forest, Cody, WY; Graham is research forester, Rocky Mountain Research Station, Moscow, ID; Hemstrom is research ecologist, Pacific Northwest Research Station, Portland, OR; Joyce is project leader, Rocky Mountain Research Station, Fort Collins, CO; Kessler is staff director for Wildlife, Fish, Rare Plants and Rangeland, Region 9 Regional Office, Milwaukee, WI; McNair is forest supervisor, Idaho Panhandle National Forest, Coeur d'Alene, ID; Peterson is project leader, Rocky Mountain Research Station, Fort Collins, CO; Shaw is national program manager for pathology research, Office of the Deputy Chief for Research, Washington, DC; Stine is research biogeographer and program manager, Pacific Southwest Research Station, Sacramento, CA; Twery is project leader, Northeastern Research Station, Burlington, VT; Walter is district ranger, Clackamas River Ranger District, Mt. Hood National Forest, Estacada, OR.

Introduction

Concern over Federal land management decisions has grown in recent years. Public debates over activities on Federal land have been contentious, especially regarding management of national forests. Decisions on the management and use of national forest lands are based on many different considerations and values. Although Federal land managers can make choices concerning how to balance the various risks and tradeoffs involved, their decisions face questions from the public about whether the management direction and its associated effects, outcomes, and outputs are appropriate.

The responsible official can use a number of methods to evaluate the scientific information supporting those decisions. Examples include scientific peer review, science advisory boards, science consistency reviews, or expert opinion.

This primer outlines a formal process for a science consistency review (SCR). The SCR is defined as *the process used to determine whether an analysis or decision document is consistent with the best available science*. That review is accomplished by judging whether scientific information of appropriate content, rigor, and applicability has been considered, evaluated, and synthesized in the documents that underlie and that implement land management decisions.

These guidelines were developed to standardize the SCR process and to guide land managers and others who choose to employ it. Special attention was given to ensuring the guidelines:

- Incorporated existing agency experience with science consistency evaluations.
- Can be used for small or large decisions, for situations of little or great complexity, and with emphasis on practical application and real-world constraints.
- Were peer reviewed by scientists, land managers, and administrators, both inside and outside the agency; their comments were incorporated in the process.
- Were field tested, which also resulted in refinements of the process.

Thus, the guidelines reflect current thinking by both National Forest System (NFS) and Research and Development (R&D) personnel on the best way to implement the SCR.

Decisionmakers can use the SCR to evaluate whether the draft analysis or decision document under review has considered and correctly interpreted applicable and available scientific information. In addition, the SCR can help decisionmakers determine whether the expected risks and consequences from the proposed action and alternative actions are consistent with what would be inferred from the scientific literature, and whether they are correctly interpreted and disclosed in the draft document.

The product of the SCR is an interim or final report from the review team to the responsible official that states whether and how the elements being evaluated met the basic evaluation criteria (see box 1 on p. 6). Interim SCR reports are used to revise draft analysis and decision documents. The reviewers then reexamine the revised documents. When this iterative process is completed, the final SCR report documents that all elements are consistent with current scientific information. The responsible official can then cite the final SCR report as evidence that the information used to make his or her decision is based on a document consistent with available scientific information.

The SCR is not intended to validate, ratify, endorse, or make the decision. Neither the SCR report nor the reviewers who prepare it should make judgments about the balance that managers should achieve among competing objectives or what levels of risk they should take. The SCR report does not advise a decisionmaker for or against a particular course of action. The responsible official remains solely responsible for the decision.

SCR Participants and Their Roles

The responsible official is the Forest Service line officer (regional forester, forest supervisor, or district ranger) who is responsible for making and executing the decision (table 1). The responsible official makes choices related to selecting a preferred alternative, balancing risk, and considering tradeoffs associated with ecological, social, and economic outcomes and effects. Although the responsible official may not be directly involved in the SCR review itself, he or she is responsible for the direction the draft document takes, how the feedback from the review is considered and incorporated into revisions of the draft document, and how the decision is made.

Technical experts are those individuals participating directly or indirectly in the development of draft analysis or decision documents subject to review. Often technical experts are interdisciplinary team members; they are typically professional employees; and they may or may not have advanced academic degrees. Generally, the technical experts directly review, reference, and incorporate information from science literature, expert opinion, or the science assessment, if applicable, into the draft documents. They are also responsible for modifying the draft document based on feedback in the SCR report.

Science consistency reviewers are the experts who perform the science consistency review. A reviewer must have scientific credibility in the field but not necessarily an advanced academic degree. In some cases a person with local or traditional knowledge may be appropriate. Reviewers can be R&D scientists; university faculty members; scientists with State agencies, tribes, or other Federal agencies; or NFS staff or technical experts not attached to the particular project or unit under review. Reviewers can also be

scientists or experts from private companies, consultants, or nongovernmental organizations. Above all, they must be knowledgeable, fair, and impartial. The reviewers may act independently when working on small-scale efforts. For more extensive reviews, they may need to have more interaction as a team, and potentially may be led by a designated team leader.

The review administrator is responsible for the conduct of the review and any interim or final SCR reports. The review administrator may be a R&D station director, a subordinate administrator, or a scientist designated by the station director. The review administrator may also be a regional office staff director, a staff director from another national forest, or an appropriate research administrator outside the Forest Service, such as a dean or department head of a land grant university in consultation with the agency. The review administrator must be selected with sensitivity to the amount of controversy expected in the draft document, the desire to maintain appropriate scientific independence from the draft document, and the need to address concerns that might arise over any perceived bias.

The review administrator identifies candidate reviewers, selects reviewers and negotiates their availability and schedules, disseminates the materials to be reviewed to the review team, coordinates the review itself, and addresses disagreements among different reviews or reviewers. For a small-scale review, the review administrator may be one of the reviewers, working either alone or as a member of a small team. For more extensive reviews, the review administrator coordinates and summarizes the reviews for the responsible official. Regardless of the scale of the project, the review administrator is responsible for preparing the SCR report and transmitting that report to the responsible official.

Table 1. Roles of participants in an SCR, as the process unfolds.

Role	Participant				
	Responsible Official	Technical Expert	Reviewer	Review Administrator	
Identifies need for SCR ¹ .	XX	X ²		X	
Initiate the SCR.	XX			X	
Establish scope of the SCR. Develop budget; identify sources of funding. Develop timeline. Establish standards for interaction between participants and public. Establish criteria for selection of reviewers.	XX			XX	
Conducts assessments and National Environmental Policy Act analysis, develops biological evaluations, does cultural resource surveys, etc; develops alternatives and evaluates them; documents literature and information used for analyses; conducts ID team meetings, prepares draft document.		XX			
Establish administrative structure for review team. Select reviewers. ³	X			XX	
Iterative steps for interim and final SCR reports ⁴	Develop elements to be evaluated.	X	XX	X	X
	Approve elements to be evaluated.	X			XX
	Convenes SCR team, distributes draft document for review, administers interim/final SCR.				XX
	Performs the review.			XX	
	Provides reviewers with requested documentation; may develop additional documentation as needed.		XX		
	Approves the interim/final SCR report.				XX
	Ensure communication between technical experts and reviewers.	XX			XX
	Ensure that interim or final SCR does not advocate any particular decision and that scientific information and consistency evaluations are value neutral.			X	XX
	Reconcile reviews.			X	XX
	Reviews and comments on interim/final SCR.	XX	X		
	Directs modification of document based on interim SCR.	XX			
	Modify document based on interim SCR.	X	XX		
Is responsible for and approves final SCR report.				XX	
Is responsible for management decision.	XX				

XX = primary responsibility

X = secondary responsibility

¹ SCR may be conducted on both analysis documents and decision documents, such as drafts of the Environmental Assessment or Environmental Impact Statement or the Decision Notice or Record of Decision.

² A technical expert may request the responsible official to initiate an SCR if the technical expert believes that an unbiased review is warranted.

³ There is a relationship between the selection of reviewers and the selection of elements. Identification of additional elements during the process may necessitate additional or different reviewers.

⁴ Modifications in the draft document may be subject to an additional review by the reviewers (the iterative process).

Administration of the SCR

The responsible official decides whether to initiate the SCR and is responsible for the documents under review. Once the SCR is initiated, the review administrator is responsible for the SCR process and reports, and the responsible official is responsible for all modifications of the documents under review. The SCR process is most effective if agency officials work collaboratively rather than confrontationally.

Occasionally, a R&D administrator may be particularly interested in the use of science in a draft analysis or decision document that could be clarified using the SCR process. This situation should be addressed collaboratively since it is normally the responsible official who initiates and funds the SCR. A R&D administrator may initiate a technical or scientific review of an analysis or decision document without the collaboration or funding of the responsible official; but in that event the responsible official reserves the right to apply the SCR report or not, at his or her discretion. If strong disagreements cloud the decision to engage or terminate the formal SCR process as described, the next level of authority should resolve the disagreements.

Many factors enter into the decision to initiate an SCR (table 2). The initial contact about whether to conduct an SCR should be made between the responsible official and the appropriate R&D scientist or administrator, because station and region leadership should be aware of any SCR within their respective jurisdictions. That initial contact enables the responsible official to review the various alternatives available for evaluating the scientific information in the proposed decision and to decide whether the SCR process is the best tool available to support his or her decision.

If the responsible official decides to engage the SCR process, the review administrator becomes responsible for its conduct and completion. Accordingly, the first step is to identify the appropriate review administrator. Then the responsible official initiates the review through a formal written request to the review administrator. Throughout the administration and conduct of the SCR, the responsible official should maintain an administrative record that documents the initiation, conduct, and conclusion of the SCR.

Several factors are important to consider as the responsible official and review administrator outline the overall administrative context of the proposed SCR. One suggestion to facilitate mutual understanding of these issues is to prepare a formal written charter, memorandum of understanding, or similar document that states how these issues are to be handled for the SCR under consideration. The charter must recognize that the responsible official is responsible for the draft document, but the review administrator is responsible for the SCR report.

1. The first priority is to establish the scope of the review and the issues that are relevant to the review's focus. The initial request from NFS determines the general outline of the SCR, but the review administrator and responsible official must work together to decide exactly what form the SCR will take.
2. The timeframe for the review must be established. The time commitment to complete such a process can be significant; the responsible official and review administrator must acknowledge that from the start.
3. The degree of openness of the SCR process among the participants and with the public should be established. The beginning of the process is the appropriate time to clarify these administrative relationships so as to minimize conflict.
4. The funding source for the SCR must be identified. Depending on the scope of the matter, the cost of conducting the SCR could be high. Generally, NFS would be responsible for the costs involved.
5. The review administrator selects the members of the review team, in consultation with the responsible official. Reviewers should have three attributes: expertise, credibility, and independence from authorship of the draft document under review. The number of reviewers on the team should relate to the scale and magnitude of the issues and the available resources.
6. The draft document under review and the supporting materials must be introduced to the review team in an effective manner. Reviewers should be charged with examining the entire draft document with emphasis on their own individual specialties. The review administrator should generally resolve or address disagreements among reviewers. Team members should allocate group tasks among themselves or follow the review administrator's direction. Discussions and assignments need to be clear and focused.
7. The team should be directed to seek consensus as they conduct their review, but not given a mandate to achieve it. The team members should be able to work independently in their areas of expertise; however, the group as a whole should be able to work together and provide input to evaluate each other's reviews and ensure that issues raised are actually science consistency issues. Face-to-face meetings are occasionally valuable but are not required for the work to be accomplished.

There is no proper point in time to initiate an SCR, but it is important to understand that the planning process may proceed more smoothly if reviewers can review draft documents, and technical experts refine them, earlier rather than later in the planning process.

Table 2. A conceptual framework that the responsible official should consider in making the decision regarding whether to conduct an SCR, the amount of effort to expend, and the time needed for an SCR.

Factor To Consider	Potential Effects¹ (Risks & Benefits)	
	Low (SCR probably not needed or need can be met by smaller effort)	High (SCR may be helpful and may require larger effort)
Spatial and temporal scales	<ul style="list-style-type: none"> • Localized site conditions • Small watershed 	<ul style="list-style-type: none"> • Broad geographic ranges and multiple agencies • Transcend organizational boundaries
Duration of effects	<ul style="list-style-type: none"> • Short-term effect on communities, economy, and/or environment 	<ul style="list-style-type: none"> • Long-term effect on communities, economy, and/or environment
Scope of decision	<ul style="list-style-type: none"> • Routine management actions (site-specific) 	<ul style="list-style-type: none"> • Large-scale regional and forest plans or plan amendments
State of knowledge	<ul style="list-style-type: none"> • Well-developed routine analysis • Professionally recognized science finding 	<ul style="list-style-type: none"> • Emerging science and technology • Disputed findings and interpretations
Data availability	<ul style="list-style-type: none"> • Well developed • Generally accepted • Associated risk small 	<ul style="list-style-type: none"> • Data gaps • Arguably insufficient data • Highly disputed
Scope of effects	<ul style="list-style-type: none"> • Limited effect on or change to communities 	<ul style="list-style-type: none"> • Long-ranging associated risks to the environment
Controversy	<ul style="list-style-type: none"> • Limited in scope and action 	<ul style="list-style-type: none"> • Highly disputed and/or arguably insufficient data

¹ The term "effects" refers to risks, benefits, outcomes, and outputs.

The Review Process

To conduct the SCR, reviewers must read and comment on the draft document and supporting materials. The elements to be reviewed will depend on the particular situation and will require coordination between the review administrator and the responsible official. The criteria to be met in the SCR do not depend on any particular situation, and thus have been standardized (box 1).

The review administrator, in consultation with the responsible official, selects the elements to be reviewed (box 2). Since not all elements subject to an SCR are equally important, the responsible official and his or her technical experts (the management side) should collaborate with the review administrator and his or her reviewers (the review team) to identify the appropriate elements to be included. The management side brings knowledge of policy significance, and the review team

brings knowledge of scientific and technical significance. The review administrator needs to consider both of these areas in order to develop a policy-relevant and scientifically valid statement of those elements that need an SCR.

The process for conducting the SCR, outlined in box 3, is designed to be flexible and scalable, especially for smaller analysis or decision documents at the project or plan amendment level. It is intended to make efficient use of reviewer time and effort, analogous to that invested in review of scientific manuscripts of equivalent length. The iterative nature of the process means that reviewers might be asked to review a document more than once, but in subsequent reviews they must consider the entire revision of the draft document, not just those elements that had been previously identified as inconsistent with the evaluation criteria.

Box 1. Using Specific Criteria To Evaluate Consistency

Experience has led to the recommendation that the elements should be reviewed with a standard set of criteria. The following criteria should be used to analyze each element relative to the document under review and the decisions to be made:

1. Is the relevant scientific information considered?
2. Is the scientific information reasonably interpreted and accurately presented?
3. Are the uncertainties associated with the relevant scientific information acknowledged and documented?
4. Are the relevant management consequences identified and documented, including associated risks and uncertainties?

Box 2. Selecting Elements To Review

Elements of the document for which science consistency review is desired or needed are difficult to identify. The following selection factors may help identify what issues are important to a particular situation and whether the potential elements can be addressed by a scientific review. Examples of factors that indicate an element that should be reviewed include one or more of the following. An element should meet both factors 1 and 2, plus at least one of factors 3 through 6, to merit consideration in the review:

1. Scientific information about an element is important to the potential decision.
2. An element is significant enough to affect the substance of the decision.
3. Public interest or official policy has identified an issue as important.
4. There is excessive conflict or uncertainty within the scientific community.
5. A potential element is relevant to the agency and within its decisionmaking authority.
6. The information prepared for the decision document has sufficient scientific credibility.

Implementing the SCR Process

Widespread implementation of the SCR process within the agency will require attention to several organizational and policy issues. These issues include primary purpose, analysis gridlock, potential for appeals, and reviewer workload. Such issues point to the need for guidance from agency leadership when the SCR process is made available to the agency at large.

The SCR process proposed here will no doubt evolve as it is applied in different situations. It is important to adaptively respond to early experience with the SCR process as outlined herein. For these and other reasons, interim staff support at the Washington Office level will be valuable as the SCR process is introduced to the agency at large.

Box 3. A Suggested Process for Conducting the Review

Initiating the review:

1. Initial discussions held between responsible official and Forest Service R&D contact.
 - a. Explore alternatives for evaluating scientific information in the proposed decision.
 - b. Decide whether an SCR is the best tool to apply in the given case.
 - c. If responsible official elects to use the SCR process, select the review administrator.
2. Letter from responsible official to review administrator asks for review.
 - a. Prepare a written charter, MOU, or other authorizing document.
 - b. Establish the scope, content, review elements, and sideboards for the review.
 - c. Forecast the expected timeframe for the review.
 - d. Clarify the openness of the review among participants and with the public.
 - e. Determine how to pay for the SCR.
3. Review administrator establishes review team.
 - a. Consult with responsible official and other domain experts to find appropriate reviewers.
 - b. Establish administrative structure for the review team.
4. Review administrator and responsible official issue charge to the review team.
 - a. Introduce team charter, documents to be reviewed, and appropriate supporting materials.
 - b. Review administrator finalizes review team administrative structure and function.

Conducting the review:

1. Selecting the review elements.
 - a. Technical experts provide reviewers with detailed initial list of elements from document.
 - b. Technical experts, reviewers, responsible official, and review administrator review the proposed elements.
 - c. Revised list of elements and justifications are returned to review administrator for final approval.

- d. Elements are written to be answered with "yes" or "no" under the evaluation criteria.
2. Scoring elements against criteria.
 - a. The elements and criteria form a matrix of rows and columns.
 - b. Each reviewer records a yes or no rating in each cell of the matrix of elements and criteria.
 - c. Ratings are accompanied by narrative justification statements in which reviewers explain their evaluations and offer suggestions for changes that would achieve consistency.
3. Reconciling reviews.
 - a. Reviewers forward finished report to review team leader or review administrator.
 - b. Review administrator reconciles variations in review content and format.
 - c. Review administrator collates reviews and prepares summary SCR report for responsible official.
4. Preparing the review report.
 - a. Draft or interim reports are anticipated as part of an iterative process that may result in a revised document that needs an additional iteration.
 - b. Review administrator may conduct or request a review of the final team report to ensure that the report does not advocate any particular decision or alternative, and that the evaluations are value neutral.

Completing the review:

1. Responsible official and review administrator jointly make the ultimate decision that the process is complete.
2. The interim or final report is transmitted from review administrator to responsible official.
3. Responsible official directs technical experts to refine draft document based on SCR report.
4. If necessary, revised document is returned to review team for further review.
5. Final SCR report and final decision are issued by review administrator and responsible official, respectively.

Table 3. A sample excerpt from a matrix of elements and criteria to be used in evaluating science consistency.

For each element, technical experts should provide an explanation of the purpose and thinking behind the element to improve the reviewer’s comprehension of the element to be rated. For each rating in each cell, reviewers should provide a note explaining why and how the rating was derived, including suggestions that could be used to improve a "no" rating.

Elements	Criteria for Decision			
	Is the relevant scientific information considered?	Is the scientific information reasonably interpreted and accurately presented?	Are the uncertainties associated with the relevant scientific information acknowledged and documented?	Are the relevant management consequences identified and documented, including associated risks and uncertainties?
1. Old Forests and Associated Species				
1.a. Spotted owl habitat requirements and availability				
1.b. Spotted owl population trends				
1.c. Silvicultural prescriptions to create old forest habitat				
1.d. Conservation approaches for Canada lynx				
2. Fire and Fuels				
2.a. Current and future fuel loading				
2.b. Current and future wildfire trends				
2.c. Smoke emissions and effects on human health				
2.d. Effectiveness of treatments for fuel reduction				
3. Nonnative Invasive Species				
3.a. Effects of spotted knapweed on native communities				
3.b. Treatments to control spotted knapweed				
3.c. Effects of zebra mussels on native aquatic communities				
4. Economic and Social Well-Being				
4.a. Rural community economic and population trends				
4.b. Role of nontimber forest products in local livelihoods				
4.c. Recreational and economic importance of off-highway vehicles				
4.d. Effects of timber harvest trends on local communities				

Summary

The responsible official should consider the SCR as an optional tool to use when he or she thinks that the scientific information contained in a draft document could benefit from a review. When conducted as suggested herein, the SCR will essentially serve as a report to validate the scientific information used in the decision, and it will enable the responsible official to assert that a decision is consistent with available scientific information.

Acknowledgments

The authors thank Thomas J. Mills and Harv Forsgren for their support in developing this paper on behalf of the Forest Service National Leadership Team. Thanks also to Meredith Webster, Brian Kent, Lisa Freedman, Jack Troyer, Gary Pierson, and Dick Smythe for helpful review comments.