Cumulative Effects Analyses for NEPA Documents

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As instructors conducting workshops on cumulative effects analysis (CEA) since the early 1990s, we recognize proposed approaches to CEA vary considerably.[2] Most approaches lack a simple formula for directing the step-by-step process to ensure successful analysis and documentation of cumulative effects for compliance with the National Environmental Policy Act (NEPA). Most approaches confuse expectations of what should be discussed and displayed in NEPA documents.

Critical mistakes commonly found leading to incomplete and disjointed CEA documentation include:

1) An incomplete and/or broad description of the proposal (who, what, where, when and how).
2) The limited development or documentation of the cause-effect network associated with the proposal which defines the interconnections for the web-of-effects.
3) An inadequate explanation of the rational for choosing spatial and temporal bounds.
4) The failure to recognize when more than one geographical or temporal bounding may be necessary for a resource to characterize changes in cumulative effects over time and space.
5) The failure to recognize the CEA is an incremental effects analysis, meaning the need to describe the contributions from the incremental effects of the agency's action in relationship to all other effects from past, present and reasonably foreseeable future federal, non-federal, and private actions.
6) The failure to discriminate long-term, indirect effects from cumulative effects. For example, "induced growth [*indirect*] effects" resulting from the proposal are often confused with cumulative effects.

In this paper, we will address each of these common mistakes and provide potential solutions using the 9-step analysis process outlined below for structuring a cumulative effects analysis (see Figure 1).

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[2] For examples, see: International Finance Corporation. 2013. Good Practice Handbook; Cumulative Impact Assessment and Management. Washington D.C. Washington State Department of Transportation. 2008. Guidance on Preparing Cumulative Impact Analyses. NOAA. 2012. Guidance on cumulative Effects analysis in environmental assessments and environmental impact statements. California Department of Transportation. 2005. Guidance for Preparers of Cumulative Impact Assessments.

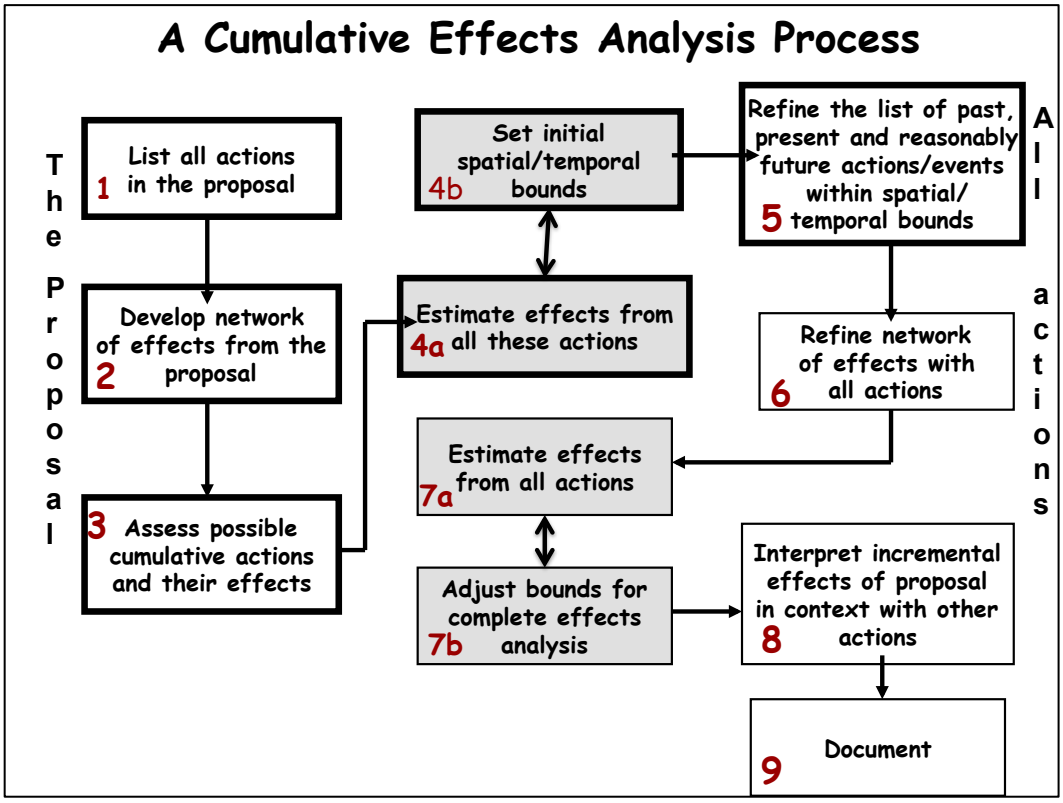

Figure 1. A 9-step process for addressing NEPA cumulative effects.

What are cumulative effects?

The CEQ regulations, which guide the NEPA analysis, define cumulative effects as:

> *"Cumulative Impact … the impact on the environment which results from the **incremental impact** of the action when **added to** other **past, present, and reasonably foreseeable future actions** regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." (40 CFR § 1508.7) [emphasis added]*

This definition is precise and focuses on the incremental contribution of the, action alternatives and mitigation measures in context (both location and scale) with the effects from past, present, and reasonably foreseeable future actions occurring in the same place and time as the proposed action.[3] It should be noted this definition puts a clear focus on the incremental effects of the action alternatives' contribution and is NOT soley a focus on the total effects from all cumulative actions. Only when the total effect of all

[3] Context is defined at 40 CFR 1508.27(a).

actions approaches or exceeds an administrative or legal threshold does the total effect of all actions become a critical consideration of the analysis. [4]

Why have cumulative effects become so important in NEPA analyses?

Prior to the Fritiofson case in 1985 (*Fritiofson v. Alexander*, 772 F 2d 1225 (5th Cir 1985)), most CEAs were unstructured and cursory. Agencies were unsure of how to implement the 1978 Council on Environmental Quality Regulations (40 CFR 1500-1508) requirements for CEAs as part of environmental analyses.[5]

In 1997, the 9th Circuit Court issued the *Carmel-by-the-Sea* decision, which set another milestone for expectations of cumulative effects analyses.[6] This case, and many subsequent cases over the next 10 years, would define more specifically what the courts expected in a CEA. The 9th Circuit Court led the way in establishing much of the precedence in defining greater expectations for CEAs.[7] The expectations for improved CEAs continued through the early 2000s reflecting new requirements:

- Agencies must identify and list the important past, present and reasonably foreseeable future actions contributing to cumulative effects.
- The spatial and temporal bounding of the cumulative effects must be described and explained.
- Assertions of "no cumulative effects" must be supported by evidence and logic.

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[4] A legal threshold can be viewed as exceeding a state water quality standard, air quality standard, or some other regulatory limit like those established under Endangered Species Act consultation. An administrative threshold is one set by an agency as part of a standard or guideline established in a program-level NEPA document or other procedural guidance mandated by an agency.

[5] The Fritiofson case centered around the issuance of permits for dredge and fill of fresh water marsh by the Corp of Engineers (CoE) under Section 404 of the Clean Water Act. The court centered on the inadequacies of the cumulative effects analysis and ordered the analysis be done. Specifically, the court instructed the CoE how to proceed with the analysis, "Given the CEQ regulations, it seems to us that a meaningful cumulative-effects study must identify: (1) the area in which effects of the proposed project will be felt; (2) the impacts that are expected in that area from the proposed project; (3) other actions -- past, proposed, and reasonably foreseeable -- that have had or are expected to have impacts in the same area; (4) the impacts or expected impacts from these other actions; and (5) the overall impact that can be expected if the individual impacts are allowed to accumulate."

[6] The Carmel-by-the-Sea case (*City of Carmel-By-The-Sea v. United States Dept. of Transp., 123 F.3d 1142, 1160-61 (9th Cir. 1997),* involved the proposed realignment of California State Highway 1 from the City of Carmel-by-the-Sea to nearby Hatton Canyon. Many aspects of NEPA were addressed by the court. In addressing cumulative effects, the court stated, "The Final Environmental Impact Statement/Report fails both to catalogue adequately past projects in the area, and to provide any useful analysis of the cumulative impact of past, present and future projects and the Hatton Canyon freeway on the wetlands, Monterey pine and Hickman's onion." The Court's use of the term "cataloging" would become the focus of future cases."

[7] See Michael Smith, 2006, Recent Trends in Cumulative Effects Impact Case Law, NAEP. Issue 4, December 2006.

Agencies found their ability to defend their cumulative effects analysis when litigated was problematic. Between 1995 and 2005, in the 9th Circuit Court of Appeals, agencies lost up to 60% of the cases where cumulative effects were a point of challenge.[8]

As a result of the case law developing on cumulative effects since the 1990s, agencies found themselves faced with a need to develop approaches to CEAs with greater structure, transparency, and uniform application. However, few agencies actually developed a structured approach. Therefore, we suggest the following approach as one that provides structure and transparency to assists the public and decision-maker in understanding the CEAs' conclusions, and documents a logical process used by the agency in coming to their conclusions.

Step 1: Why is defining the proposal appropriately, and giving specific descriptions of the alternatives' actions important?

Defining the Proposal: NEPA documents begin with a purpose and need statement that includes the agency's **proposal** for an action. The proposal explains to readers the who, what, where, and when of the action(s). The information presented must be broad enough to allow for alternatives, but not so broad as to include actions outside the agency's scope for the action.[9]

The proposal should define the
Who, What, Where, and When of the action(s)

Connected and similar actions must also be included in the proposal. Connected action must be included as part of the proposal.[10] A simple test for determining the connectedness of actions is by applying the criteria of "independent utility" (i.e., can the associated action be justified by itself, independent of the primary action). An evaluation of the purpose and need for the project can be instructive in determining the independence of actions.[11] CEQ Regulations § 1508.25(a)(3) defines similar actions as future actions proposed by the agency within the same geographic area or timeframe as the current action, and with similar effects.

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[8] See Michael Smith, 2006, Recent Trends in Cumulative Effects Impact Case Law, NAEP. Issue 4, December 2006.

[9] *...the purpose and need "must be neither so narrow as to yield only one suitable alternative nor so broad as to produce an overwhelming and unmanageable number of alternatives."* Citizens Against Burlington v. FAA , 938 F.2d at 196 (US. Court of Appeals, DC, 1991).

1. [10] As defined by the CEQ regulations, actions are connected if they: (i) Automatically trigger other actions which may require environmental impact statements. (ii) Cannot or will not proceed unless other actions are taken previously or simultaneously. (iii) Are interdependent parts of a larger action and depend on the larger action for their justification (40 CFR 1508.25).

[11] See Thomas v. Petterson, 753 F.3d 754 (9th Cir.1985) and, Delaware Riverkeeper Network v. FERC (DC Circuit. 2014).

Specifically describe the no action and all reasonable action alternatives. Unless the alternatives are discussed in detail the information needed for an effects analysis is incomplete, and leads to a deficient and fragmented analysis by resource specialists. Without specific information to base their analysis on, resource specialists may make different assumptions about what actions will be taken and where they will be implemented. They may also assume the implementation of different mitigation measures and the effects of those mitigation measures. If actions are vaguely described, the effects analysis will be equally vague.

Mitigation must not be overlooked. Mitigation measures as a part of the alternatives need to be described with the same level of specificity as other components of the alternatives. Although designed to prevent or reduce environmental risks, mitigation can have negative or undesirable consequences as well. In order for consequences, intended or unintended, to be evaluated, specific descriptions of all mitigation need to be described.

Most importantly, an incomplete description of the actions within the alternatives will not permit an accurate development of the cause-effect network, as discussed below in step 2.

It is best if the entire interdisciplinary team develops both, the purpose and need statement, as well as the proposed alternatives and mitigation measures. Thus, building a specific description of the proposed actions and setting the sideboards for the environmental effects investigation.

Step 2: Why is the networking of direct and indirect effects essential to an adequate cumulative effects analysis?

Creating a cause-effect network diagram (logic diagram) of the direct and indirect effects is an essential next step for understanding and visualizing how your project will lead to end-point effects. It also can provide important connections for designing mitigation not previously considered. These diagrams enable a clear understanding by resource specialists on the cause-effect sequences leading to environmental, social, and economic endpoints.

There are two types of network diagrams used for a NEPA analysis: 1) Ishikawa diagrams, and 2) cause-effect sequence diagrams.

Ishikawa diagrams.[12] Ishikawa diagrams, also known as "fishbone diagrams," are used to formulate mitigation measures to reduce adverse end-point results. The

[12] Ishikawa diagrams were popularized in the 1960s by Kaoru Ishikawa. Kaoru Ishikawa pioneered quality management processes and became one of the founding fathers of modern quality improvement management

diagrams created are known as “fishbone diagrams” because a completed diagram can look like the skeleton of a fish. An example of an Ishikawa diagram is shown in Figure 1. It illustrates an end-point of poor gas mileage in an automobile. The root causes are identified. Corrective mitigation measures can be applied to reduce the identified negative effects. Effectiveness of the mitigation measures still needs to be analyzed. For example, will the driver actually stop their habit of speeding?

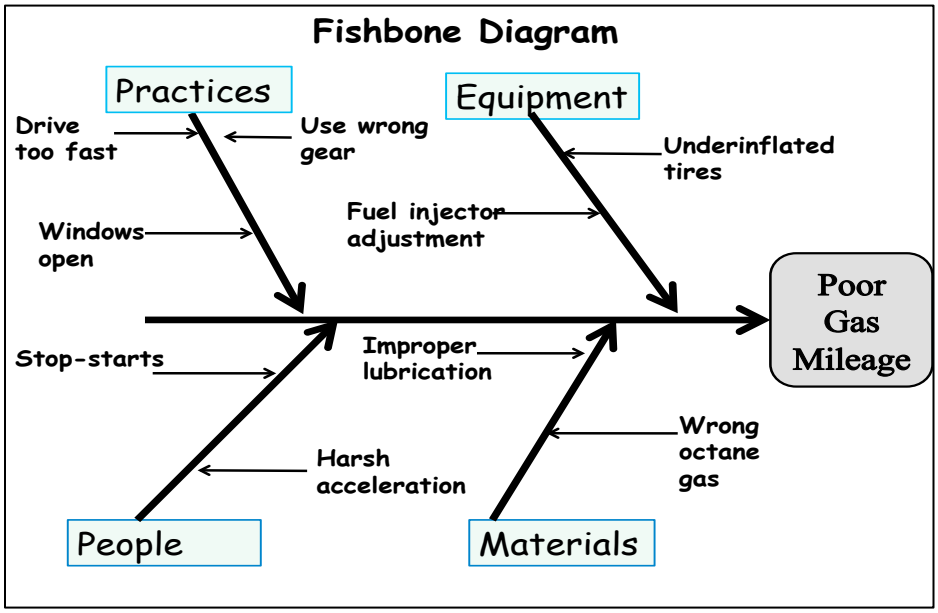

Figure 1. Example, Ishikawa diagram.

Cause-effect sequence diagrams. Sequence diagrams are schematic displays of causative actions, discussed in step 1, being driven to their “social endpoint.” When developed properly, this graphical view of a project’s logic sequencing of actions through intermediate effects to their social endpoint.

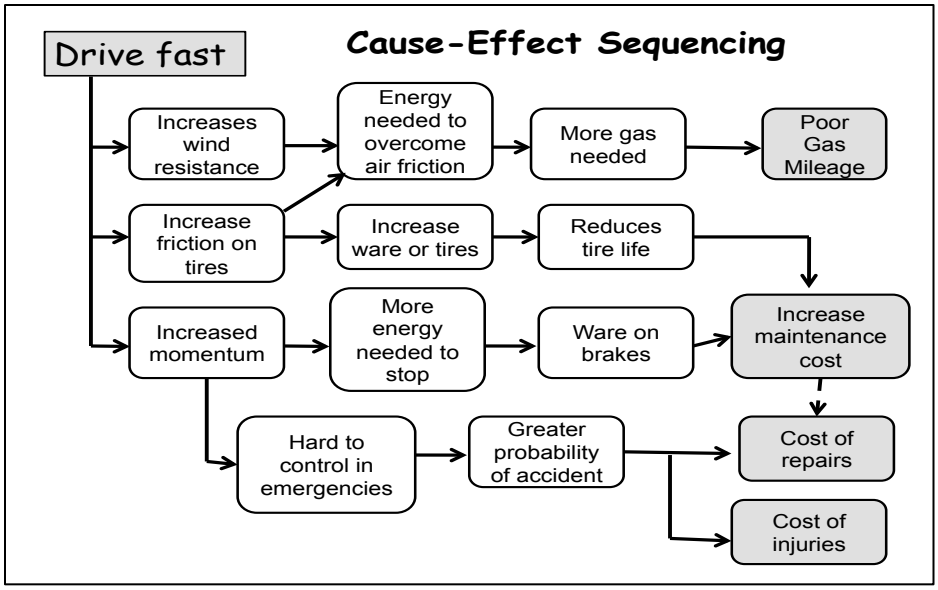

Figure 2. Example, cause-effect sequencing diagram.
These diagrams convey critical thinking necessary to show a "hard look" has been taken and end effects and specialists' conclusions are supported with logical evidence.

A social endpoint is an end-effect we humans care about; as expressed in law, administrative objectives, or things we deeply care about (value).

Diagraming Direct and Indirect Impacts. Figure 2 displays the effects of one action from our previous "fishbone diagram," driving fast. Note, driving fasts leads to multiple end-points, while the Ishikawa diagram results in multiple causes. Both techniques are useful in constructing a logic train for exploring direct and indirect effects of the action, as well as cumulative effects. Additionally, diagraming can identifying where mitigation measures may be most effective. Identifying and assessing mitigation measures and their effectiveness is important to ensure a complete effects analysis.

Many of the intermediate steps in developing a cause-and effect diagram for one resource may intersect with environmental, social, and economic effects diagrams for other resources. Resource specialists will intuitively go from action "A" to endpoint "Z" without describing and documenting all the interconnected cause-effect sequences that demonstrate a logic track from "A" to "Z." By constructing and displaying these cause-effect diagrams, all of members of the interdisciplinary team (IDT) can see, evaluate, and critique the thinking of other team members. This hopefully will lead to interconnected diagrams showing related cause-and-effect conclusions between resources and communities, and where mitigation measures are most needed.

Induced growth effects (indirect effects). The courts have long recognized the need for agencies to identify the cause-effect sequences and predict the induced impacts

(indirect effects) that emanate from the alternatives. The 9th Circuit court in its 1985 *Sierra Club v. Marsh* decision reiterated growth induced changes such as land use patterns, and resultant impacts to water and air are not so far removed from the action they can be dismissed--they are reasonably induced effects.

Some initial criteria for including indirect induced growth effects of a proposed action are:

1) If a proposed action is ***intended*** to stimulate growth, courts are likely to find the agency must consider this growth in the effects analysis.
2) If there are **relatively detailed or precise plans** for development in the vicinity of a proposed action, a full consideration of these effects will be required.
3) If the induced effects are **identified as an issues** in the scoping process and are **relatively certain** to occur (cause-effect relationships).

In *Sierra Club v. Marsh*, the 9th Circuit Court suggested three criteria for judging how far the cause-effect sequence should be extended to account for induced growth:

1) With what confidence can one say that the impacts are likely to occur?
2) Can one describe them "now" with sufficient specificity to make their consideration useful?
3) If the decision-maker does not take them into account "now" will the decision-maker be able to take account of them later.

Once the logic diagram has been completed, the IDT, the public, and the decision-maker will have a clearer picture of the sequence of direct and indirect effects of the alternatives and mitigation measures.

Ishikawa diagramming is used to formulate possible mitigation measures.

Cause-effect sequencing is used to drive an action to its social endpoints.

When these diagrams are complete, the next steps identify where cumulative actions may intersect with the cause-effect sequencing steps (direct and indirect effects) resulting from the proposed alternatives, and mitigation measures. This sets the initial spatial bounding for the cumulative effects analysis – steps 3, 4, and 5.

Step 3, 4, and 5: How do you set the spatial bounds for the cumulative effects analysis?

After the cause-effect diagram is completed for direct and indirect effects of the proposed alternatives, the next step is to estimate the spatial extent of those effects for

each resource or community being analyzed.[13]

Setting the initial spatial boundaries. The initial project boundary is a geographic area where the action will occur. Resource specialist use the project boundary to determine which resources or communities occur in the area, and may be affected by the action. Once a resource specialist determines their resource may be effected, they complete the cause-and-effect diagram for direct and indirect effects to the resource to determine the geographic area of analysis for that resource. Generally, each resource will have its own analysis boundaries. The rationale for determining the project and resource or community boundaries must be documented.

Setting a cumulative effect analysis (CEA) spatial boundary. The CEA bounding begins with an inventory past, present and future actions taken by federal, non-federal and private entities within the bounded area for direct and indirect effects. These actions can be added to the cause-effect sequencing completed for direct/indirect impacts to assist resource specialists in identifying the resources, ecosystems, and communities most affected by cumulative actions. Resource specialists should only include past, present, and reasonably foreseeable future actions that overlap in space with the direct and indirect effects.

Identifying and evaluating cumulative actions assists the specialist in setting appropriate geographic boundaries for a CEA. The CEA boundary is almost always expanded from the resource analysis boundary so the resource specialist can see a bigger picture of effects to the resource. The boundary is expanded to the point at which the action's direct and indirect effects no longer measurably contribute to cumulative effects. Some examples of boundaries for cumulative impact analysis include watersheds, air sheds, species' habitat, migration routes, or neighborhoods (1997, CEQ Considering Cumulative Impacts). The rational for setting appropriate spatial boundaries for the cumulative effects analysis must be documented.

Principles

As a general rule, the area of analysis for a specific effect should be expanded until the contribution from the alternatives is no longer quantitatively or qualitatively meaningful.

Each resource will have its own unique temporal and spatial bounds.

Analysis of cumulative effects may include multiple spatial bounded area and timeframes.

[13] For a well-defined project boundary, such as a block of Federal land, this delineation and inventory may be relatively simple. For linear corridors, the project boundary may be defined as linear distance on either side of the corridor along the entire length of the corridor.

Estimate the contribution from the past, present and reasonably foreseeable future actions. Estimate the environmental contributions quantitative and/or qualitative) from past present and reasonably foreseeable future actions within the boundaries established for direct and indirect effects. Include in this assessment any background levels for the effect.[14] In many situations the contribution from your project will dominate the effects being bounded if they are relatively meaningful to the potential for a significant effect to the resource. However, if past, present and reasonably foreseeable future actions have meaningful effects within these boundaries, you must determine the relative importance of these effects in relationship to the incremental effects contributed by your project.

Evaluate the incremental contribution from the project. Figure 3 illustrates the nature of the investigation of cumulative effects for a project.[15] Whether at the direct and indirect, or subsequent larger cumulative effects geographic bounds, two questions need to be addressed:

1) What is the incremental contribution of effects from the project when compared to the total of the effects from past, present, and reasonably foreseeable future actions?

2) Does the total of cumulative effects exceed a threshold of significance, and is the incremental effects from the agency's action responsible for exceeding the threshold either now or in the future?

[14] Many environmental constituents, or pollutants, occur naturally in the environment. These background or baseline lev
should be integrated into the analysis much like the effects from past, present, and reasonably foreseeable actions.
[15] The concepts illustrated are also true for programmatic proposals.

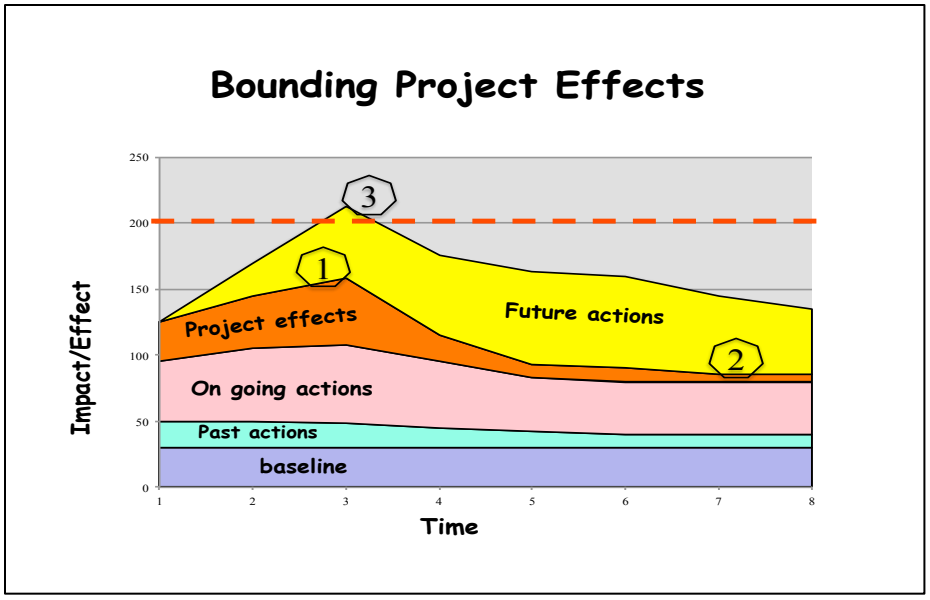

Figure 3. Example diagram for bounding cumulative effects analysis a project.

First test. Note at point 1 (year 3) in the diagram the contributions from the project account for approximately 25 percent of the total. The contribution from the project at point 2 (7 years) is less than 3 percent, with a predicted continual decline in future year. Thus one can determine the incremental impacts of the project at various times and at some time in the future make a determination that the increment resulting from the project are no longer meaningful.

Second test. In Figure 3 the total of effects from all actions (i.e., the alternatives, baseline, past, present, and reasonably foreseeable future) exceed a threshold of significance (point 3). Because this threshold level is exceeded, and the project contributions are important in contributing to exceeding the threshold, the second test is met, and this level of analysis would be included in the document.

Determining the level of effects from the agency's action in relationship to effects from other past, present, and reasonably foreseeable future actions helps the resource specialist understand what level of analysis is needed for the CEA.

A two-part test for determining the importance of a particular geographical bounding

1. What is the incremental contribution to overall effects from the project when compared to the aggregate of the effects from a baseline, past, present and reasonably foreseeable actions?

2. Does the total of cumulative effects exceed a threshold of significance, and is the increment of effects from the proposal

responsible for exceeding the threshold, now or in the future?

Step 6: How to determine appropriate timeframes for past, present, and reasonably foreseeable future actions, and how specific should they be characterized?

Determining what past, present and reasonably foreseeable future projects have to be inventoried or "cataloged" and to what level of detail they need to be inventoried is always a challenge for the resource specialist. Specialists will often want to be as precise in the analysis of past, present, and reasonably foreseeable future actions as they are for the alternatives' actions. On-the-other-hand, some resource specialists may want to dismiss the importance of this information and ignore this analysis all-together. In most analyses the level of specificity for the past, present and reasonably foreseeable future actions is in-between the two extremes.

Past Actions. Past actions are actions most commonly overlooked in the analysis of cumulative effects. Because these actions contribute to effects often labeled as 'background' or current conditions, they go un-inventoried. There may be times when past actions can be considered as part of 'current condition' and not require inventory or assessment, however this case should not be assumed for all projects. Court decisions are informative as to what level of inventory or 'cataloging' of past projects must be done.[16] In response to these court decisions, the Council on Environmental Quality, in 2005, issued a memorandum clarifying how agencies should address the cataloging of past actions.

> "Agencies are not required to list or analyze effects of individual past actions – unless such information is necessary to describe cumulative effects of all past actions combined."
>
> "Generally, agencies can conduct adequate effects analysis by focusing on current aggregate effects of past actions without delving into the historical details of individual past actions."

Figure 4 displays a thought process in deciding when to catalogue past projects and when not to catalogue past projects. The diagram is suggested as an initial effort to

[16] The first significant case on past actions was *Carmel-by-the-Sea v. DOT (1997)*. The DOT was proposing a new section of Highway 1 around the town of Carmel-by-the-Sea in coastal California. From the specifics in the analysis, the 9th Circuit Court concluded that a mere reference to past project and their effects was inadequate. The court concluded a specific 'cataloging' of past projects should have been done in this specific situation. In 2005, what is known as *Lands Council v. Powell* case was decided. The 9th Circuit Court again determined an inventory or cataloging of past projects was required based on its previous Carmel-by-the-Sea decision. The court concluded the time, type, place, and scale of past timber harvests should have been explained in sufficient detail for an informed decision.

help document rationale for how you approach the question of how to characterize past actions, and whether or not to include them in your analysis. There may be other steps or questions that can, or should, be asked in making the cataloguing decision. The important thing to keep in mind is that regardless of how you address past projects, the rationale for these decisions should be documented. This diagram identifies three end points for addressing past actions, however, there could be more end points.

1) Catalogue each project and assess the individual contributions from each.
2) Aggregate all past actions into one over-all estimate of the effects from these past actions.
3) Integrate past actions into the background as current conditions and do not separate out the effects of past actions. Use current conditions, which include an explicit discussion of the effects of past actions.

For analysis purposes, inventories of past projects may be aggregated, in part or in whole, to create one total estimate of effects from past projects, or subtotals of effects for different types of past projects (i.e., vegetation management projects, road projects, agriculture development, urban growth, etc.).

Ongoing (present) actions. The second type of projects to consider are other ongoing projects. These projects should also be inventoried and evaluated either separately or as an aggregate. The cataloguing of ongoing projects can follow the same flowchart and thinking process used for past projects.

Reasonably foreseeable future actions. The third category of project to consider in the CEA is reasonably foreseeable actions. The most frequently asked question about reasonably foreseeable future actions centers around the definition of the word, "reasonably." The courts have defined the scope of "reasonably foreseeable" as those projects proposed rather than contemplated. Also, reasonably foreseeable projects are not *speculative* or *remote*.[17] Future actions *likely* or *anticipated* should be considered as reasonably foreseeable, to determine if these actions contribute to important impacts. Judgment is involved in deciding what is reasonably foreseeable, and this judgment requires rationale and documentation.

[17] In evaluating what future actions must be considered as "reasonably foreseeable" in completing a thorough cumulative effects analysis, the courts have settled on projects that are proposed rather than contemplated (Weinberger v. Catholic Action of Hawaii, 454 US 139, 70 E.Ed.2d 298, 1981). Actions that are characterized as "remote" or "speculative" need not be considered (Kleppe v. Sierra Club, 427 US 390, 1976).

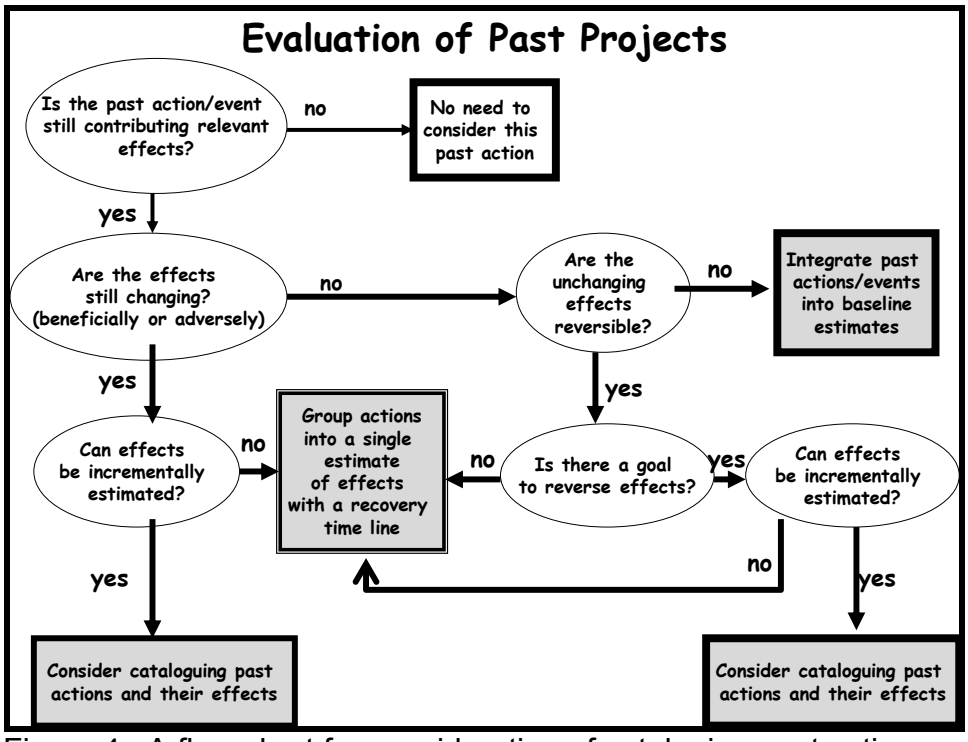

Figure 4. A flow chart for consideration of cataloging past actions.

One last point about past, present and reasonably foreseeable future actions; all actions must be considered in the CEA—those from your agency, as well as other federal, non-federal and private actions.

Step 7: How should I affirm the temporal and spatial bounds?

Once the complete list of past, present and reasonably foreseeable future actions is settled on by the IDT, an evaluation of the cause-effect sequencing of these actions, with the cause-effect sequencing of the alternatives, should be verified. The following justifications should be established:

- Documentation of the rationale for the geographical and temporal bounds.
- Documentation of how past actions are characterized.
- Documentation for what is and is not reasonably foreseeable.
- Documentation for the final (largest) geographical boundary, especially if multiple bounds are explored.

Step 8: What's most important in interpreting effects?

Once the bounding of the cumulative effects is done and the incremental effects of the alternatives' actions are understood, these effects need to be characterized in a way reflecting a thorough analysis. General statements about environmental effects, and as

importantly cumulative effects, are not considered adequate.[18] The analysis of cumulative effects should be dependent on data and information, not on subjective general forecasting.

Professional judgment and assumptions will undoubtedly be a part of these estimates, but these judgments must incorporate some level of data, past experience (observation), and/or evidence, which can include citing and extrapolating research studies and published reports. [19]Any assumptions need to be spelled out and their rationale.

A good effects analysis should show how effects have been interpreted adequately as described below.

Be site specific. If a few paragraphs of the effects section of the document are taken out of context and you cannot determine where you are geographically, it is not site-specific. Geographical references should be provided in discussing the environmental effects and causative actions so you know:

- where the actions are, where issues emerge,
- where mitigation exists, and
- where effects result.

Measure change. An important aspect of the CEA is explaining the effects by comparing it to a baseline. In other words, expressing —magnitude, extent, direction, duration, and speed of changes.[20]

Answer the "so what" question. An important question to ask when doing effects analysis is, "So what?" Effects can ultimately be driven to a social implication, which may really be behind why we consider this cause-effect sequence to be important. As an example, the introduction of sediment into a stream from road construction in and of itself is not an end-point. Ask the question, "So what?" This question may then take you to the next cause-effect link, sediment reduces fish populations. So what? Reduction in fish may lead to reduced fishing success, and this last effect may be an appropriate social endpoint.

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[18] Neighbors of Cuddy Mountain v. United States Forest Service, 137 F.3d 1372, 1379 (9th Cir. 1998).
[19] Idaho Sporting Congress v. Thomas, 137 F.3d 1146, 1150 (9th Cir. 1998).
[20] Using a local weather station example,
Action: It's going to rain. But viewers want to know more, such as:
Magnitude – 2 inches
Extent – throughout the two county area
Duration – for 3 hours
Speed – with brief bursts of over 5 in/hr.
Direction – which is above what we see but once in every 5 yrs.
So What ? There will be flooding, and commuter traffic will be delayed, outdoor events will be canceled, farm crops will be destroyed.
Because – The rivers cannot contain the intensity of rainfall produced runoff, banks will overflow and ponding will occur at many road river crossings.

Explain the "because." A simple look to ensure the rationale to support concluding statements about assumptions, data, and information must be included in the documentation of the analysis, supporting "we know this because."

Consider synergy. Synergy considers the interaction of two or more actions and their effects, in some cases dissimilar and unconnected actions. When the effects of these actions are added together they do not combine to produce a simple additive result. The concept of synergy is especially important in cumulative effects.[21]

There are two types of synergy. One type is characterized by effects to a resource accumulating non-linearly. This type of synergy is common in nature. A second, more complex synergy results in an impact from two dissimilar effects that initially may not appear to interact with one another, but produce effects not anticipated. As an example, if a person were to ingest alcohol (a depressant) and also ingest a methamphetamine (a stimulant) the simple expectation is the stimulant would offset the depressant and little effect would be result. However, a chemical synergy takes place that is complex and not readily predictable, and bizarre unpredictable behavior can result.

These more complex synergies complicate cumulative effects analysis and challenge specialists. To address these complex relationships, sophisticated simulation models are often employed.

As a natural resource example of synergy, we know there is a relationship between stream temperature and fish health and survival. For each species the relationship can be reasonably well defined and we can estimate changes to fish populations. We also know there is a relationship between suspended sediment loads and fish populations. These relationships can also be reasonably well defined. What is not well defined is how temperature changes coupled with sediment changes combine to affect fish populations. To estimate the synergy between these two apparent independent effects is the challenge. It can often result in the need for complex simulation models. As we learn more about the complex interrelationships of environmental variables, the need for and consideration of synergistic analyses will increase.

Step 9: How can cumulative effects best be displayed in the NEPA document?

Many NEPA-based lawsuits are argued over the agency's documentation of its analysis, which is why it is important to include your rationale and support your conclusions in the document and administrative record. The rationale for your conclusions must be documented in the EA or EIS and supporting record.

[21] CEQ Guidance on cumulative effects analysis, 1997. p. 8.

In completing NEPA documentation, ensure the "because" part of your analysis in concluding statements is satisfied.

One essential step is to make it easy for people to find where you have addressed cumulative effects. Having a section or sections titled cumulative effects helps the reader find where these effects are addressed. However, just labeling a section as "cumulative effects" is insufficient. Organization alone will not satisfy the cumulative effects analysis. There must be substance to these sections.[22]

There is no single template or format considered most appropriate for documenting cumulative effects because every action is different, and the nature and extent of a cumulative effects analysis may differ by action. Additionally, the CEQ regulations do not require any specific format or organization for the cumulative effects discussions.

Many approaches have been used, and each has its strengths and weaknesses. One format commonly used is to organize the effects discussion by resource. For each resource, the direct, indirect, and cumulative impacts of the alternatives are discussed. Usually this format will combine direct and indirect impacts under one heading, with a separate heading for cumulative effects under each alternative analyzed. Information under these heading describes the boundaries and methods used for the analyses, along with a discussion of potential direct, indirect, and cumulative effects on the resource, and what they mean to the health of the resource.

The second approach is to have a separate chapter after Environmental Consequences titled *Cumulative Impacts*, and discuss each resources cumulative impacts separately within this chapter, including the same information discussed above. Lumping the cumulative impacts for all resources into one section is not always practical since many of the resource, ecosystem, and communities analyzed have different boundaries and methods of analysis, which must be included as part of the hard look requirement.

However, including the cumulative effects analysis as part of an all-encompassing discussion on environmental effects should not be considered a fatal flaw. As the 9th Circuit Court points out, the document should not put "form over substance" in the way in which cumulative effects are discussed. The courts will give deference to the agencies discussions, regardless of where they are positioned in the document.[23] But it is best to have the cumulative effects discussions easily identifiable as it leads to clear writing and tracking of information.

Cumulative effects will often involve complex concepts and cause-effect relationships that can be difficult to explain in simple terms. The use of diagrams, flow charts, pictures and other displays can usually communicate these complex relationships more easily

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[22] City of Carmel-by-the-Sea v. US DOT, 123 F.3d 1142, 1166 (9th Cir. 1997).

[23] See Center for Envir. Law and Policy v. BoR. 9th Cir., 2011. "Although this evidence is not presented in the cumulative effects section of the EA, it would impermissibly elevate form over substance to hold that Reclamation must replicate its entire analysis under the heading of cumulative effects."

than text. As an example, displaying the fire-intensity levels of a wildfire over a large geographical area using a map (see Figure 5), or describing the aerial extent of ozone levels as a result of a new expressway using a chart, helps readers understand the visualize the information, thus better understanding the effects.

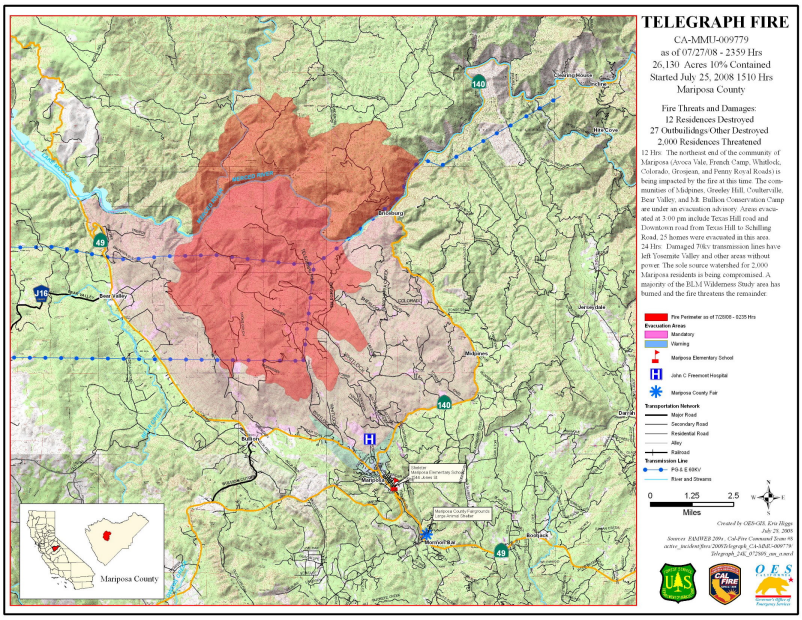

Figure 5. Wildfire intensity map for the Telegraph Fire. Mariposa, CA, June 2008.

Discussion organization. For each important cumulative effect addressed, some key points must be included in the discussion:

1) The increment of effect from the alternative should be discussed and put in context with the total effect from other actions (i.e., how important is the effect from the alternatives in light of effects from other actions).
2) What is the total cumulative effect from all actions, and do the effects approach or exceed some significance threshold? How important is the contribution from your alternatives in exceeding this threshold?
3) Discuss the cumulative effects from 1 and 2 above for multiple time and spatial bounds as necessary (i.e., the effects from the project extend over time and/or over larger geographical bounds). Discuss the rationale for the different spatial and temporal bounds used.

Concluding Remarks

We have presented a 9-Step process for evaluating and documenting the cumulative effects analysis for a program or project. This 9-step process is intended to provide a framework to structure cumulative effects analysis that will ensure a defensible analysis.

We have found that practitioners often express frustration when cumulative effects are identified as a requirement for various aspects of a project. Without knowing how to proceed, cumulative effects analyses become fragmented, inconsistent from resource to resource, and more often than not, ignored all together. Concluding statements that assert, “no cumulative effects,” without supporting analysis and rationale are common. We suggest, that if followed, this this 9-step process will enable efficient, focused, and defensible analyses and documentation for cumulative effects.