610.74 Technical Note on "Analyzing Effects of Conservation Practices"

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Resources
Conservation
Service (NRCS)

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Analyzing Effects of Conservation Practices

A Prototypical Method for Complying with National Environmental Policy Act (NEPA) Requirements for Farm Bill Implementation

Overview:

effects of growing food and fiber cause pronounced change to economic systems, hydrology, habitat connectivity, air emissions, and discharges of pollutants to receiving waters. NRCS conservation planning and practice implementation is intended to lead to positive change. But it remains important to analyze and document these effects at an appropriate scale over a relevant time period.

Figure 1. Croplands in Conservation. The

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Purpose

The purpose of the guidance in this document is to provide:

- An approach for identifying and organizing the effects of Farm Bill-emphasized conservation practices that relies on agency expertise and available scientific literature.
- A methodology for making generalized and specific (cited) effects useful at national, regional and statewide levels that clearly illustrates the chain of causation for the effects of the proposed actions.
- Documentation of NRCS's direct, indirect and cumulative effects for environmental compliance and disclosure to clients and the public.

The methodology is intended for use by planners and specialists responsible for developing Environmental Assessments for Farm Bill Programs whether 1) for geographic priority areas or 2) to address issues that arise during or after the implementation of conservation treatments related to the effects of those treatments.

The outcome for using the guidance presented herein is to better achieve the agency's mission "to provide leadership in a partnership effort to help people conserve, improve, and sustain our natural resources and environment" especially as this mission will be advanced through Farm Bill Program implementation. The specific goals are:

1. To thoroughly understand and anticipate issues likely to arise due to Farm Bill Program implementation related to effects.
2. Provide a methodology for developing the effects analysis required for compliance with NEPA and other environmental requirements.
3. To identify gaps in scientific support.
4. To increase NRCS's strength as a technical agency.
5. To enable NRCS to focus its resources to achieve resource goals in a cost-efficient, effective manner.

Background

The agency's understanding and careful analyses of planned actions and their anticipated effects at the site and landscape levels have become increasingly important to convey how NRCS conservation practices achieve their predicted effects. The methodology presented in this document is one way for the agency to conduct analyses to verify that the intended results will occur and inadvertent adverse impacts will not occur. An integral part of the process is a mindset that on-the-ground implementation must be continually monitored for intended effects with evaluations and improvements promptly fed back to agency and partner decision-makers and the technology transfer system. This follow-through is called "adaptive management."

From the standpoint of environmental requirements, NEPA requires that direct, indirect and cumulative effects be analyzed in the context of actions, alternatives and effects. Cumulative effects are studied concurrently with indirect effects. The alternatives normally considered at a state, geographic priority area, watershed or other areawide level include the resource management systems and pertinent practices that are designed to address identified resource concerns and achieve desired resource goals. In some cases, there may also be a need to consider program alternatives, such as how to prioritize applications for participation within a particular program. These program alternatives will likely affect where and how many of the resource management systems or practices actually get put on the ground. In all cases, the no-action alternative is also examined as a baseline option including all the connected and similar actions that could contribute to effects.

The objective of effects analysis is to make sure decision-makers take into account the full range of consequences of their proposed actions. Conclusions about effects are to be scientifically supported or to identify gaps in science. Analysis will involve assumptions and uncertainties but must be conducted with the best techniques and data available. The need for better techniques and data can be identified, but is not justification for avoiding or delaying analysis of effects. Where substantial uncertainties initially exist, proposed actions and their implementation can be modified over time as new methodologies and data emerge.

Introduction to the Methodology

The steps that follow explain the effects analysis methodology. The methodology is intended for *initial* use at a national or regional level on a programmatic basis. Subsequently, the results can be used as templates for state and local analyses.

1. **Practices Identification** - The first step in the methodology is to identify the critical or featured practices identified or anticipated for use to achieve Farm Bill Program natural resources goals. Figure 2 depicts the EA or environmental assessment requirements and relationship to practices and environmental impacts. At the national level, the spatial focus is a generalized setting consisting of the expected major land use(s) and typical landscape features. A later section in the guide deals with refining the spatial scale to regional, state and local areas and climates. The temporal or time scale generally encompasses:
   - pre-implementation condition (typically a time period that bounds the trends that led to current conditions)
   - immediate future during which the majority of the featured practices installation will occur
   - time needed for the practices or system to become fully functional in their effects.

When effects analysis supports national and sometimes state programmatic decisions, alternatives will include different program delivery approaches such as varying cost-share rates or financial allocation methods. These alternatives will alter the amount and location of practice implemented. The effects of these alternatives must be analyzed in concert with the effects of the conservation practices used to achieve the particular resource goals. However, this paper focuses on a methodology for analyzing the effects of conservation practices, not policy choices.

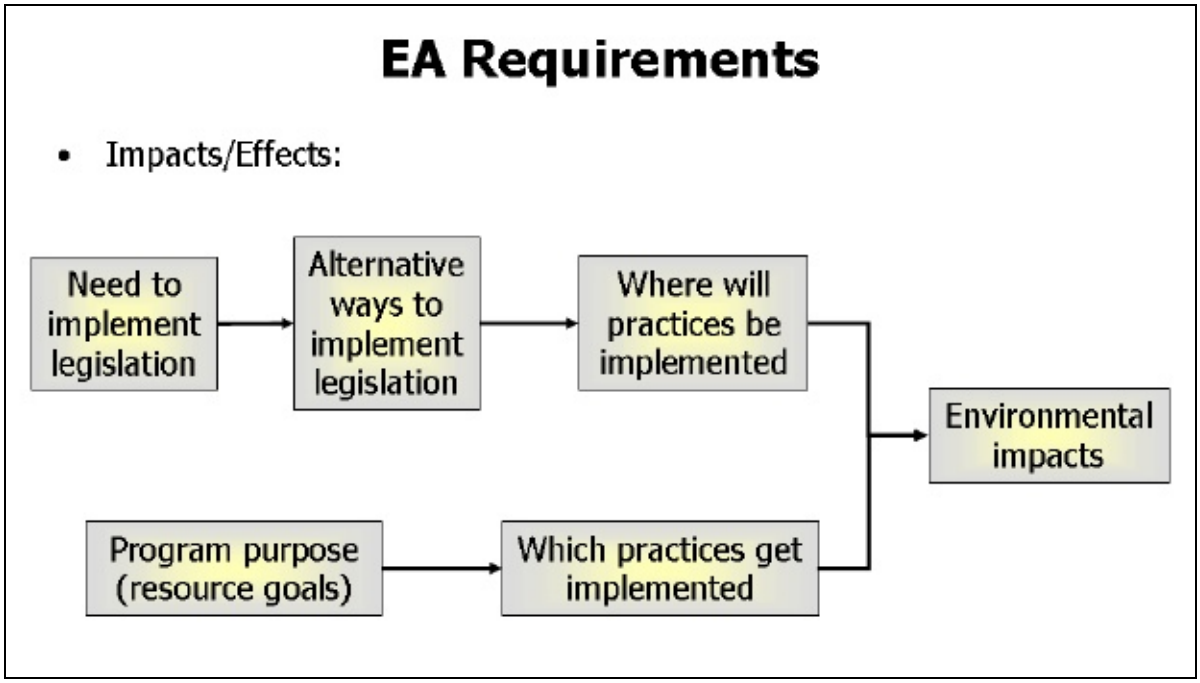


Figure 2. EA (environmental assessment) requirements and relationship to practices and environmental impacts.

2. **Network Diagram of Effects** - A network diagram is prepared for featured practices or a related set of practices that act together to achieve desired purposes. It is essentially a flow chart of direct, indirect and cumulative effects resulting from the practices being installed throughout the landscape. A complete cumulative effects analysis includes consideration of other ongoing and planned activities in the area that affect the same resources. National Practice Standards and Conservation Practice Physical Effects matrix (CPPE) are the main references for identifying direct effects and beginning the effects network diagram. A question approach is used to begin the diagram: 1) What is physically created by the practice or practice set?, 2) After the practices are installed, what are the direct effects?, 3) After direct effects occur, what indirect effects result?, and 4) As the practices are applied throughout the landscape and community at expected levels of participation and takes effect directly and indirectly, what are the cumulative effects? A completed network diagram represents an overview of expert consensus on the kinds and magnitude (i.e., positive or negative) of direct, indirect and cumulative effects of proposed actions which can be used as a reference point for the next step as well as a communication device with partners and the public.

   The network diagrams in this document do not depict effects on resources of special environmental concerns such as endangered or threatened species or cultural resources. However, these effects should be included when analyzed at a relevant regional, state or local level.

3. **Literature Review** - A literature review of all network diagram nodes and pathways is conducted. Standard literature searches and services are used and the results are collated. This step of the process may be the most time consuming, but is essential to verify the consensus reached in the preceding step

4. **Attributed Effects** - An attributed listing of specific, quantified effects related to key nodes and pathways are summarized using understandable graphs, tables, charts, etc.

5. **Findings** - Documentation is recorded for:
   a) effects based on research consistencies,
   b) inconsistent or contradictory studies, and
   c) gaps in research.

6. **Effects Analysis** - A summary is prepared and distributed for broader interdisciplinary review. The summary provides: 1) revised network diagrams, 2) highlights of the findings, 3) mitigation recommendations for anticipated adverse impacts. This information will be useful as the foundation for the programmatic or geographic priority area Environmental Assessments or Environmental Impact Statements.

Before reviewing an example of the methodology presented in the next section, it is important to again note the goals of the process: 1) to thoroughly understand and anticipate effects issues likely to arise due to Farm Bill Program implementation, and 2) to comply with NEPA in a cost and time-effective manner. Varying conditions within the nation at regional, state and local levels influence effect outcomes and require additional analyses. However, completing this work at a regional, state or programmatic level will provide a tier that more detailed analysis can be nested within. In some cases, areawide analysis may eliminate the need for additional site specific evaluation. The effort also provides templates that can expedite assessments and statements for specific areas and eliminate repetitive discussions and analyses.

The Methodology - An Example

An example of one of two primary practices used extensively in the "Continuous Conservation Reserve Program" or CCRP illustrates the effects analysis methodology. As background, continuous sign-up for high priority conservation practices began in 1996 as a provision of the amended Food Security Act of 1985. As this Farm Bill provision was implemented, two practices out of ten "buffer" practices predominated: 1) Filter Strip and 2) Riparian Forest Buffer. During the period October 1, 2000 to September 30, 2001, the NRCS Performance and Results Measurement System (NRCS 2002) indicates about 200,000 acres of filter strip were installed, primarily in the Midwest. During this same period riparian forest buffers were installed on about 100,000 acres, primarily in the Midwest and Southeast regions. The cumulative national extent for the two practices is about 1 million acres.

Figure 3. A filter strip (top) and a riparian forest buffer (bottom).

The following pages provide an example of effects analysis for the featured practice, Riparian Forest Buffer. This practice is defined as "an area of predominantly trees and/or shrubs located adjacent to and up-gradient from watercourses or water bodies." Purposes for this practice are quite varied and include the following:

- Reduce excess amounts of sediment, organic material, nutrients and pesticides in surface runoff and reduce excess nutrients and other chemicals in shallow ground water flow.
- Create wildlife habitat and establish wildlife corridors.
- Create shade to lower water temperatures to improve habitat for aquatic organisms.
- Provide a source of detritus and large woody debris for aquatic and terrestrial organisms.
- Provide a harvestable crop of timber, fiber, forage, fruit, or other crops consistent with other intended purposes.
- Provide protection against scour erosion within the floodplain.
- Restore natural riparian plant communities.
- Moderate winter temperatures to reduce freezing of aquatic overwintering habitats.
- To increase carbon storage.

While all purposes are important, the first two in the preceding list were principal goals of the CCRP.

The following example is organized in a slide format so it can be easily incorporated into training packages and other presentations. Slides follow the methodology steps outlined earlier. Note that certain steps are only partially completed or described. There are 9 slides.

Step 1
Practices Identification.

"CCRP" Practices (NRCS Practice Code)

Alley cropping, 311
Contour buffer strip, 332
Cross wind trap strip, 589C
Field border, 386
Filter strip, 393
Grassed waterway, 412
Herbaceous wind barrier, 422A
Riparian forest buffer, 391
Vegetative barrier (grass hedge), 601
Windbreak/shelterbelt/living snow fence, 380

Example Follows

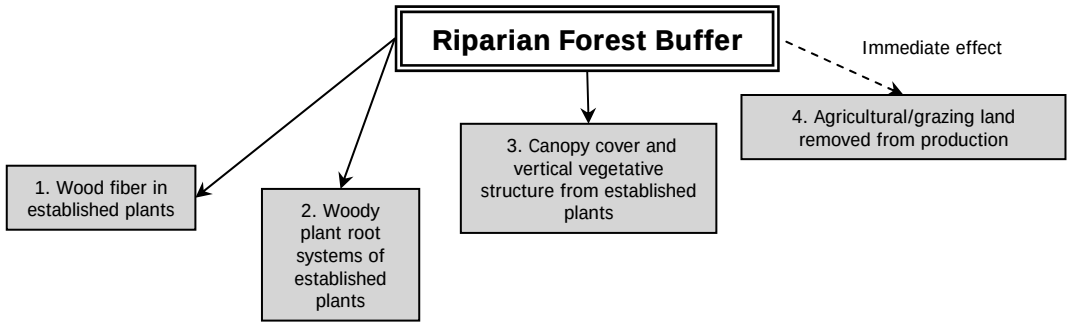
Slide 1

Example … Riparian Forest Buffer

Step 2
Network Diagram of Effects.

First

For the practice, what is physically created*?

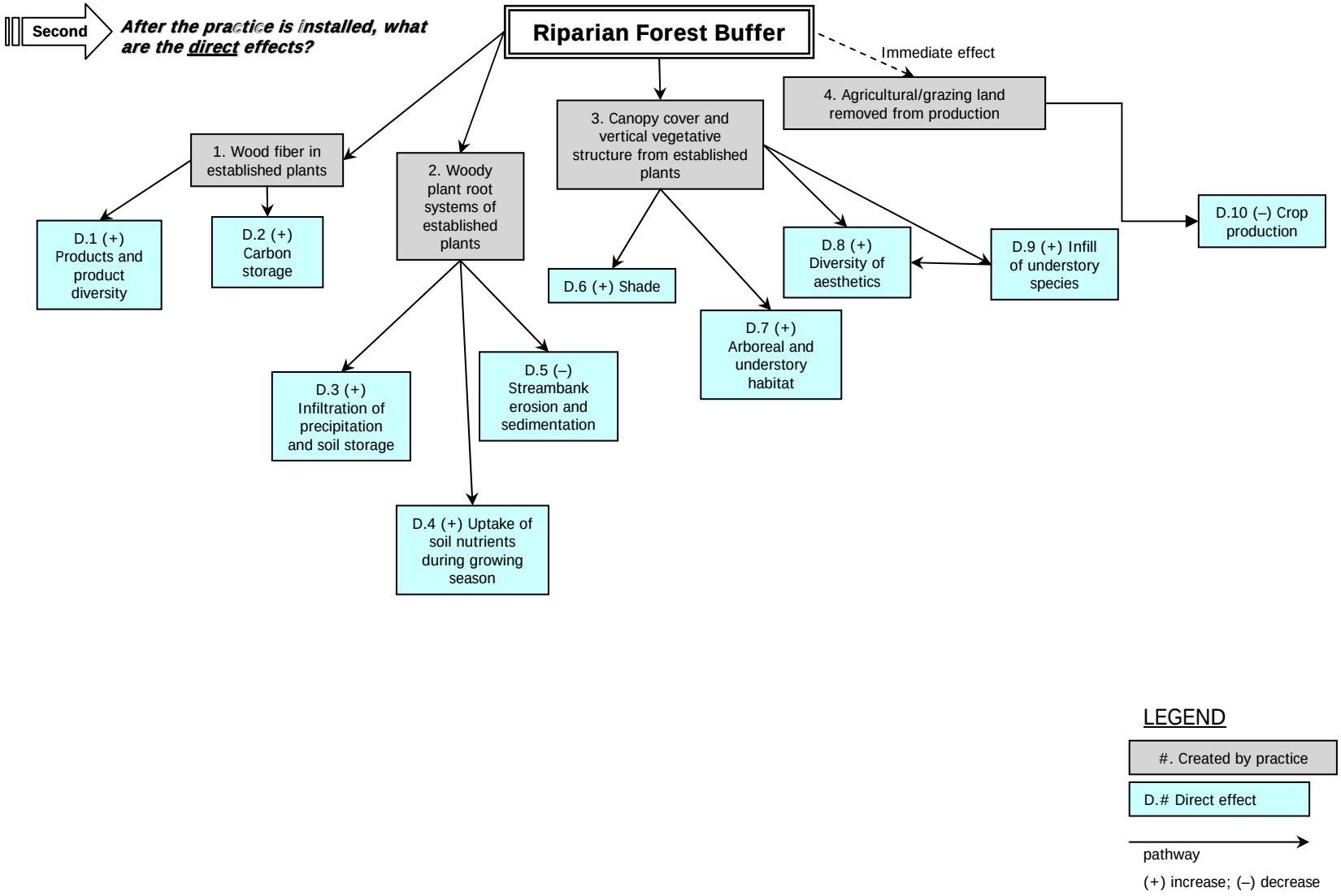


LEGEND

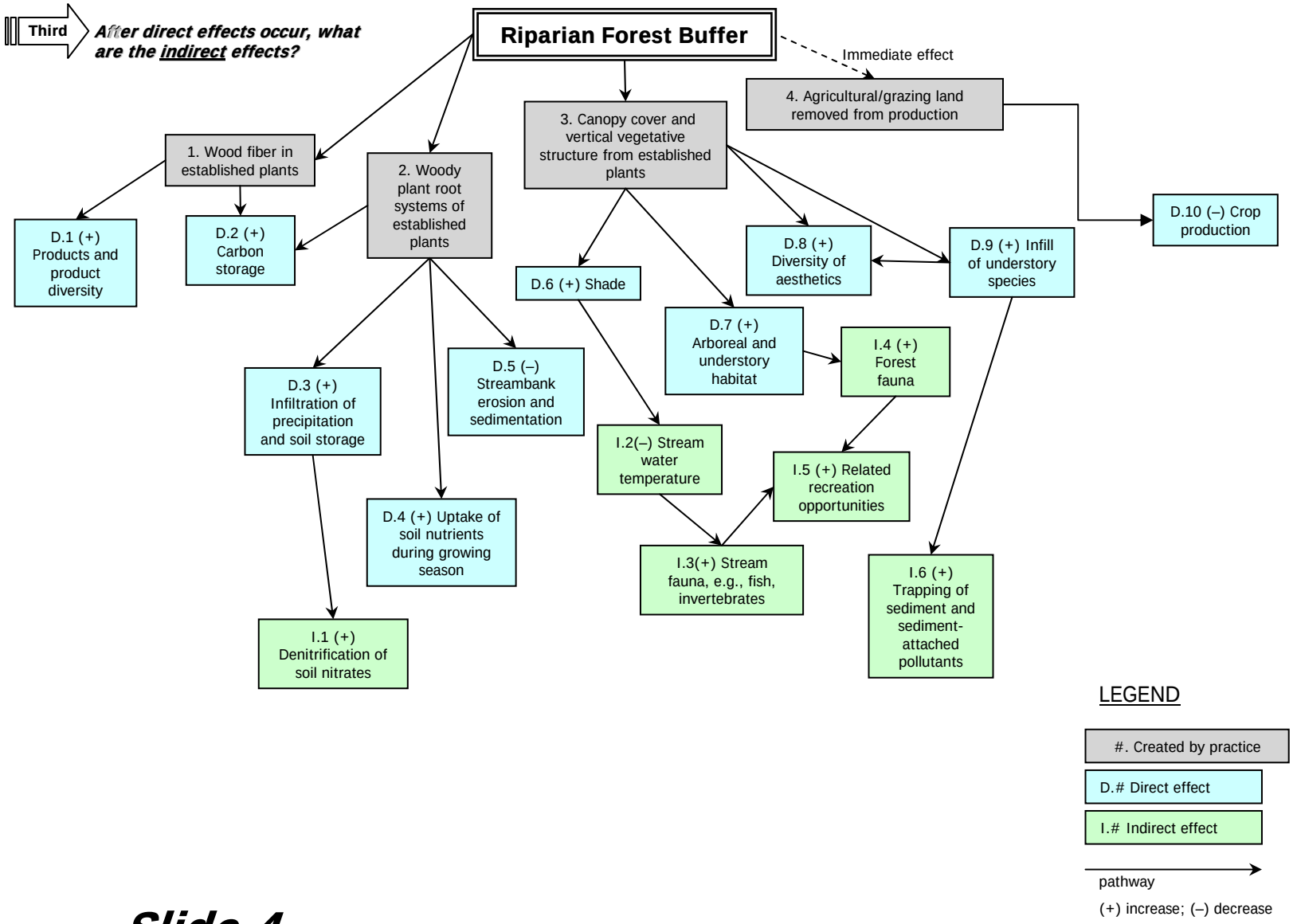
#. Created by practice

*The physical state of what's at the site at the conclusion of installation of the practice or shortly after the practice is considered to be established. The national practice standard is the basis for answering this question.

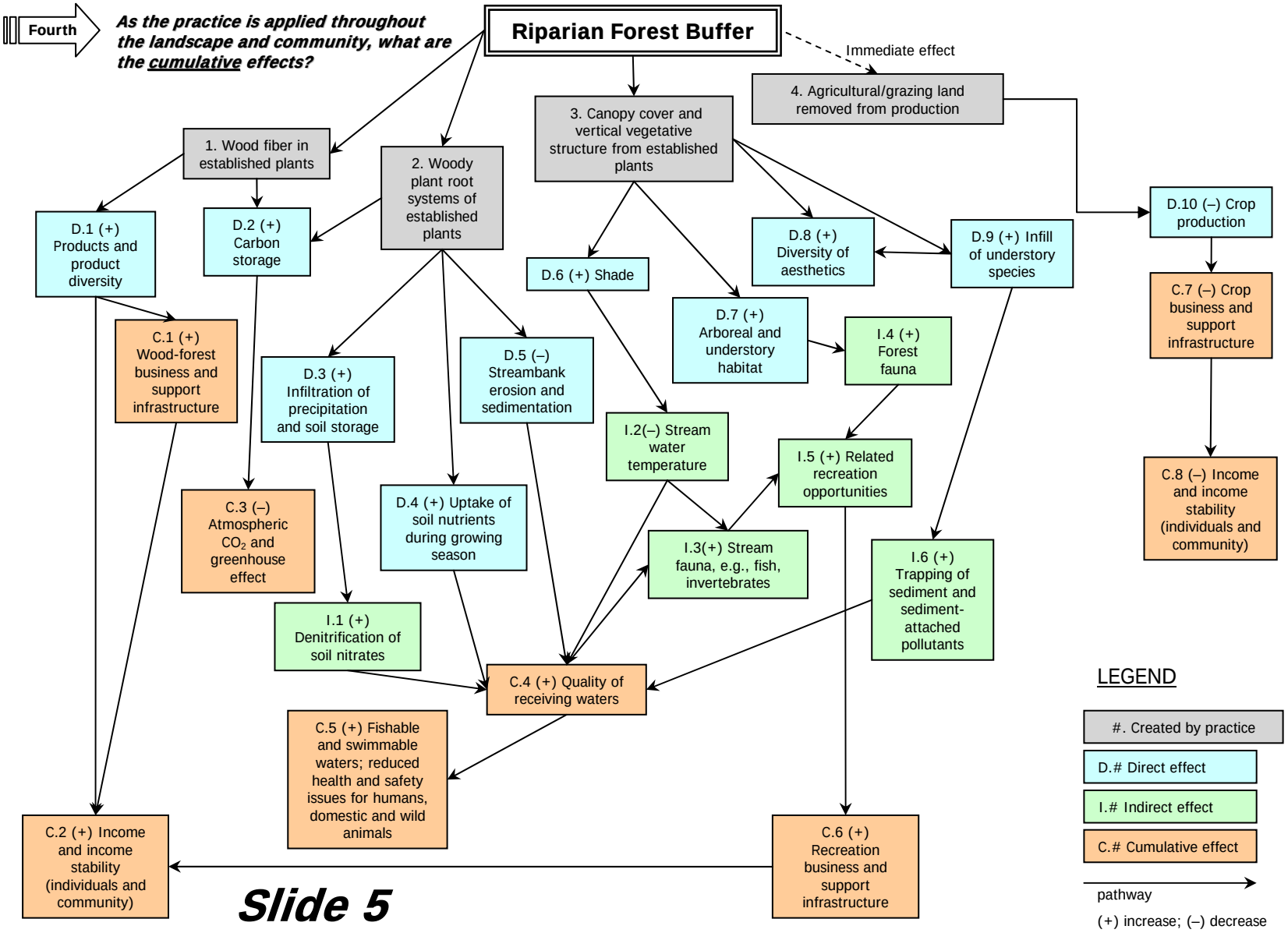
Slide 2


Second
After the practice is installed, what are the direct effects?
Riparian Forest Buffer
Immediate effect
1. Wood fiber in established plants
2. Woody plant root systems of established plants
3. Canopy cover and vertical vegetative structure from established plants
4. Agricultural/grazing land removed from production
D.1 (+) Products and product diversity
D.2 (+) Carbon storage
D.3 (+) Infiltration of precipitation and soil storage
D.4 (+) Uptake of soil nutrients during growing season
D.5 (–) Streambank erosion and sedimentation
D.6 (+) Shade
D.7 (+) Arboreal and understory habitat
D.8 (+) Diversity of aesthetics
D.9 (+) Infill of understory species
D.10 (–) Crop production
LEGEND
#. Created by practice
D.# Direct effect
pathway
(+) increase; (–) decrease

Slide 3


Third
After direct effects occur, what are the indirect effects?
Riparian Forest Buffer
Immediate effect
1. Wood fiber in established plants
2. Woody plant root systems of established plants
3. Canopy cover and vertical vegetative structure from established plants
4. Agricultural/grazing land removed from production
D.1 (+) Products and product diversity
D.2 (+) Carbon storage
D.3 (+) Infiltration of precipitation and soil storage
D.4 (+) Uptake of soil nutrients during growing season
D.5 (–) Streambank erosion and sedimentation
D.6 (+) Shade
D.7 (+) Arboreal and understory habitat
D.8 (+) Diversity of aesthetics
D.9 (+) Infill of understory species
D.10 (–) Crop production
I.1 (+) Denitrification of soil nitrates
I.2(–) Stream water temperature
I.3(+) Stream fauna, e.g., fish, invertebrates
I.4 (+) Forest fauna
I.5 (+) Related recreation opportunities
I.6 (+) Trapping of sediment and sediment-attached pollutants
LEGEND
#. Created by practice
D.# Direct effect
I.# Indirect effect
pathway
(+) increase; (–) decrease

Slide 4

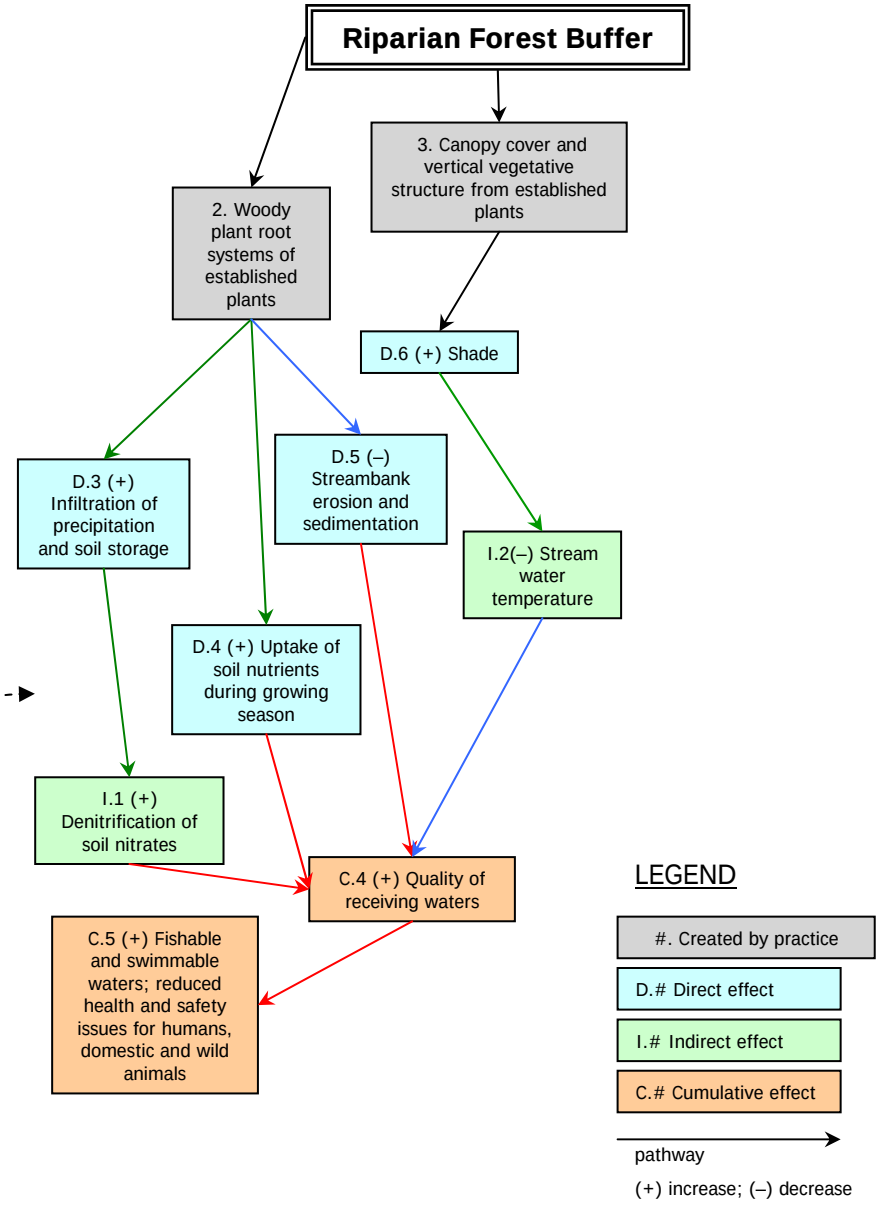

Fourth
As the practice is applied throughout the landscape and community, what are the cumulative effects?
Riparian Forest Buffer
Immediate effect
4. Agricultural/grazing land removed from production
3. Canopy cover and vertical vegetative structure from established plants
1. Wood fiber in established plants
2. Woody plant root systems of established plants
D.1 (+) Products and product diversity
D.2 (+) Carbon storage
D.6 (+) Shade
D.8 (+) Diversity of aesthetics
D.9 (+) Infill of understory species
D.10 (–) Crop production
C.1 (+) Wood-forest business and support infrastructure
D.3 (+) Infiltration of precipitation and soil storage
D.5 (–) Streambank erosion and sedimentation
D.7 (+) Arboreal and understory habitat
I.4 (+) Forest fauna
C.7 (–) Crop business and support infrastructure
I.2(–) Stream water temperature
I.5 (+) Related recreation opportunities
C.8 (–) Income and income stability (individuals and community)
C.3 (–) Atmospheric CO_2 and greenhouse effect
D.4 (+) Uptake of soil nutrients during growing season
I.3(+) Stream fauna, e.g., fish, invertebrates
I.6 (+) Trapping of sediment and sediment-attached pollutants
I.1 (+) Denitrification of soil nitrates
C.4 (+) Quality of receiving waters
C.5 (+) Fishable and swimmable waters; reduced health and safety issues for humans, domestic and wild animals
C.2 (+) Income and income stability (individuals and community)
C.6 (+) Recreation business and support infrastructure
Slide 5
LEGEND
#. Created by practice
D.# Direct effect
I.# Indirect effect
C.# Cumulative effect
pathway
(+) increase; (–) decrease

Step 3
Literature Review.

What effects have been researched? ... green lines

What effects are currently being researched? ... blue lines

What effects are not yet supported? ... red lines



Note: Only part of the network diagram is shown.

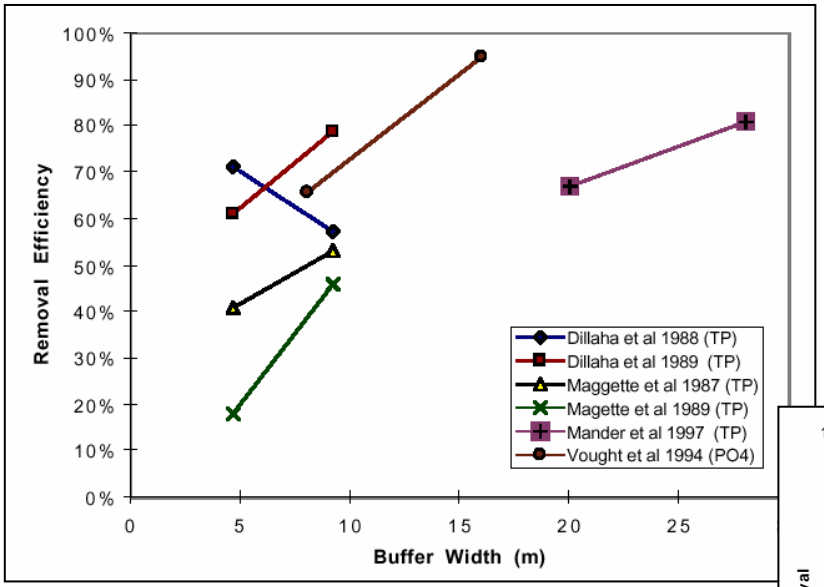
Slide 6

Step 4
Attributed Effects.

Slide 7

Step 5

Findings:
a) effects based on research consistencies,
b) inconsistent or contradictory studies, and
c) gaps in research.

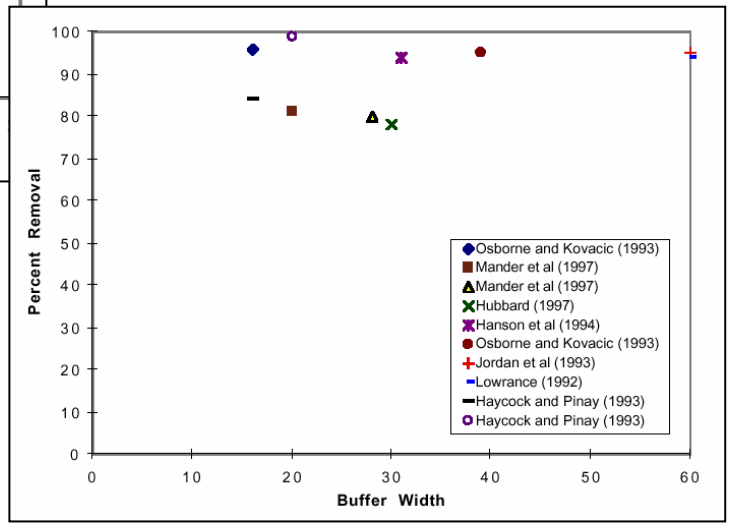


Phosphorus Removal from Surface Runoff (Wenger 1999*).

Effects:
Buffers of 5 meters in width or greater are significantly effective in reducing phosphorus and nitrates for many agricultural settings ...

Inconsistencies/Gaps in Research:

- ***Subsurface flows in many settings bypass riparian buffer root systems***
- ***Early studies indicate buffers can remove pesticides, organics, metals***
- ***Limited studies on pathogen removals are inconsistent***



Subsurface Nitrate Removal (Wenger 1999*).

***Wenger, S. 1999. A Review of the Scientific Literature on Riparian Buffer Width, Extent and Vegetation. Institute of Ecology, University of Georgia, Athens, GA.**

Slide 8

Step 6
Effects
Analysis.

Example

A completed effects analysis can nest within and support required assessments and statements.

Elements of an *Environmental Assessment* are as follows*:*

- Purpose and need
- Title of the proposed action
- Alternatives
- Environmental impacts
- Mitigation measures
- Agencies and persons consulted

Elements of an *EIS* are as follows:

- Purpose and need
- Alternatives including proposed action and no action
- Affected environment
- Environmental consequences
- List of preparers
- List of agencies, organizations, and persons to whom copies of the statement are sent

Summary

The NRCS and partner organizations are planning and installing riparian forest buffers throughout all regions of the country under CCRP.

Over 140 articles and books were reviewed to establish the effects of riparian forest buffers and provide adequate scientific documentation of the public expenditures for this form of conservation.

The network diagrams, findings, and recommended mitigation are presented in this summary …

Slide 9

Notes about Conducting a Regional, State or Local Analysis

An effects analysis should ideally be completed first at the national or programmatic level so that a regional, state or local analysis can be tiered to that 'upper' level. But practically, a specific-area evaluation or assessment can be conducted in isolation and still be very effective. The method presented earlier in this document provides a template process useful for a locally defined area to allow analysts to focus on and capture unique characteristics such as state and local environmental issues, climate, cultural diversity in farming techniques, and physiography.

An important aspect in a local analysis is "bounding" the effects of the applicable farm bill program provision spatially and temporally. Important factors in bounding the spatial scale are

- anticipated levels and locations of program participation,
- typical settings where primary practices are installed,
- nonprogrammatic but related activities and effects and their extent,
- areas having a "sense of community,"
- hydrological connectivity, and
- ecological similarity and connectivity.

The temporal bounding will generally encompass

- a fairly short past time period under which current conditions and trends have established (i.e., the baseline or benchmark conditions),
- the immediate future during which the majority of the featured practices installation will occur, and
- a longer yet reasonable future time period needed for the practices to become fully functional in its effects.

Modification of the templates presented should be done carefully with an eye towards truly unique characteristics and issues to reducing repetitive discussion and unnecessary focus on 'micro-scales.' Under most circumstances, the local analysis should proceed rapidly presuming that the major processes and effects are identified and supported by either scientific literature (preferred evidence) or in the case where none exists, best professional judgment.

Figure 4. Conservation district members and an NRCS conservationist discuss local conservation issues that will help "bound" spatial and temporal scales during effects analysis.

References

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U.S. Congress, 1970. *National Environmental Policy Act of 1969.* PL 91–190, 42 USC § 4321–4347 as amended by PL 94–52, 94–83, 97–258, § 4(b), Washington, DC

USF&WS (U.S. Fish and Wildlife Service), 2001. *Endangered Species Glossary.* Southeast Region, http://es.southeast.fws.gov/ glossary.html, Atlanta, GA

Appendix

Useful Definitions

(Footnotes are listed at the end of the appendix.)

Affected Environment. The affected environment in a NEPA analysis that addresses direct, indirect and cumulative effects includes all potentially affected resources (soil, water, air, plants, animals), ecosystems, and human communities.[1]

Areawide Conservation Planning. The 3-phase, 9-step iterative process used by NRCS to help clients plan and apply conservation treatments for a watershed or other geographical area (referred to as the planning area) defined by the clients and stakeholders. The areawide conservation plan addresses all resource problems identified including effects issues, contains alternative solutions that meet the minimum quality criteria for each resource, and addresses applicable laws and regulations.[2]

Baseline Conditions. Conditions of resources, ecosystems and human communities used as the bases or levels of comparison for analyzing effects of proposed actions. These may be established or estimated from historical or current day conditions.[1]

Biological Assessment. A document prepared for the Endangered Species Act Section 7 process to determine whether a proposed major construction activity under the authority of a Federal action agency is likely to adversely affect listed species, proposed species, or designated critical habitat.[3]

Benchmark Condition. The status or quality of one or more current planning area situations, circumstances, or settings projected over a future specified time period. Status and quality are usually measured and defined by using one or more relevant indicators and target values. The projection of benchmark condition accounts for reasonably foreseeable future actions as well as past and present actions but does not include the effects of alternatives (proposed actions) being contemplated by the planning group. The benchmark condition is used as a point of reference to 1) compare against projected resource conditions anticipated for an alternative, and 2) measure change in resource conditions resulting from applied conservation treatment.[2]

Bounding. The process of establishing spatial and temporal boundaries to encompass the consequences of proposed action as well as additional effects on the resources, ecosystems, and human communities of concern during an effect analysis.[1]

Candidate species. Plants and animals that have been studied and the US Fish and Wildlife (FWS) or National Marine Fisheries Service (NMFS), as appropriate, has concluded that they should be proposed for addition to the Federal endangered and threatened species list.[3]

Common Resource Area (CRA). A geographical area where resource concerns, problems, and treatment needs are similar. Landscape conditions, soil, climate, human considerations, and other natural resource information is used to determine the geographical boundaries of the common resource area.[2]

Conservation Practice. A specific treatment, such as a structural or vegetative measure, or management technique, commonly used to meet specific needs in planning and implementing conservation, for which standards and specifications have been developed.[2]

Conservation Practices Physical Effects (CPPE) matrix. The matrix in the FOTG, Section V, that gives the physical effects of many conservation practices on soil, water, air, plants, and animals.[2]

Conservation Practice Standards. National standards commonly used by NRCS to treat natural resource problems. Each practice standard includes the following components: name, unit of measurement, code number, definition, purpose, condition where practice applies, criteria, considerations, plans and specifications, and operation and maintenance.[4]

Council on Environmental Quality (CEQ). A three-member council appointed by the President that reviews and appraises the various programs and activities of the Federal Government to ensure they are in compliance with NEPA.[5]

Critical habitat. Specific geographic areas, whether occupied by listed species or not, that are determined to be essential for the conservation and management of listed species, and that have been formally described in the Federal Register.[3]

Cumulative Effects. 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 action (40 CFR § 1508.7).[1] See Types of Cumulative Effects.

Cumulative Effects Analysis. A procedure with an objective to account for the full range of consequences from proposed actions. The process will involve assumptions and uncertainties but must be conducted with the best techniques and data available.[1]

Direct effects. Caused by a proposed action that occurs at the same time and place.[6]

Ecosystem. Dynamic and interrelating complex of plant and animal communities and associated nonliving (e.g. physical and chemical) environment.[3]

Endangered. The classification provided to an animal or plant in danger of extinction within the foreseeable future throughout all or a significant portion of its range.[3]

Endangered Species Act of 1973, as amended (ESA). Federal legislation intended to provide a means whereby the ecosystems upon which endangered and threatened species depend may be conserved, and provide programs for the conservation of those species, thus preventing extinction of native plants and animals.[3]

Environmental Assessment (EA). A concise public document that briefly provides sufficient evidence and analysis for determining whether to prepare an environmental impact statement or finding of no significant impact.[2]

Environmental Evaluation (EE). A concurrent part of the planning process in which the potential long-term and short-term impacts of an action on people, their physical or social surroundings, and nature are evaluated and alternative actions explored.[2]

Environmental Impact Statement (EIS). A document detailing the environmental impact of a proposed law, construction project, or other major action that may significantly affect the quality of the environment. EIS's are required by the National Environmental Policy Act (NEPA) and various state environmental laws.[2]

Field Office Technical Guide (FOTG). The official NRCS guidelines, criteria, and standards for planning and applying conservation treatments.[2]

Impacts. The difference between the anticipated effects of alternative treatment in comparison to existing or benchmark condition effects. Differences may be expressed by narrative, quantitative, visual, or other means. Impacts are used as a basis for making informed conservation decisions.[2]

Indicator. The description or measurement of a resource concern that, when observed periodically, indicates or demonstrates trends. Directly linked to indicators are target values which identify a specific quantitative or qualitative estimate for the desired state of the resource concern.

Indirect effects. Caused by a proposed action that occurs later in time or is further removed in distance.[6]

Long-term Impacts. Impacts that occur during or after an action and may take the form of delayed changes or changes resulting from the cumulative effects of many individual actions.[8]

Minimizing Significant Cumulative Effects. Avoiding, altering or mitigating adverse effects by modifying, eliminating or adding alternatives to the proposed actions. Mitigation involves applying treatment to counter significant effects from applied actions.[1]

National Environmental Policy Act (NEPA). The 1970 Act that requires federal agencies to consider the effects on the environment of proposed federal actions. This Act established the requirement for conducting environmental evaluations and for the preparation of environmental assessments and environmental impact statements.[2]

Proposed species. Any species of fish, wildlife, or plant that is proposed in the Federal Register to be listed under Section 4 of the Endangered Species Act.[3]

Resource Management System (RMS). A conservation system that meets or exceeds the quality criteria in the FOTG for resource sustainability for all identified resource concerns for soil, water, air, plants and animals.[2]

Scoping. The early, up-front and open process to determine the extent of the significant issues, such as resource problems and concerns, regulatory requirements, etc., to be addressed in the planning process. The process determines 1) whether the resources, ecosystems and human communities have already been affected by past or present activities and 2) whether other agencies or the public have plans that may affect the resources in the future.[2]

Short-term Impacts. Temporary changes occurring during or immediately following an action and usually persisting for a short while.[8]

Target value. Identifies a specific value to be used in conjunction with an indicator.

Threatened. The classification provided to an animal or plant likely to become endangered within the foreseeable future throughout all or a significant portion of its range.[3]

Threshold. The status or quality of a condition tied to a spatial and temporal scale where effects from a proposed action are anticipated to have a conspicuous or evident beneficial or adverse impact on a resource, ecosystem or human community. The impact is usually scientifically or legally based. Example: Clearing of riparian vegetation over the next 5 years on a 25,000-acre watershed is anticipated to increase water temperatures above the upper limit for a cold-water fishery (acceptable range is 5 to 18^{o}C).[1]

Tiering. Refers to the coverage of general matters in broader environmental impact statements (i.e. national policy statements) with subsequent narrower statements or environmental analysis (i.e. basinwide program statements) incorporating by reference the general discussions and concentrating solely on the issues specific to statement subsequently prepared.[6]

Types of Cumulative Effects (Types 1, 2, 3 and 4).[1]

- Type 1 - Repeated "additive" effects from a single proposed project, e.g., construction of a new road through a national park resulting in continual draining of road salt onto nearby vegetation.
- Type 2 - Stressors (e.g., substance, compound or material) from a single source that interacts with receiving organisms to have an "interactive" net effect, e.g., toxic compounds that build up disproportionately at higher levels within food chains.
- Type 3 - Effects arising from multiple sources that affect environmental resources additively, e.g., agricultural irrigation throughout a community that draws down a groundwater aquifer.
- Type 4 - Effects arising from multiple sources that affect environmental resources in a countervailing or synergistic fashion, e.g., discharges of nutrients and heated water to a river that cause an algal bloom and subsequent loss of dissolved oxygen that is greater than the additive effects of either pollutant.

[1]CEQ 1997
[2]NRCS 2002
[3]USF&WS 2001
[4]NRCS 1992
[5]U.S. Congress 1970
[6]NRCS 2001a
[7]NRCS 2000b
[8]USPS 1991