The Effects Pathway: Consequences and Determination

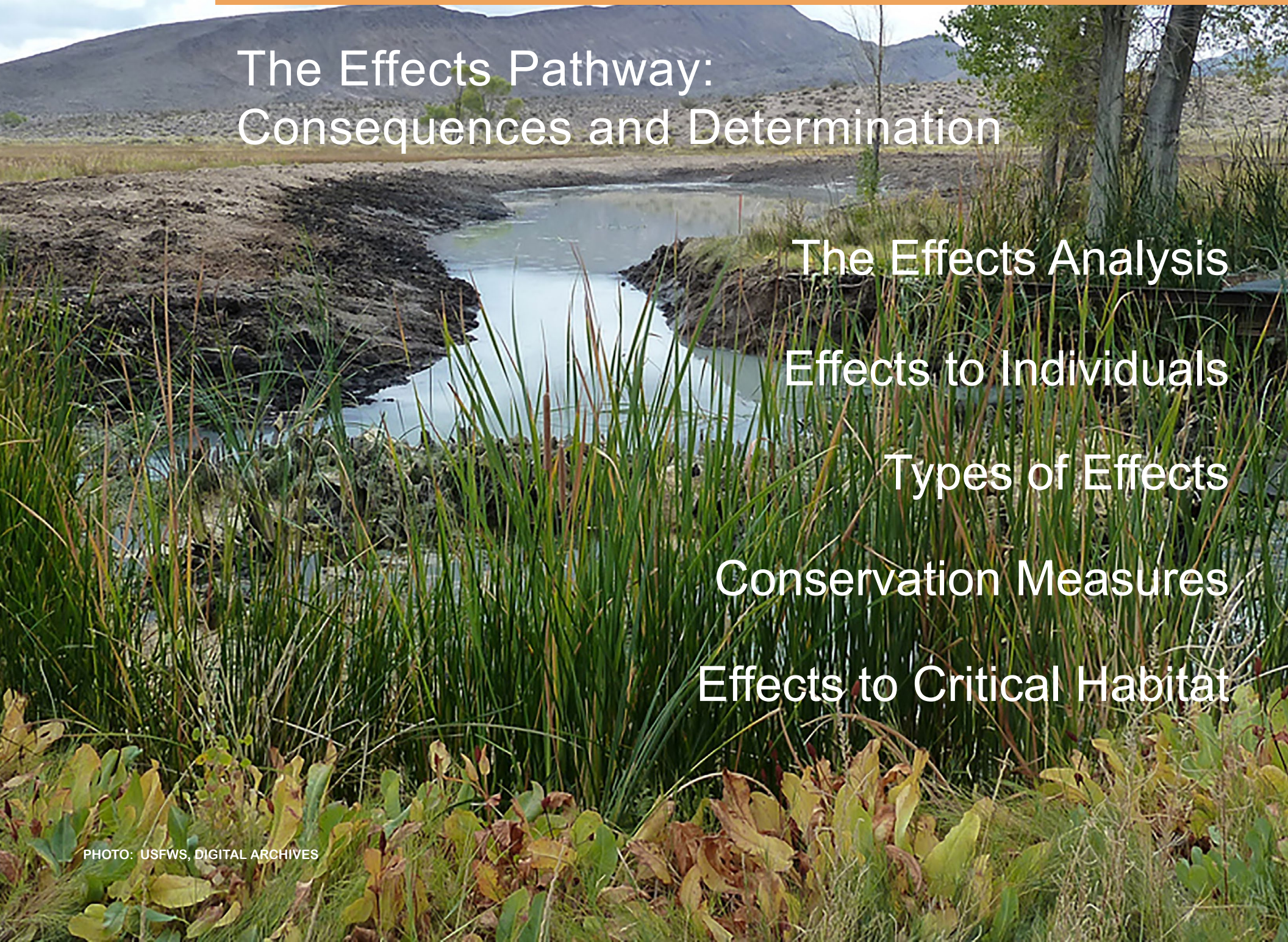
The Effects Analysis

Effects to Individuals

Types of Effects

Conservation Measures

Effects to Critical Habitat



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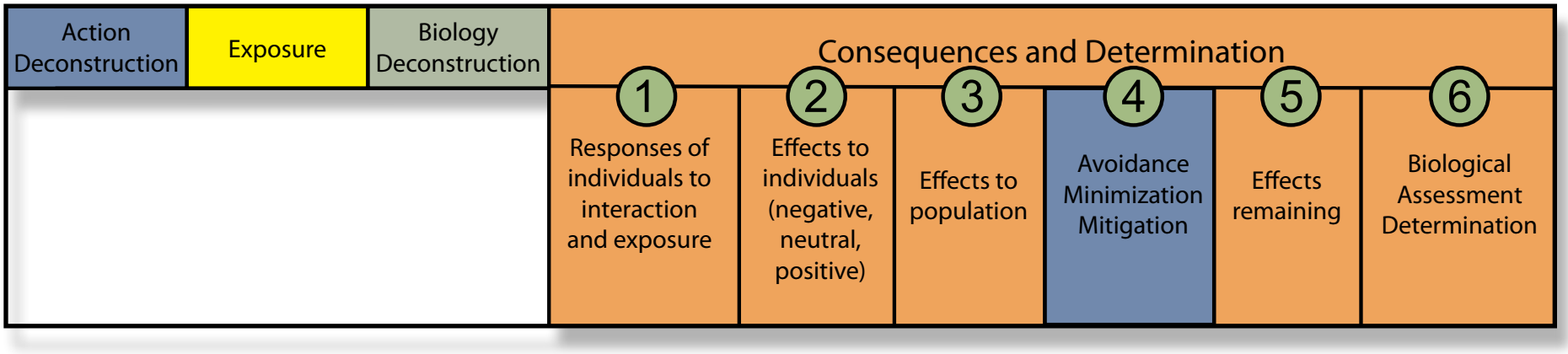
WHAT YOU'LL LEARN

Once deconstruction of the action and biology has occurred and exposure has been identified, it is time to move on to analyzing the potential responses of individuals to the stressors identified. This is where all of your previous work comes together.

In short, in this segment of the process first you determine the consequences of the action on the individuals. If you remember the whole effects pathway – this is the final segment.



In this document, you will learn how to 1) analyze the *responses* of individuals to a stressor, and how those responses result in 2) *effects* to individuals and 3) populations. You can then identify 4) avoidance/minimization/mitigation measures which could 5) avoid or reduce those effects; and finally, you will make a 6) determination of effects for this species for your biological assessment.

You are finishing up assembling the pieces that you need to create your draft BA – step 7 in the Section 7 Structured Coordination Process.

It's important to understand that eventually, the Services will need to establish the various causal links that will be used to support their determinations at the listed entity scale in their Biological Opinion.

Your work in developing your BA is critical. Failure to create and support any of these causal links may result in an inaccurate effects analysis, resulting in additional consequences to the species (and legal risk to all of us!).

Remember during the development of the Biological Assessment, the Services are there to assist you (the Action Agency).

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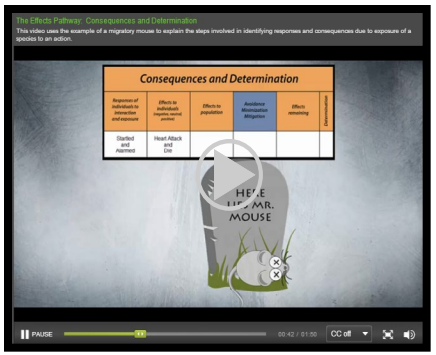
RESPONSES AND EFFECTS



Let's look at a quick example to get a better understanding of what we're doing here. Click on the image on the right to see the process play out.

BUT JUST ONE MINUTE! In this video you only see the direct effect to the mice from the blasting.

Could there be indirect effects? What if when the mice return, they find their entire breeding habitat gone? The stressor, increased noise, could be avoided, but the mice are also exposed to the stressor, reduced vegetative cover, when they return. The video only demonstrates the stressor noise, but in reality, don't forget that you would need to evaluate all stressors across the entire Effects Pathway Matrix.

Analysis like this is why the description of the Action and Action Area sometimes changes late in BA development, and also this is how we can ensure that all Conservation Measures (BMPs, etc.) are MEANINGFUL (and not just something we add "because we have always done it this way".)

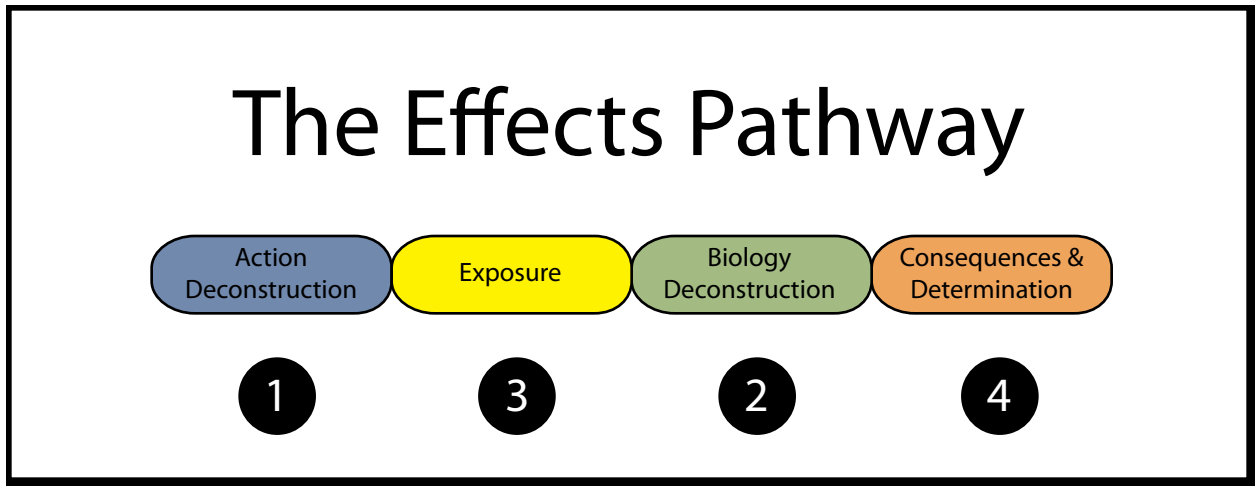
If, in this example, there were no opportunities to avoid exposure or minimize it (like blast only once, or use smaller charges, reducing the frequency or intensity of exposure to the stressor, "increase in noise"), what would you propose to OFFSET the loss of individuals (that would be a mitigation component that is added back into the Description of the Action up front)? Think about that for now. The rest of this document is going to show you how to do this analysis and give you some tips and hints to do it well.

EFFECTS ANALYSIS

In this step of The Effects Pathway you are completing your EFFECTS ANALYSIS.

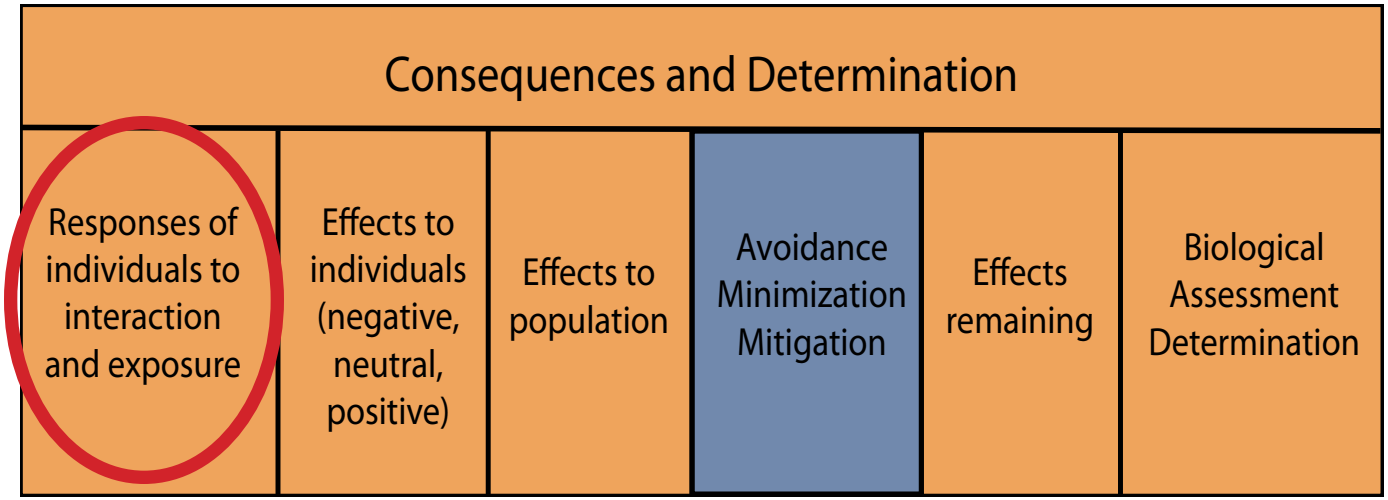
In the previous step in The Effects Pathway (Exposure), you established which individuals or resources are likely to be **EXPOSED** to the stressors caused by your proposed action.

Remember, earlier we defined effects as a response by individuals or resources to stressors. The effects analysis is based on that previous work and can be segmented into a two-step process**,** **response** and **effects**. You first determine how individuals or resources will **RESPOND** to being exposured to a stressor; and second, decide what **EFFECT** results from that **response**.
So let's go over the steps involved in completing this analysis. We'll be using the Effects Pathway Matrix as we go along and we will continue to build upon our previous work.

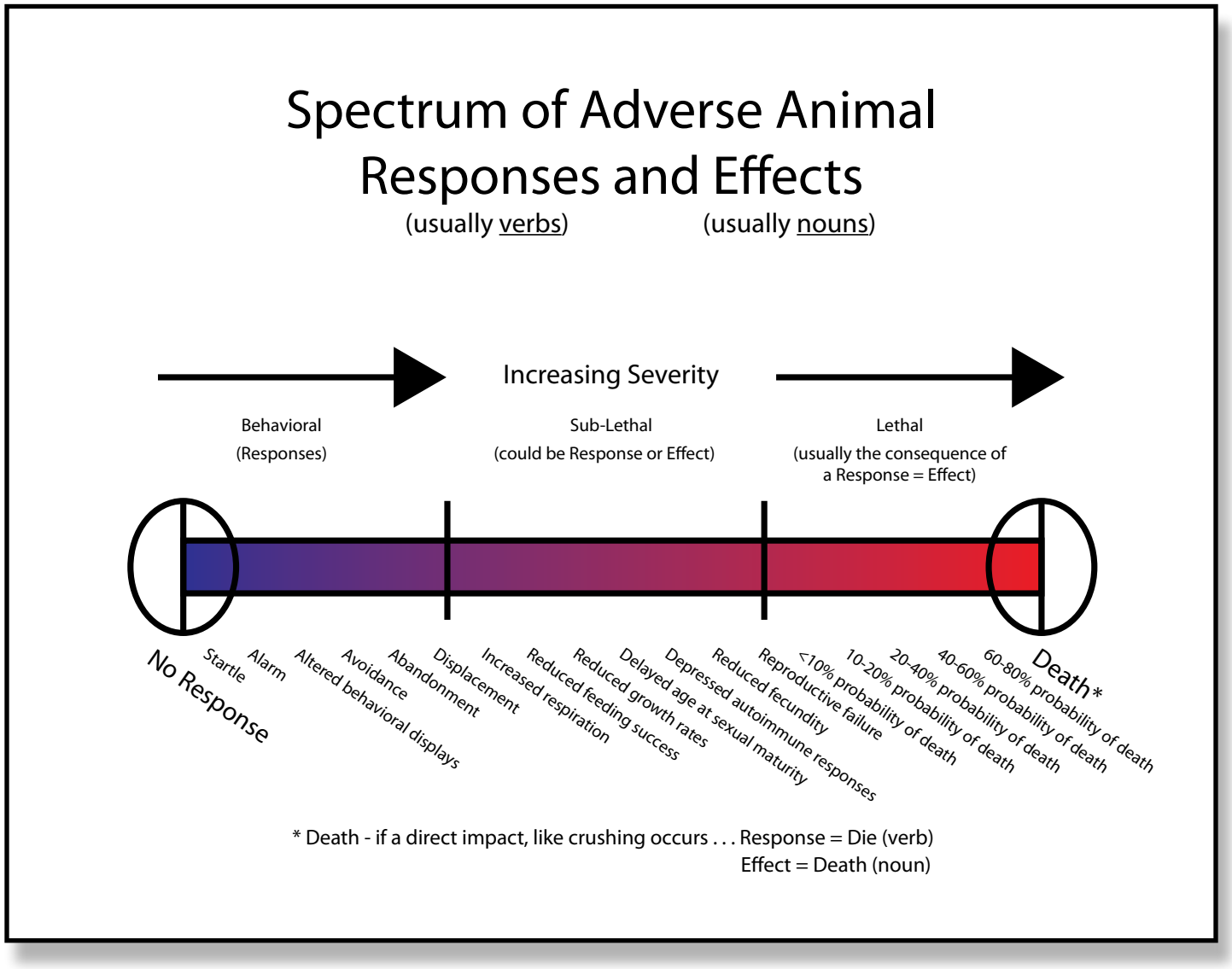


STEP 1: DETERMINING RESPONSES

This portion of our pathway is set up so that it shows you the steps you should follow – in order. Your first task is to identify the responses of individuals to the exposure you identified earlier.



When thinking about adverse responses, it can be helpful to consider them as a continuum, with one side of the continuum milder responses, such as “startle” and “avoidance,” and the opposite side representing more severe responses, up to “death.” Another way to think of this is for one side to represent sub-lethal responses and the opposite end representing lethal responses.



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This chart shows the continuum. In thinking back to our mouse earlier, remember that its initial response was to startle. Individuals can have more than one response to a stressor, so think carefully about how the species or its resources respond.

The chart is available here as a PDF you can download. This is one document you'll definitely want to keep – you'll find it very useful whenever you are working on a BA.

A species response to a stressor can be expressed in any one of a number of ways:

- Behavioral – alert, startle, flush, flee or avoid (staying away from the stimulus).
- Physiological – hormone disruptors in wastewater that impair reproduction or alter the sex of individuals (a physical expression of a physio-change).
- Physical – bodily injury; or altering a component or habitat (e.g., removing forage plants).

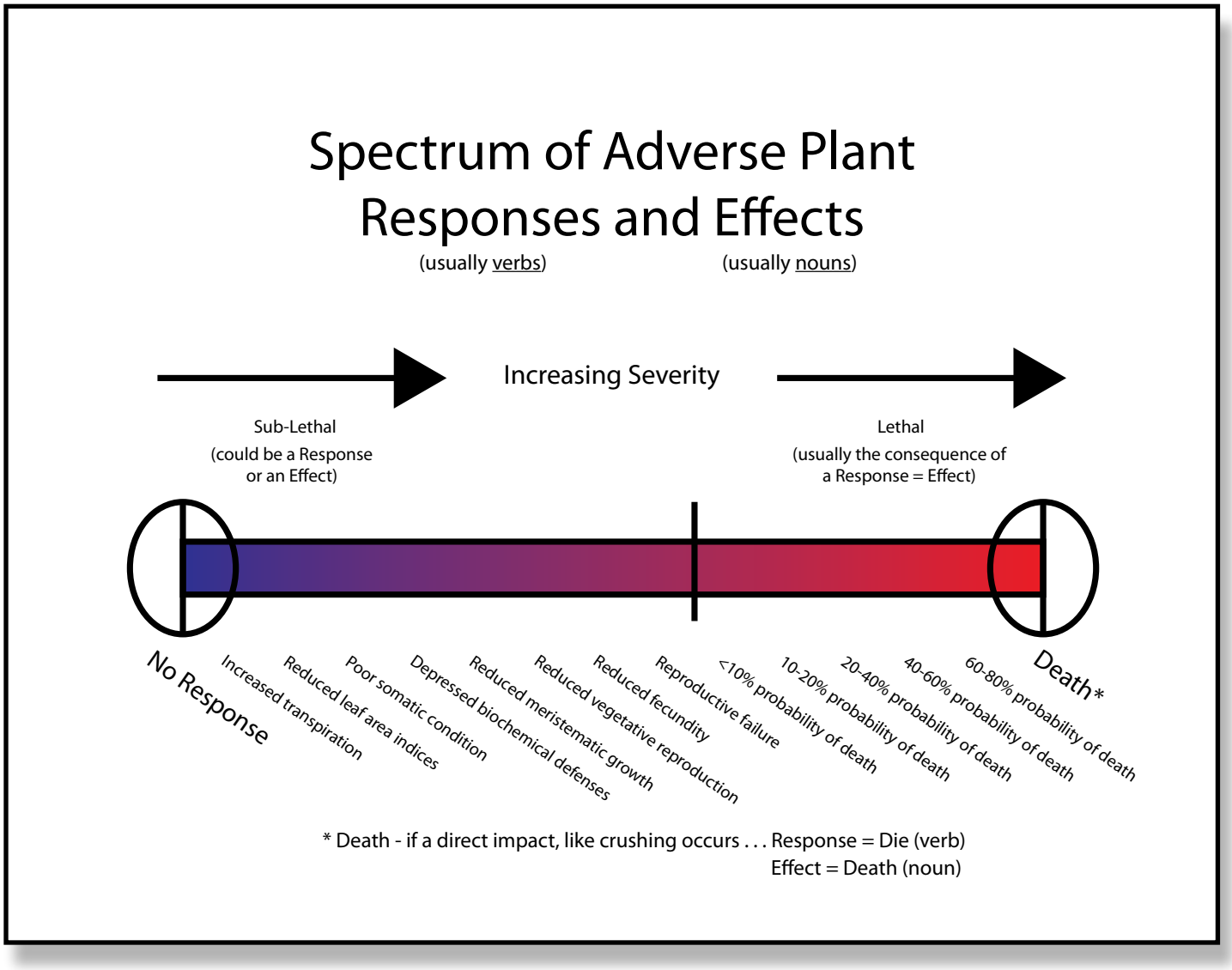
PHOTO: RHONDA FOLEY, USFWS

PHOTO: USFWS DIGITAL ARCHIVES

Remember, the interactions can either be DIRECT or INDIRECT!

And even though we've mainly focused on animals up to this point, don't forget that plants may also be included in your BA.

If you have some that need to be analyzed, this chart provides the same type of information and can be helpful.



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SO, WHAT DO YOU LOOK FOR?

With habitat-based analyses of animals, look for a species' response to things such as:

- Reductions in habitat quantity and/or quality
- Reductions in resource availability
- Landscape fragmentation and barriers to movement
- Disruption of ecological processes that maintain particular resources
- Changes in habitat conditions that benefit competitors
- Introduction of organisms that compete for resources

PHOTO: GEORGE GENTRY, USFWS

Some of the specific responses we see are the result of changes in habitat fragmentation and barriers to movement and disruptions of ecological process of importance to the listed resource of concern.

It's also important that we look for responses to changes that are less intuitive (or direct), such as changes to habitat conditions that benefit competitors or are detrimental to beneficial organisms (e.g., host species).

For habitat-based analyses, there's an extra step of having to establish that causal link between changes in habitat quantity, quality, and availability, and a response of individuals of the listed species. This differs from critical habitat analyses in that there is no need to establish this causal relationship.

USING THE EFFECTS PATHWAY MATRIX

At this point, if you have been following along with the previous Effects Pathway eMags, you have a copy of the Matrix. You should pull that out and fill in the "Responses of individuals to interaction and exposure" column (the first ORANGE colored column) for each of the stressors you identified in the EXPOSURE section.

If you remember, we had been using "Mechanical removal of vegetation" as our example. Here is a small sample of what it would look like, adding in the species' response.

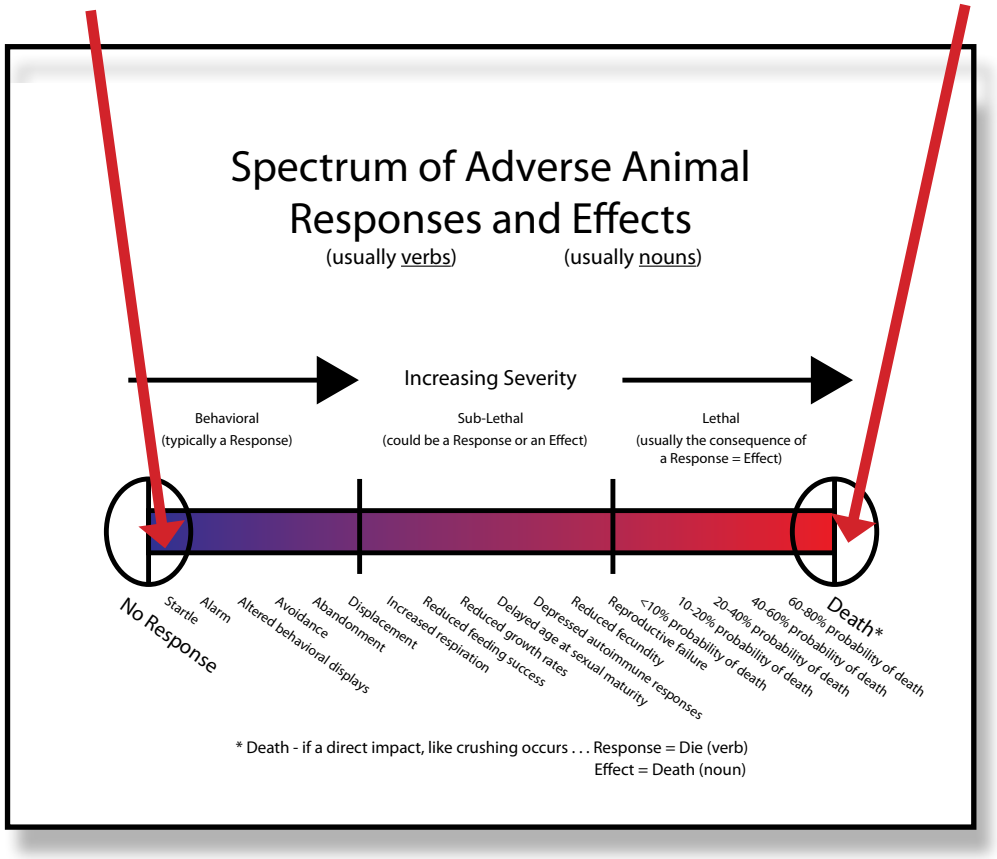
Action Deconstruction				Exposure		Biology Deconstruction				
Project	Activity	Activity	Structure	DIRECT Interaction (vehicle strike, crushing, trampling, etc.)	Indirect interaction A change in the environment that results in a resource quantity or quality change (negative, neutral, positive)	Resource or Individuals Directly Exposed	Life stage affected (of the species)	Resource Functions of the Resource (Breeding, Feeding, Sheltering, Migration/Dispersa	Responses of individuals to interaction and exposure	Effec ndivi negative, posit
Bridge Replacement	Clearing the construction site	Mechanical removal of vegetation	(None)	Crushing foraging frogs		Individual frogs	Juveniles Adults		Individual frogs killed	
					Decrease in insects (negative)	Insect prey	Juveniles Adults	Feeding	Abandonment Displacement Reduced feeding success	
					Loss of vegetative cover (negative)	Riparian and emergent vegetation	Larva	Feeding Sheltering	Abandonment Displacement Reduced feeding success	
							Juveniles Adults	Sheltering Migration/Dispersa	Abandonment Displacement	
						Overhanging willows	Juveniles Adults	Sheltering Migration/Dispersa	Abandonment Displacement	
						Blackberry thicket	Juveniles Adults	Sheltering Migration/Dispersa	Abandonment Displacement	
					Increase in water temperature (negative)	Cool oxygenated water (temperature x to x)	Eggs	Sheltering	Individuals killed	
							Larva	Sheltering	Abandonment Displacement Increased respiration	
							Juveniles	Sheltering	Abandonment Displacement Increased respiration Increased disease	
							Adults	Sheltering	Abandonment Displacement Increased respiration Increased disease	

<< -- DOWNLOAD BLANK MATRIX -- >>

STEP 2: IDENTIFY EFFECTS TO INDIVIDUALS

Remember, an EFFECT is any response from being exposed to a stressor, and the individual's response leads to an EFFECT.

MOUSE STARTLES (RESPONSE) ---------->>>>> MOUSE DIES (EFFECT)



Use the right hand terms on this chart for identifying effects to individuals.

TYPES OF EFFECTS

Remember that we cannot jump from the Action to a Consequence – "building a road kills frogs". Going back to what the regulations say needs to be included to initiate formal consultation (50 CFR 402.14), we need to make sure that all aspects of effects are considered.

This includes Direct Effects, Indirect Effects, the Effects of Interrelated and Interdependent actions (which were also the effects to determine your action area), and Cumulative Effects.

So let's look at each of these a little closer to make sure we are considering them as we work through our Effects Pathway.

PHOTO: NRCS/USDA

Direct Effects	Occur during action implementation
Indirect Effects	1. caused by the action; 2. later in time; and 3. reasonably certain to occur
Interrelated Actions	Other actions that would not occur BUT FOR a larger action
Interdependent Actions	All other actions that would not occur BUT FOR the action under consideration
Cumulative Effects	Effects of FUTURE non-federal activities reasonably certain to occur in the action area

Of course, some of these terms have slightly different meanings in the Endangered Species Act and NEPA – we've included them here so you can see the differences.

Effect Type	ESA	NEPA
Direct	Effects occurring DURING action implementation	Effects occurring ON SITE (in project footprint)
Indirect	Effects occurring LATER IN TIME	Effects occurring SEPARATE IN TIME AND/OR SPACE FROM THE ACTIVITY
Cumulative Effects	FUTURE State, private, and NON-FEDERAL activities that are reasonably certain to occur within the action area.	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 UNDERTAKES THEM.

WHAT IS MEANT BY "BUT FOR"?
(under Interrelated and Interdependent Actions)

Here is an example to help you understand:

A housing development planned in endangered species habitat has an access road to it. The access road goes through a wetland, which requires a Clean Water Act 404 permit from the U.S. Army Corps of Engineers (Corps). The Services must consider the effects of the larger action (housing development) when it analyzes the effects of the permitted action (fill of Corps jurisdictional wetlands).

So remember, you're analyzing for all of these types of effects. Since you've already clearly described and deconstructed the action, identified the stressors associated with each of the action's components, and identified responses of individuals, your effects analysis should naturally flow out of all of this work you've done. You may find that you have already included direct, indirect, and cumulative effects. Your BA does NOT need to have separate sections on each effect type - they are only called out here to ensure you have considered all aspects of potential effects in your thought processes.

And remember - don't forget to include BENEFICIAL effects of your activities in your BA!

Here are some examples of beneficial effects:

Beneficial Effects (Animals)

- Increased feeding rates
- Increased growth rates
- Increased birth rates and fecundity schedules
- Increased reproductive lifespan
- Increased recruitment into all life stages
- Increased survival rates
- Recolonization of extirpated sites
- Increase in the number of populations and subpopulations
- Increased connectivity between population segments
- Decrease energy expenditure
- Increase energy intake
- Increased fitness
- Increased survival
- Increased sheltering
- Decreased respiration

Beneficial Effects (Plants)

- Increased leaf area indices
- Improved somatic condition
- Increased meristematic growth
- Increased vegetative reproduction
- Increased fecundity
- Increased survival rates
- Recolonization of extirpated sites
- Increase in the number of populations and subpopulations
- Increased connectivity between population segments

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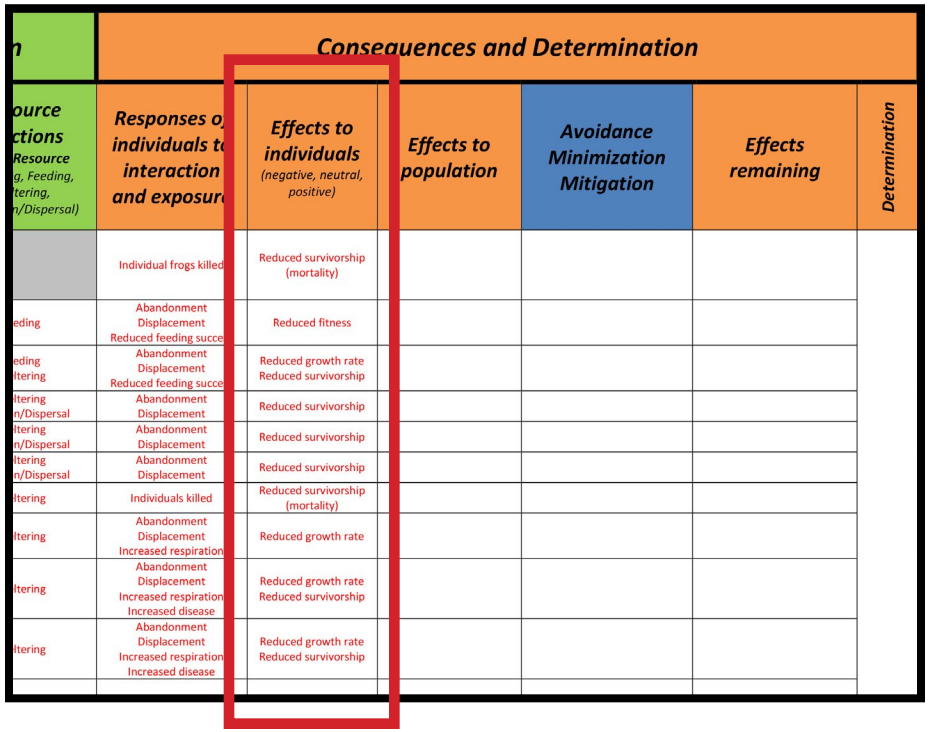
Factors to consider in your analysis:

- Proximity of the action to listed species
- Proximity of the effects to listed species
- Distribution of species and habitat use
- Timing of stressors
- Duration of stressors
- Type of stressors
- Frequency, intensity, severity of stressors

Even though these factors are not each specifically identified in the Effects Pathway Matrix, you should include them in your narratives. Understanding these factors could help you develop Best Management Practices to avoid or minimize effects. These are the details that support your conclusions!

Let's go back to our sample Matrix. You can see how the next column (Effect to individuals) gets completed.



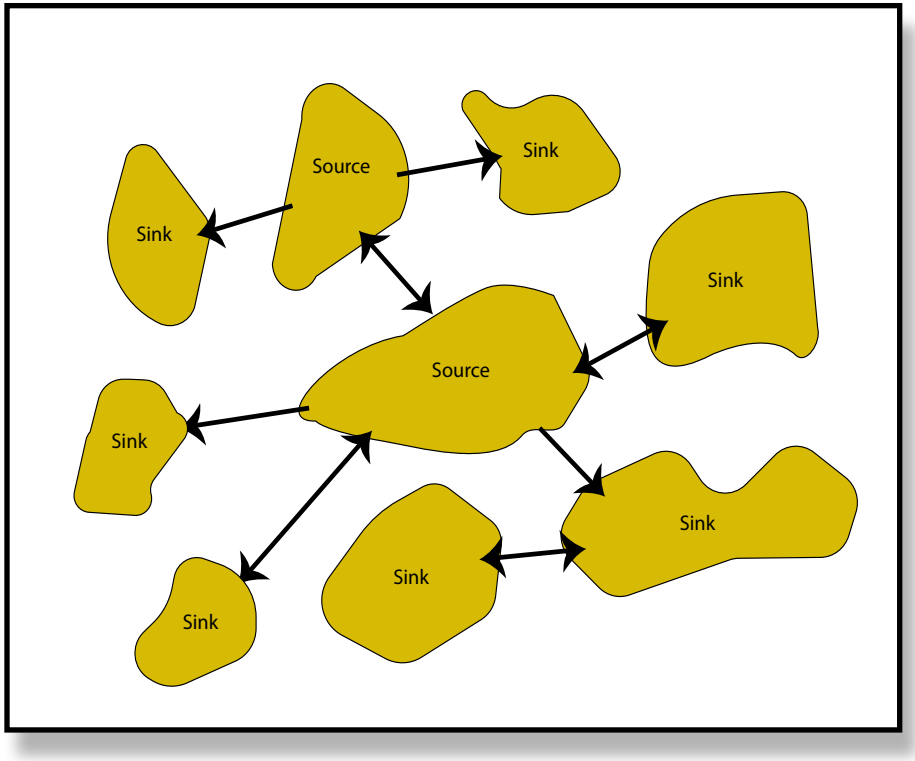
	Consequences and Determination					
ource ctions Resource g, Feeding, tering, n/Dispersal)	Responses o individuals t interaction and exposur	Effects to individuals (negative, neutral, positive)	Effects to population	Avoidance Minimization Mitigation	Effects remaining	Determination
	Individual frogs killed	Reduced survivorship (mortality)				
eding	Abandonment Displacement Reduced feeding succe	Reduced fitness				
eding ltering	Abandonment Displacement Reduced feeding succe	Reduced growth rate Reduced survivorship				
ltering n/Dispersal	Abandonment Displacement	Reduced survivorship				
ltering n/Dispersal	Abandonment Displacement	Reduced survivorship				
ltering n/Dispersal	Abandonment Displacement	Reduced survivorship				
ltering	Individuals killed	Reduced survivorship (mortality)				
ltering	Abandonment Displacement Increased respiration	Reduced growth rate				
ltering	Abandonment Displacement Increased respiration Increased disease	Reduced growth rate Reduced survivorship				
ltering	Abandonment Displacement Increased respiration Increased disease	Reduced growth rate Reduced survivorship				

STEP 3: IDENTIFY EFFECTS ON POPULATIONS

You've identified the potential responses of, and effects to, individuals, but the job is not done. If your action area covers an entire population (geographically) you will need to analyze population-level effects. Most BAs, however, do not encompass an entire population. As stated earlier, the Services will need to establish the various causal links that will be used to support its determination at the listed entity scale in their Biological Opinion. They will still need to translate individual responses to potential population and species-level responses (into terms that relate to population ecology) in the Biological Opinion (if it is a Formal Consultation).

Since you will be working with the Services in drafting your BA, discuss population and species effects with them. Any initial work you can do, and any information you can provide about potential effects will be helpful.

Think back to when you did your biology deconstruction. One of the things you were encouraged to do back then was to look at the species population structure based upon known data. You may have developed a diagram like this showing segmented populations and migration corridors to explain interactions among occurrences and subpopulations.



What are the resources and/or circumstances (conditions) needed for populations to persist?

Does this activity impact those resources or conditions?

Remember to consider resiliency (the population's ability to bounce back after a stochastic event) and representation (the population's ability to adapt to changing environmental conditions).

Consider the resource needs and requirements/circumstances for the ***species*** to persist.

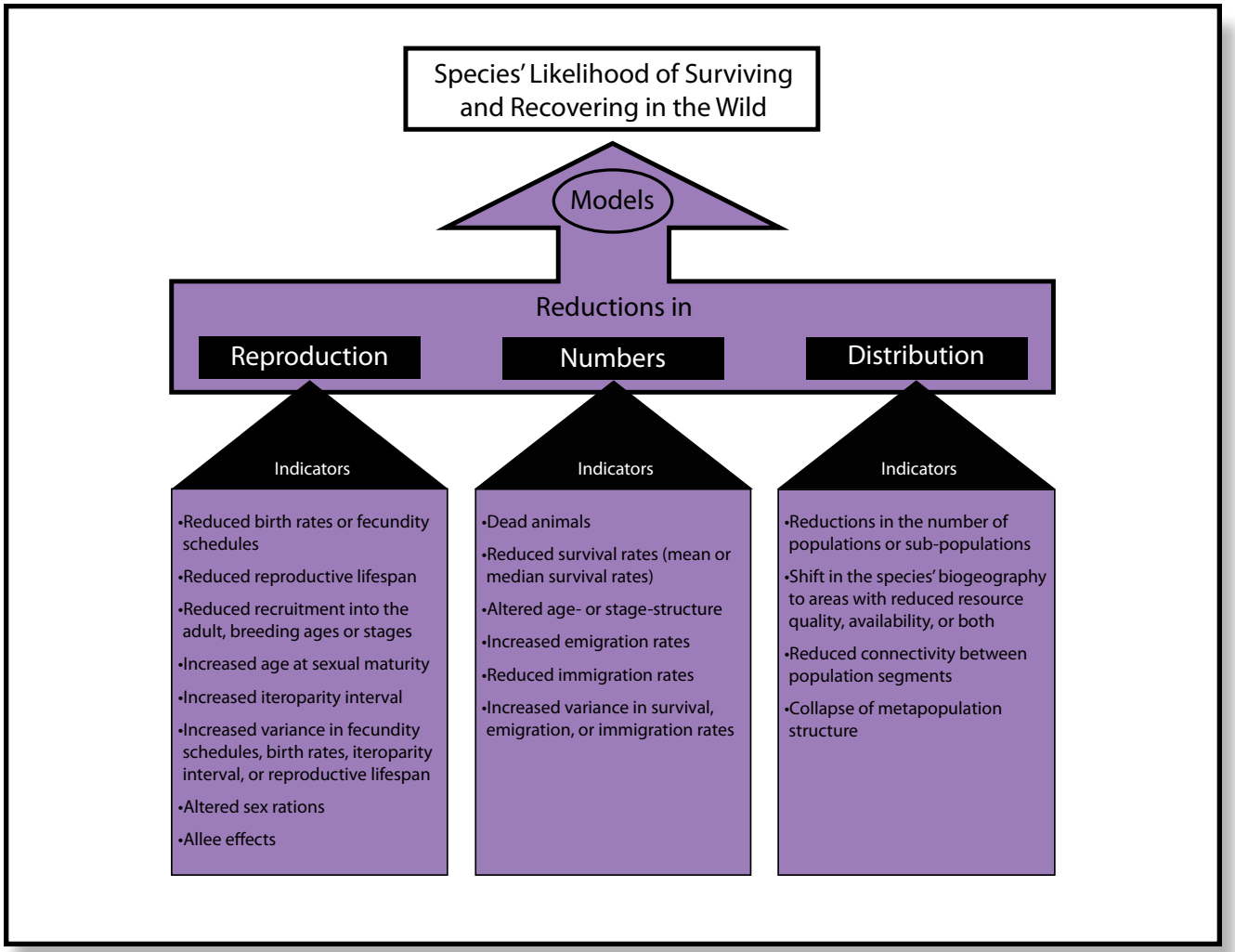
Consider resiliency, representation, and redundancy - these are referred to as the three Rs in population biology.

So, how do we know if a listed species or its designated critical habitat is "Affected" by an action?

Check out the chart on the next page.

PHOTO: PATRICK KOBERNUS, USFWS

If we see any of these indicators as a result of our activities, that tells us there could be reductions in Reproduction, Numbers, or Distribution. Notice that many of the terms used in this chart are also on the right side of the Adverse Response Continuum.



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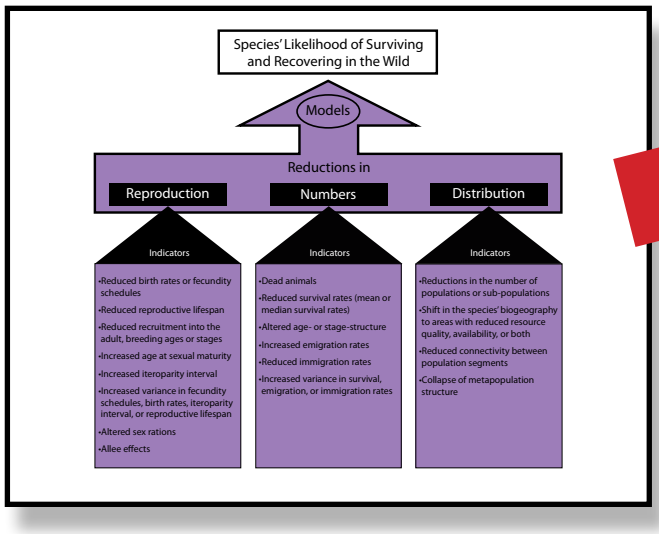
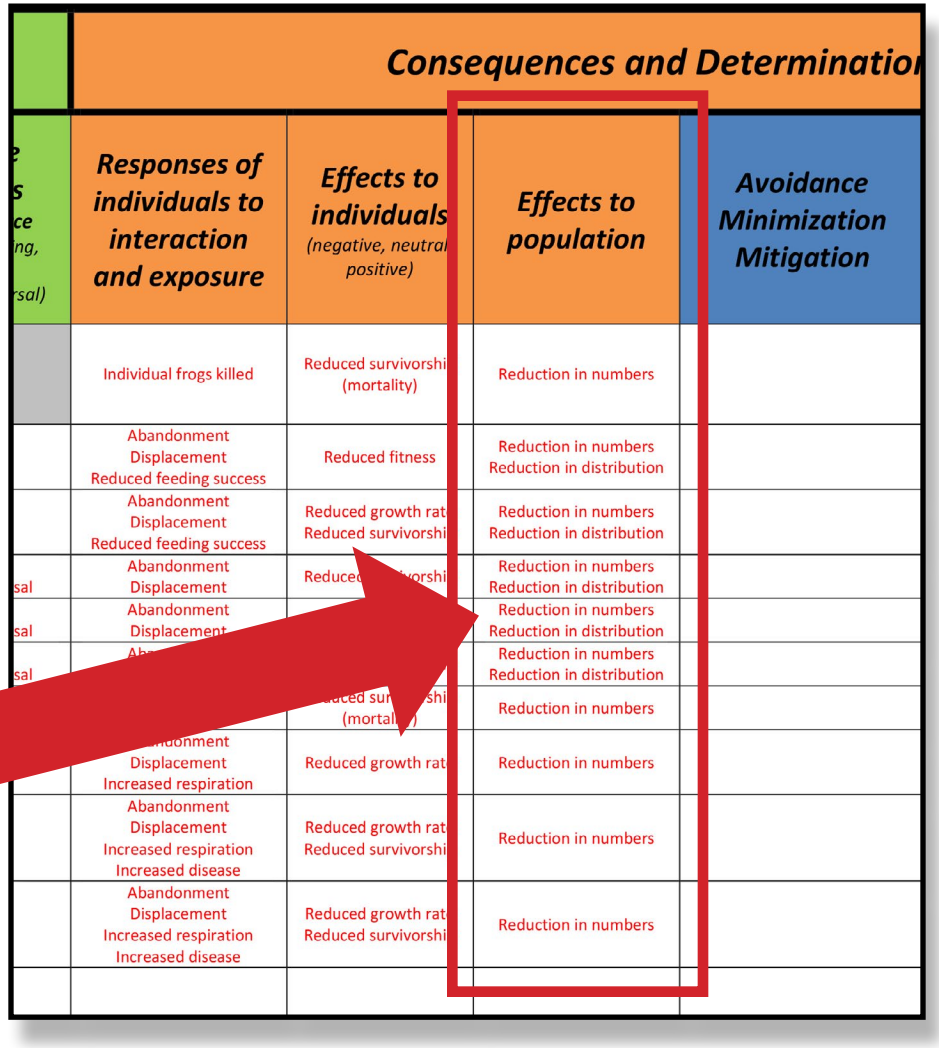
At this point, you want to make sure you are aware of these effects and are documenting them so you can include them in your BA. Again, you can see how this was done with our sample activity.





STEP 4: IDENTIFY AVOIDANCE, MINIMIZATION AND/OR MITIGATION MEASURES

This step also refers back to something you should have done (or at least started) earlier – when you were Describing the Action. You've identified how the individuals respond to the exposure and interactions and now it's time to look at ways to alleviate some of the negative consequences (if possible) on the individuals and population.

Remember that the Services are often discussing ways to reduce or avoid the adverse effects of an action on the listed species and its habitat; this part of consultation is a key to making the process function well. Going through the type of breakdown of actions and stressors you have done already will show where and how the species and habitat may be affected and greatly influence the protective measures that are developed.

Because no one can alter the way the individual and/or species responds to the stressors, you cannot base your analyses on how they MAY respond at some point in the future. You need to accept what the individuals usually do and work from there. But, you may be able to change the stressor so that it could generate a different type of exposure and maybe then, there could be no (or reduced) response.

Virtually every request for formal consultation will have some measures in it to avoid or reduce adverse impacts to the listed species and its critical habitat. Some may also include measures to offset adverse effects that cannot be avoided or reduced. These need to be considered in your BA to see if they would change the end result of the effects of any given activity.

All avoidance, minimization, and mitigation measures identified here need to be included back in your Description of the Action section. They are actions you plan to do, and your effects determination is dependent on their implementation. Oftentimes, this column becomes the basis for a monitoring plan during project activities.

Some questions to consider:

- What Physical or Biological Features (PBFs) have been identified for the species?
- Will Conservation Measures/Best Management Practices (BMPs) be incorporated to avoid or minimize exposure?
- If avoidance and/or minimization measures are not incorporated, what mitigation will be proposed to offset the effects?

HINT - Mitigation can be defined/interpreted differently, depending upon whom you are working with. If you work with the Corps of Engineers, avoidance and minimization are components of mitigation, followed by compensation for unavoidable impacts. Make sure when you toss around some of these terms, all parties are defining them the same way.

Conversations about conservation measures need to occur between the Services and Action Agencies. Here is a video which depicts an actual scenario of how cooperative conservation can work to ensure effects are minimized.

Here are some reminders:

- Say what you know and what you do not know.
- You cannot automatically assume that a proposed protective measure will work.
- Base your analysis on some previous experience or admit that you do not know whether the proposed protective measure will be effective.
- Don't forget Conservation Measures/BMPs and short- and long-term results for the Critical Habitat too (this is covered in more detail on the next page).
- All avoidance, minimization and mitigation actions need to be added back into the Description of the Action, deconstructed, and run through the effects pathway.

Enter conservation measures into the Matrix in the BLUE "Avoidance, Minimization, and Mitigation" column. Here is a segment of the Matrix:

Consequences and Determination				
Responses of individuals to interaction and exposure	***Effects to individuals*** *(negative, neutral, positive)*	***Effects to population***	***Avoidance Minimization Mitigation***	***re***
Individual frogs killed	Reduced survivorship (mortality)	Reduction in numbers	Qualified biologist surveys ahead of clearing and grubbing and moves frogs to suitable riparian habitat	
Abandonment Displacement Reduced feeding success	Reduced fitness	Reduction in numbers Reduction in distribution	Revegetation of area impacted (post-project)	
Abandonment Displacement Reduced feeding success	Reduced growth rate Reduced survivorship	Reduction in numbers Reduction in distribution	Avoid removing vegetation between April 1 and July 31	
Abandonment Displacement	Reduced survivorship	Reduction in numbers Reduction in distribution	Revegetation of area impacted (post-project)	
Abandonment Displacement	Reduced survivorship	Reduction in numbers Reduction in distribution	Obtain and restore 1 acre adjacent to dispersal corridor	
Abandonment Displacement	Reduced survivorship	Reduction in numbers Reduction in distribution	Obtain and restore 1 acre adjacent to dispersal corridor	
Individuals killed	Reduced survivorship (mortality)	Reduction in numbers	Avoid removing vegetation between April 1 and July 31	
Abandonment Displacement Increased respiration	Reduced growth rate	Reduction in numbers	Avoid removing vegetation between April 1 and July 31	
Abandonment Displacement Increased respiration Increased disease	Reduced growth rate Reduced survivorship	Reduction in numbers	Qualified biologist surveys ahead of clearing and grubbing and moves frogs to riparian habitat	
Abandonment Displacement Increased respiration Increased disease	Reduced growth rate Reduced survivorship	Reduction in numbers	Qualified biologist surveys ahead of clearing and grubbing and moves frogs to riparian habitat	

HOW DO I ANALYZE FOR EFFECTS TO CRITICAL HABITAT?

The first step is to analyze how the Physical and Biological Factors (PBFs) of critical habitat would be affected. Think about the various activities of the proposed action and clearly explain how these activities affect or do not affect each PBF. Based on these analyses, in the second step, you need to explain how the function and conservation role of the critical habitat will be influenced by the proposed action.

As an example, let's say that you have an area of critical habitat where the species conducts all its breeding activities. Therefore, the conservation role of that area is to provide breeding habitat. The PBF related to breeding is water flowing at a certain speed and depth for a particular period of the year. The proposed action would alter the shape of the stream such that the water flows deeper and faster.

Putting this in the terms you need to consider when analyzing effects to critical habitat, the PBF (a specific flow regime) and its function (providing suitable water flows for breeding) would be affected. Just as you do with the species, you then need to evaluate the intensity and the scale of these effects to gauge the overall effect on critical habitat. If more than one PBF is present, step through the same process with each element. Remember, you already identified the baseline condition of each PBF in your Action Area. Now, discuss how that will ***change***.

You need to consider all effects caused by your proposed action that will affect designated critical habitat. You should also be aware that an action occurring outside of critical habitat may affect PBFs within the critical habitat and these effects must also be considered. For example, consider a dam that is built outside of critical habitat but alters the flows of water within critical habitat.

Here's an example for you to see how it was done for one action:

Physical and Biological Features (Primary Constituent Element)	Baseline Condition and Quality (from Exercise 1)	Exposure to Stressors	Conservation Measures (Avoidance, Minimization, Mitigation)
1. Aquatic Breeding Habitat. Standing bodies of fresh water (with salinities less than 7.0 parts per thousand), including: natural and manmade (e.g., stock) ponds, slow-moving streams or pools within streams, and other ephemeral or permanent water bodies that typically become inundated during winter rains and hold water for a minimum of 20 weeks in all but the driest of years.	There are six manmade ponds within one mile of the project site, with salinities of 6.1 6.2, 6.2, 6.0, 6.7, and 6.4. Angie Creek has two off-channel pools 20' and 75' south of the bridge replacement site that could be used for breeding. Three ephemeral pools between Yvonne Road and the Wetlands hold water until August in all but the driest of years. Angie Creek is slow-moving south of the bridge site except during heavy rain events. Suitable breeding pools are found throughout the Laurietor Wetlands, particularly at the Angie Creek confluence.	• Increase in water temperature during construction • Change in salinity during construction (reduction? Increase?) • Increase in drying of ephemeral pools when vegetation is cleared for construction and restoration	Avoid construction activities in breeding habitat between February 1 and April 30. Minimize ground disturbance within 50' of aquatic breeding habitat between February 1 and April 30. Qualified biologist will monitor temperature, pH, turbidity of aquatic breeding habitat in action area during construction. Post-construction restoration to enhance existing aquatic breeding habitat between the Yvonne Road bridge and Laurietor wetlands. Long-term monitoring of restoration success criteria
2. Non-Breeding Aquatic Habitat. Freshwater and wetted riparian habitats, as described above, that may not hold water long enough for the subspecies to hatch and complete its aquatic life cycle but that do provide for shelter, foraging, predator avoidance, and aquatic dispersal for juvenile and adult California red-legged frogs. Other wetland habitats that would be considered to meet these elements include, but are not limited to: plunge pools within intermittent creeks; seeps; quiet water refugia during high water flows; and springs of sufficient flow to withstand the summer dry period.			
3. Upland Habitat. Upland areas adjacent to or surrounding breeding and non-breeding aquatic and riparian habitat up to a distance of 1 mile in most cases and comprised of various vegetational series such as grasslands, woodlands, wetland, or riparian plant species that provide the frog shelter, forage, and predator avoidance. Upland features are also essential in that they are needed to maintain the hydrologic, geographic, topographic, ecological, and edaphic features that support and surround the wetland or riparian habitat. These upland features contribute to the filling and drying of the wetland or riparian habitat and are responsible for maintaining suitable periods of pool inundation for larval frogs and their food sources, and provide breeding, non-breeding, feeding, and sheltering habitat for juvenile and adult frogs (e.g., shelter, shade, moisture,			

You complete this information for each of the PBFs that are present in your designated Action Area.

STEP 5: SPECIFY REMAINING EFFECTS

Based on the best science available, determine what effects remain after incorporating avoidance, minimization, and mitigation measures.

You need to incorporate this step into your BA because you will be making your final determinations based on the remaining effects.

You can see how this was done with our example for individuals.

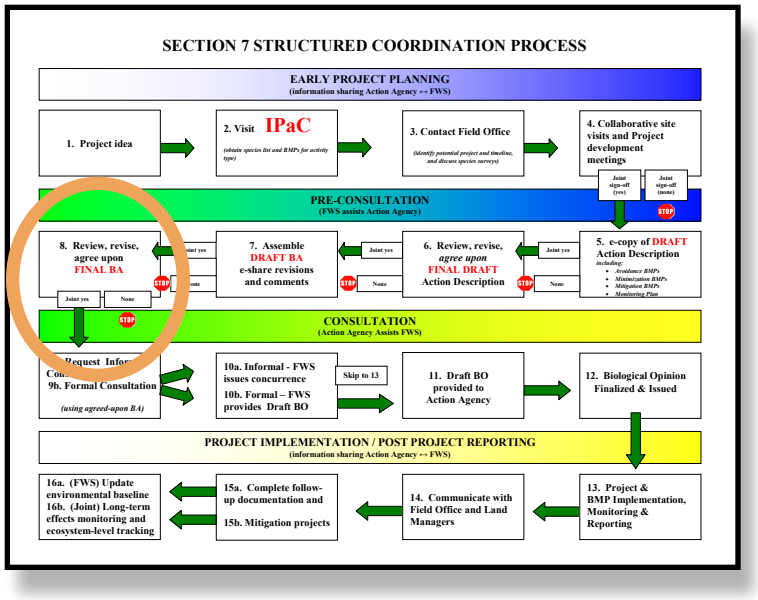
Action Deconstruction				Exposure		Biology Deconstruction			Consequences and Determination				
Project	Activity	Activity	Structure	DIRECT Interaction (vehicle strike, crushing, trampling, etc.)	Indirect interaction A change in the environment that results in a resource quantity or quality change (negative, neutral, positive)	Resource or Individuals Directly Exposed	Life stage affected (of the species)	Resource Functions of the Resource (Breeding, Feeding, Sheltering, Migration/Dispersal)	Responses of individuals to interaction and exposure	Effects to individuals (negative, neutral, positive)	Effects to population	Avoidance Minimization Mitigation	Effects remaining
Bridge Replacement	Clearing the construction site	Mechanical removal of vegetation	(None)	Crushing foraging frogs		Individual frogs	Juveniles Adults		Individual frogs killed	Reduced survivorship (mortality)	Reduction in numbers	Qualified biologist surveys ahead of clearing and grubbing and moves frogs to suitable riparian habitat	Stress to individuals from handling Introduction of individuals into competitor territories
					Decrease in insects (negative)	Insect prey	Juveniles Adults	Feeding	Abandonment Displacement Reduced feeding success	Reduced fitness	Reduction in numbers Reduction in distribution	Revegetation of area impacted (post-project)	Short-term loss of prey; long-term improvement in prey availabilty
					Loss of vegetative cover (negative)	Riparian and emergent vegetation	Larva	Feeding Sheltering	Abandonment Displacement Reduced feeding success	Reduced growth rate Reduced survivorship	Reduction in numbers Reduction in distribution	Avoid removing vegetation between April 1 and July 31	none
							Juveniles Adults	Sheltering Migration/Dispersal	Abandonment Displacement	Reduced survivorship	Reduction in numbers Reduction in distribution	Revegetation of area impacted (post-project)	Short-term loss of plant cover; long-term improvement in vegetation
						Overhanging willows	Juveniles Adults	Sheltering Migration/Dispersal	Abandonment Displacement	Reduced survivorship	Reduction in numbers Reduction in distribution	Obtain and restore 1 acre adjacent to dispersal corridor	Short-term loss of woodies; long-term improvement in suitable habitat size
						Blackberry thicket	Juveniles Adults	Sheltering Migration/Dispersal	Abandonment Displacement	Reduced survivorship	Reduction in numbers Reduction in distribution	Obtain and restore 1 acre adjacent to dispersal corridor	Short-term loss of woodies; long-term improvement in suitable habitat size
					Increase in water temperature (negative)	Cool oxygenated water (temperature x to x)	Eggs	Sheltering	Individuals killed	Reduced survivorship (mortality)	Reduction in numbers	Avoid removing vegetation between April 1 and July 31	none
							Larva	Sheltering	Abandonment Displacement Increased respiration	Reduced growth rate	Reduction in numbers	Avoid removing vegetation between April 1 and July 31	none
							Juveniles	Sheltering	Abandonment Displacement Increased respiration Increased disease	Reduced growth rate Reduced survivorship	Reduction in numbers	Qualified biologist surveys ahead of clearing and grubbing and moves frogs to riparian habitat	Stress to individuals from handling Introduction of individuals into competitor territories
							Adults	Sheltering	Abandonment Displacement Increased respiration Increased disease	Reduced growth rate Reduced survivorship	Reduction in numbers	Qualified biologist surveys ahead of clearing and grubbing and moves frogs to riparian habitat	Stress to individuals from handling Introduction of individuals into competitor territories

When determining the effects remaining after conservation measures have been implemented for Critical Habitat, it is often broken down into the short- and long-term consequences. It is very common to have short-term adverse effects with long-term beneficial effects, both of which need to be described.

Here is a sample. Again, you would complete this for each of the PBFs.

Physical and Biological Features (Primary Constituent Element)	Baseline Condition and Quality (from Exercise 1)	Exposure to Stressors	Conservation Measures (Avoidance, Minimization, Mitigation)	Consequences		Determination
				Short-term	Long-term	(NE, NLAA, LAA)
1. Aquatic Breeding Habitat. Standing bodies of fresh water (with salinities less than 7.0 parts per thousand), including: natural and manmade (e.g., stock) ponds, slow-moving streams or pools within streams, and other ephemeral or permanent water bodies that typically become inundated during winter rains and hold water for a minimum of 20 weeks in all but the driest of years.	There are six manmade ponds within one mile of the project site, with salinities of 6.1 6.2, 6.2, 6.0, 6.7, and 6.4. Angie Creek has two off-channel pools 20' and 75' south of the bridge replacement site that could be used for breeding. Three ephemeral pools between Yvonne Road and the Wetlands hold water until August in all but the driest of years. Angie Creek is slow-moving south of the bridge site except during heavy rain events. Suitable breeding pools are found throughout the Laurietor Wetlands, particularly at the Angie Creek confluence.	• Increase in water temperature during construction • Change in salinity during construction (reduction? Increase?) • Increase in drying of ephemeral pools when vegetation is cleared for construction and restoration	Avoid construction activities in breeding habitat between February 1 and April 30. Minimize ground disturbance within 50' of aquatic breeding habitat between February 1 and April 30. Qualified biologist will monitor temperature, pH, turbidity of aquatic breeding habitat in action area during construction. Post-construction restoration to enhance existing aquatic breeding habitat between the Yvonne Road bridge and Laurietor wetlands. Long-term monitoring of restoration success criteria	Aquatic breeding habitat will be disturbed between May and September due to construction. Salinity quality will decrease and ephemeral pools will dry as vegetation is removed. Avoidance measures will eliminate disturbance during egg deposition.	Existing aquatic breeding habitat will be restored and enhanced and three new pools will be incorporated into the restoration design.	
2. Non-Breeding Aquatic Habitat. Freshwater and wetted riparian habitats, as described above, that may not hold water long enough for the subspecies to hatch and complete its aquatic life cycle but that do provide for shelter, foraging, predator avoidance, and aquatic dispersal for juvenile and adult California red-legged frogs. Other wetland habitats that would be considered to meet these elements include, but are not limited to: plunge pools within intermittent creeks; seeps; quiet water refugia during high water flows; and springs of sufficient flow to withstand the summer dry period.						
3. Upland Habitat. Upland areas adjacent to or surrounding breeding and non-breeding aquatic and riparian habitat up to a distance of 1 mile in most cases and comprised of various vegetational series such as grasslands, woodlands, wetland, or riparian plant species that provide the frog shelter, forage, and predator avoidance. Upland features are also essential in that they are needed to maintain the hydrologic, geographic, topographic, ecological, and edaphic features that support and surround the wetland or riparian habitat. These upland features contribute to the filling and drying of the wetland or riparian habitat and are responsible for maintaining suitable periods of pool inundation for larval frogs and their food sources, and provide breeding, non-breeding, feeding, and sheltering habitat for juvenile and adult frogs (e.g., shelter, shade, moisture, cooler temperatures, a prey base, foraging opportunities, and areas for predator avoidance). Upland habitat should include structural features such as boulders, rocks and organic debris (e.g., downed trees, logs), as well as small mammal burrows and moist leaf litter.						
4. Dispersal Habitat. Accessible upland or riparian dispersal habitat within designated units and between occupied locations within a minimum of 1 mile of each other that allow for movement between such sites. Dispersal habitat includes various natural habitats and altered habitats such as agricultural fields, which do not contain barriers (e.g., heavily traveled road without bridges or culverts) to dispersal. Dispersal habitat does not include moderate- to high-density urban or industrial developments with large expanses of asphalt or concrete, nor does it include large reservoirs over 50 acres in size, or other areas that do not contain those features identified in PCE's 1, 2, or 3 as essential to the conservation of the subspecies.						

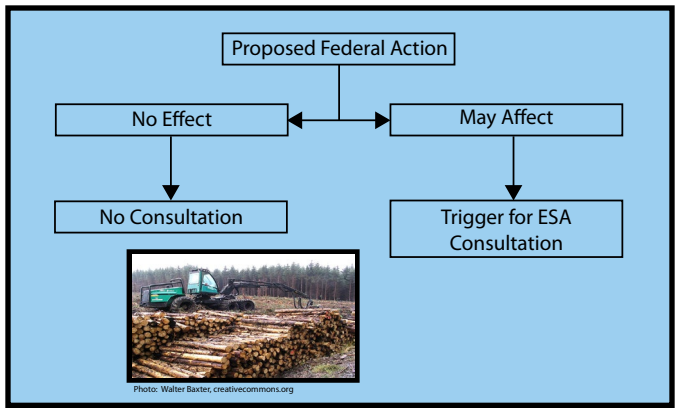
STEP 6: MAKE THE EFFECTS DETERMINATION



You have considered the consequences of the exposure of your species to the stressors from the action. You've worked your way through the Effects Pathway. That only leaves this final step – making the EFFECTS DETERMINATION. It is the last piece of information you need to write your Biological Assessment so that you can complete step 8 in the Section 7 Structured Coordination Process.

You're going to collectively evaluate the "Effects remaining" from the previous step to figure out your final determination.

Remember that if your proposed Federal action "may affect" listed species and or designated critical habitat, you need to consult.



But if you determine NO EFFECT, consultation is not required and you need to document the rationale for your determination for your records. This means, NO effect to even a single individual directly or indirectly or through effects to its habitat – this is a pretty high bar, but sometimes very appropriate based upon species' range or activity type, or after you have incorporated avoidance measures into your Biological Assessment.

Examples could include:

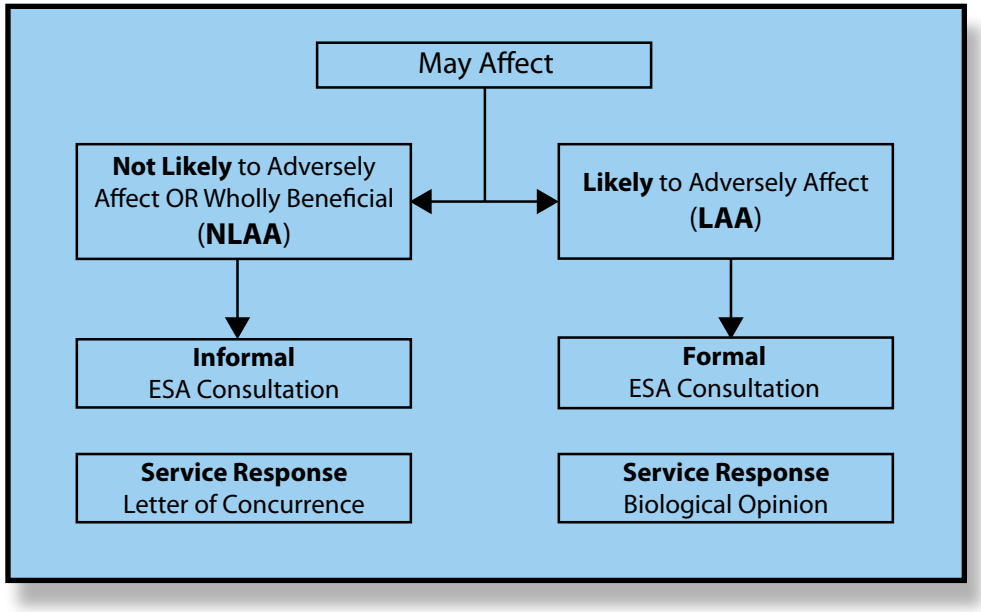
The project and effects are outside the range of the species. Lack of exposure is the easiest situation to make a no effect determination.

The species is not physiologically able to detect the effect. This is a more difficult situation. Is it truly that there is no effect? Or is it that there is no observable effect?

This means NO effect. None. Nada. Zilch. Sorry, we don't mean to be redundant here – but seriously, there must be NO effect. If the species or habitat is present in the action area, then it's possible that you may not be able to call it NO effect, because, if the species is present, what you do ***could*** affect it. These situations need to be carefully analyzed and the results documented in the project's files.

You have a Federal action that MAY AFFECT listed resources.

Your determinations could then be "May Affect, Not Likely to Adversely Affect" (NLAA) or "May Affect, Likely to Adversely Affect" (LAA).



This determination will impact the type of consultation and the Service Response.

DETERMINATIONS (MAY AFFECT):

May affect, Not Likely to Adversely Affect (NLAA)

If the total of all project effects to listed resources are **insignificant , discountable,** or **wholly beneficial** then the appropriate determination is NLAA.

- Insignificant: not able to be measured, detected, or evaluated.
- Discountable: effects that are extremely unlikely to occur.
- Wholly beneficial: no adverse effects

PHOTO: JASON ST. SAUVER, USFWS

May affect, Likely to Adversely Affect (LAA)

Adverse effects are those that negatively affect the species' breeding, feeding, migrating, or sheltering in some way (even for a short-term with long-term benefits that would improve the baseline). They are measurable, observable, and likely to occur. Adverse effects to Critical Habitat adversely affect the PBFs.

The chart on the next page will help you choose your determination. It includes definitions of key terms, necessary criteria, effects determination wording, outlines the appropriate action, and describes what the Service will do to respond.

Specific terms, definitions, criteria and wording for use in section 7 consultation documents.

Determination Category	Determination Sub - category	Criteria necessary for inclusion in category or sub-category	Effects Determination wording/phrase	Action Needed by Action Agency	Response from FWS
No Effect Definition - Proposed action will not affect listed species ---- **Or** ------	----------	"Action won't pose any effects to listed species or designated critical habitat." *(Remember that effects are measured at the individual scale not population scale. And don't forget to consider whether any effects could occur through an indirect mechanism e.g. changes to its habitat, etc.)*	No Effect (NE)	Document rationale for findings in project file	None
May Affect Definition - A proposed action that may pose any effect to listed species or designated critical habitat	**May affect - Not Likely to Adversely Affect (NLAA)** ------- **Or** ------	"Effects on listed species are expected to be discountable, insignificant or beneficial." Discountable = those effects that are extremely unlikely to occur. Based on best judgment a person would not expect discountable effects to occur Insignificant = based on best judgment, a person would not be able to meaningfully measure, detect, or evaluate insignificant effects. Insignificant effects should never reach the level where take* occurs Beneficial = are contemporaneous positive effects without any adverse effects *(even short term)* to the species	May affect - Not Likely to Adversely Affect (NLAA)	After informal consultation. discussions and preparation of a biological assessment on impacts to the species - request a concurrence letter from the FWS	If the FWS agrees with action agency's assessment and determinations - they issue a concurrence letter. If FWS does not concur, discussions and consultation between agencies continues
	May Affect - Likely to Adversely Affect (LAA)	Any adverse effect that is not insignificant or discountable *[see definitions above]*	May Affect - Likely to Adversely Affect (LAA)	Submit biological assessment and request formal consultation from the FWS	Issue a biological opinion, and if adverse effects are likely to result in Take* - issue an Incidental Take Statement with Terms and Conditions

* **Take** (Section 9 of the Act) is defined as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct". **Harm** is further defined by the Service (50 CFR, §17.3) to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. **Harass** is defined by the Service (50 CFR, §17.3) as an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering.

Examples to help you understand NLAA key terms:

Insignificant –

A project that would remove vegetation from an acre of suitable, but unoccupied, habitat for the endangered Holmgren milkvetch that is scattered in small populations among tens of thousands of acres of suitable habitat might seem… and might be… insignificant. However, if one plant occurs on that acre, we could meaningfully measure, detect, and evaluate that effect… there's an exposure to a stressor and a response… it would not be insignificant.

Discountable –

One might think flood frequency of 1 in 100 years due to your project would make such a thing a discountable effect, but you do expect them to occur at some point. Just because our project may only have a 30 year life, we may not think it is likely to occur, but it is reasonable to believe that it may happen at some point during the project. For example, central Arizona has suffered at least **four**, 100-year+ floods in the last 30 years. Conversely, one might have a better argument that a 1,000 year flood due to your project is not expected to occur over your 30 year project life.

Wholly Beneficial ("if we build it they will come") –

Bair Island is within the range of the clapper rail and salt marsh harvest mouse, but had been converted to farmland and salt ponds for years. If rails and mice *are not present in the action area*, but the restoration will create habitat needed for Recovery, a determination of NLAA, wholly beneficial, could be appropriate. You must always be cautious when describing a "wholly" beneficial project, because sub activities related to construction might cause temporary impacts that are not beneficial.

So, what do you think? No Effect? NLAA? LAA? Make your determination for the species as well as for the critical habitat.

The answers should be very straight-forward. If they are NOT, go back and look at the definitions for insignificant and discountable, apply them to the effects remaining, and talk with your partners.

DETERMINATIONS FOR PROPOSED SPECIES/CRITICAL HABITAT

The ONLY time an action agency would use the word "jeopardy" is if they are evaluating impacts to a species that is ***proposed*** for listing.
It is important that an action does not result in adverse effects that could preclude recovery (BEFORE it is even listed)!

You only HAVE to include proposed species in a BA if you determine your action is likely to JEOPARDIZE the continued existence of the species. However, some agencies have internal policies on conferencing / consulting on impacts to proposed species.

Rule of thumb: if your action will not be completed before the species is listed, start talking with the Service's representatives (or else you run the risk of getting stopped.)
Use a similar thought process for proposed critical habitat. Your determination will either be "likely to result in adverse modification" or "not likely . . ."

And for both the species and critical habitat, this determination is NOT at the individual level – but at the scale of the entire proposed entity (species or critical habitat).

THE EFFECTS PATHWAY MATRIX

The Effects Pathway Matrix is a tool, or framework, for ensuring that the chain of logic from your action to your determination does not miss any important pieces of information.

A good Effects Pathway Matrix can be the foundation for your BA and can be incorporated as an Appendix. If you use it, you will still need to turn each of the paths into narratives that tell the story linking your action to your determination. Some of the information may no longer be necessary to elaborate in the BA, but it sure is nice to show how you considered it.

Think about using the Effects Pathway Matrix for your next BA project. It's a great tool to ensure you have completely thought out everything.

<< -- DOWNLOAD BLANK MATRIX -- >>