Northwest **Power** and **Conservation** Council



June 30, 2017

**MEMORANDUM**

**TO:** **Council Members**

**FROM:** **Erik Merrill, Manager, Independent Scientific Review**

**SUBJECT:** **ISRP Final 2017 Wildlife Project Review**

## BACKGROUND:

Presenters: Steve Schroder, ISRP Chair, and Dave Heller, ISRP

Summary: At the Council's request the Independent Scientific Review Panel (ISRP) reviewed 29 wildlife mitigation projects. The ISRP will present its findings on the projects and on programmatic issues that apply across the projects (ISRP 2017-7). Six projects met scientific review criteria, 21 projects met criteria with some qualifications, and 2 projects did not meet criteria. The programmatic issues include adaptive management, program integration and analysis, weed management, and future project reviews. Overall, after reviewing project documents and meeting with wildlife managers, the ISRP was impressed with the wildlife managers' dedication and knowledge.

Relevance: Section 4(h)(10)(D) of the Northwest Power Act guides the Council in recommending projects to implement the Fish and Wildlife. Over the next two months, the Council will develop initial recommendations that take into account 1) the ISRP's review of the projects, 2) public comments on the projects and ISRP review, 3) administrative review by Council staff, 4) the requirements of Section 4(h)(10)(D) and other provisions in the Act, and 5) consistency with the Council's Fish and Wildlife Program.

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Workplan: Project reviews are an integral part of the Fish and Wildlife Program's workplan.

More Info: The complete ISRP report is posted (link) and a Word version is available on BOX (link).

INDEPENDENT SCIENTIFIC REVIEW PANEL

# Final 2017 Wildlife Project Review

ISRP 2017-7 JUNE 28, 2017

Steve Schroder, ISRP Chair, and Dave Heller presentation to the Northwest Power and Conservation Council, July 11, 2017

# ISRP and Peer Review Group (PRG)

- ***Independent Scientific Review Panel***
  - **Stan Gregory, , Ph.D.**
  - **Dave Heller, M.S.**
  - **Wayne Hubert, Ph.D.**
  - **Scott Lutz, Ph.D.**
  - **Alec Maule, Ph.D.**
  - **Robert Naiman, Ph.D.**
  - **Greg Ruggerone, Ph.D.**
  - **Steve Schroder, Ph.D.**
  - **Carl Schwarz, Ph.D.**
  - **Desiree Tullos, Ph.D.**
  - **Chris Wood, Ph.D.**


- ***Peer Review Group***
  - **J. Richard Alldredge, Ph.D.**

- ***Coordinator***
  - **Erik Merrill, J.D., NPCC**

# Effects of FCRPS Dams

(Due to Construction & Inundation)

## Lost > 376,000 Acres

- Lands lost were
  - Continuous riparian wetlands
  - Floodplains
  - Forests

## Mitigation

- >700,000 Acres protected for fish & wildlife
- ~800 Parcels

From BPA Wildlife Categorical Review April 2017

Willamette River

Willamette River Dams Mitigation Area

Photo From: Willamette Wildlife Mitigation Program--ODFW

# BPA

## Wildlife Areas Assigned To FCRPS Dams

Willamette

Lower Columbia

Chief Joseph & Grand Coulee

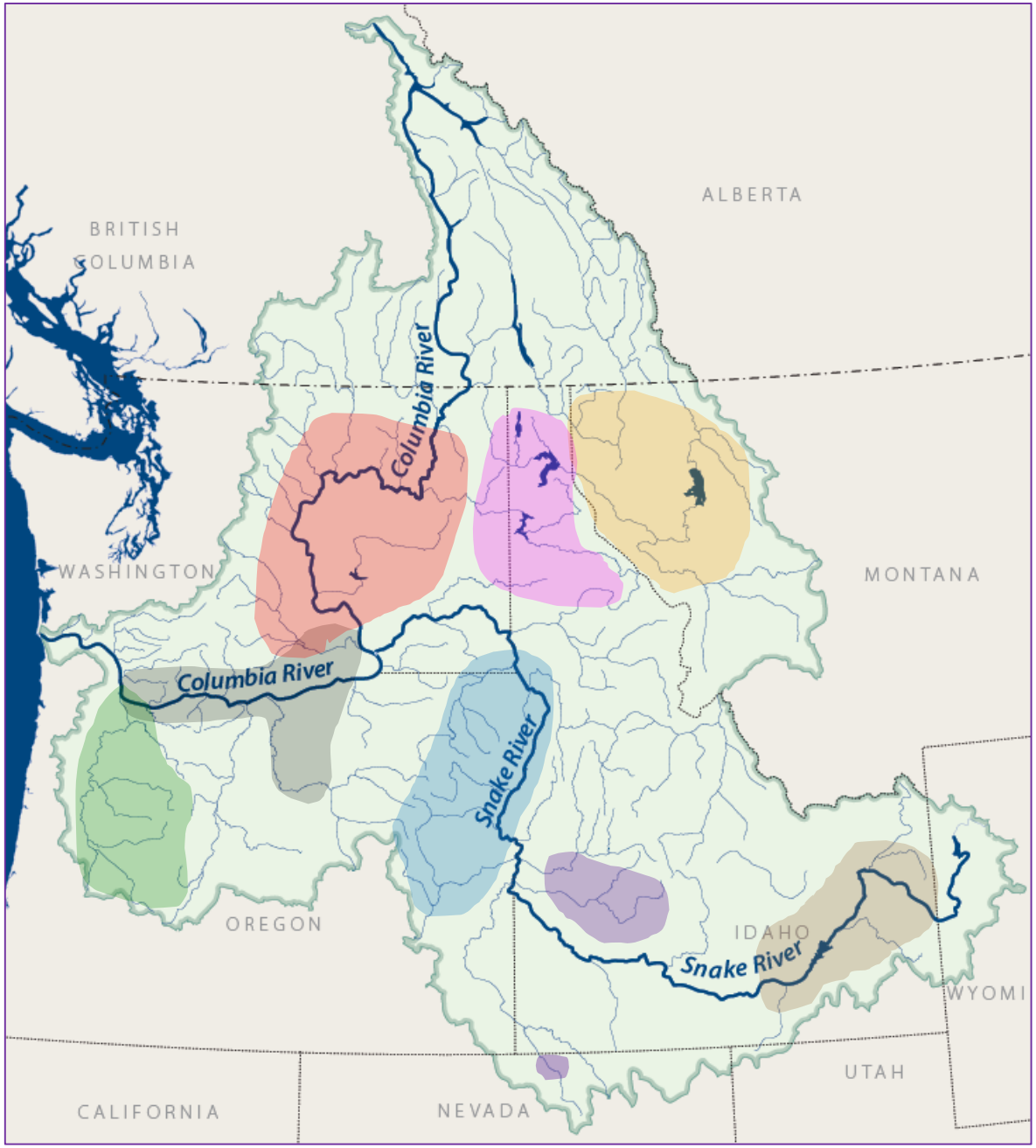
Lower Snake River Dams

Albeni Falls

Anderson Ranch

Minidoka, Palisades

Montana Settlement




Approximate Locations Modified Basin Map From Columbia River Intertribal Fisheries Commission

# Wildlife Mitigation Review

- 29 projects were reviewed in 2017
- Last review occurred in 2009

Logan Valley
Lower Snake River Dams Mitigation Area
Photo from Burns-Paiute Tribe

# Wildlife Mitigation Review

- 6 projects met scientific review
- 21 met criteria with some qualifications
- 2 did not meet criteria


Willamette River Dams Mitigation Area

Photo From: Willamette Wildlife Mitigation Program--ODFW

# Wildlife Mitigation Review

All had Overarching Goals
(Desired Future Conditions)

Qualifications

- ~90% need quantitative & time sensitive objectives
- ~70% need a formal adaptive management plan
- ~60% need to revise or develop project management plans

Precious Lands
Lower Snake River Dams Mitigation Area
Photo from Sondenaa et al. (2107) Nez Perce Tribe

# Quantitative and Time Explicit Objectives

## Task-Based

### General Annual Maintenance

- Invasive species control
- Debris removal
- Fence inspection & maintenance
- Etc.

### Specific Work Tasks

- Building fences
- Planting shrubs, forbs, & grasses
- Tree thinning
- LWD placement, etc.

Shoshone-Bannock Southern Idaho Wildlife Mitigation Program

Minidoka Palisades Wildlife Area

Photos from: A. Eddingsaas (2017)

# Quantitative and Time Explicit Objectives

## Biologically Based

(Stream bank stabilization and riparian vegetation planting)

Prior to bank stabilization

Five months after completion

Two years after completion

## Shoshone-Paiute Tribes with IDFG River Menders Program

- Decrease Erosion & suspended sediment
- Increase riparian vegetation
- Decrease in water temperature
- Decrease in  diel fluctuation of water temperature

East Fork of the Owyhee River

Anderson Dam Mitigation Area

Photos from: Shoshone-Paiute Tribes-Southern Idaho Wildlife Mitigation Project

# Monitoring & Evaluation

- Implementation

Build & install Great Grey Owl nesting and resting platforms

Effectiveness

Maintain or Increase resident populations of Great Grey Owls

Scotch Creek—Chesaw Wildlife Unit

Chief Joseph/Grand Coulee Mitigation Area

Photos from B. Dupont & J. Olson (2017) WDFW

# RM&E Challenges & Questions

## For Wildlife Mitigation Projects

- Current level of $ support not adequate to support effectiveness monitoring
- Some proponents believe no monitoring is allowed
- There is confusion regarding “5%” cap
  - Some projects used more than 5%
  - Others used outside $ for M&E
  - Resolution on the 5% cap is needed

## Result

- Large variation in information to evaluate progress

Photo by Keith Kohl

# RM&E Recommendations

## For Wildlife Mitigation Projects

- Coordinate monitoring among projects when evaluating alternative management actions
  - Determine where, when, what habitat actions increase or sustain habitat & biodiversity

- Compare active & passive management

-Why-

- Uncertainty about how species respond to restoration actions

- Focus is on habitat restoration—also need to evaluate wildlife responses

Wenas wildlife area
Chief Joseph/Grand Coulee Mitigation Area
Photo from C.C. Morris (2017) WDFW

# Adaptive Management

- Monitoring & Evaluation reveals successes & problems
- Successes & failures are shared/published
- Alternatives are implemented & Evaluated
- Cycle is repeated as needed
- ~70% of the Wildlife Mitigation Projects need to establish a formal Adaptive Management Plan

Wenas wildlife area
Chief Joseph/Grand Coulee Mitigation Area
Photo from C.C. Morris (2017) WDFW presentation

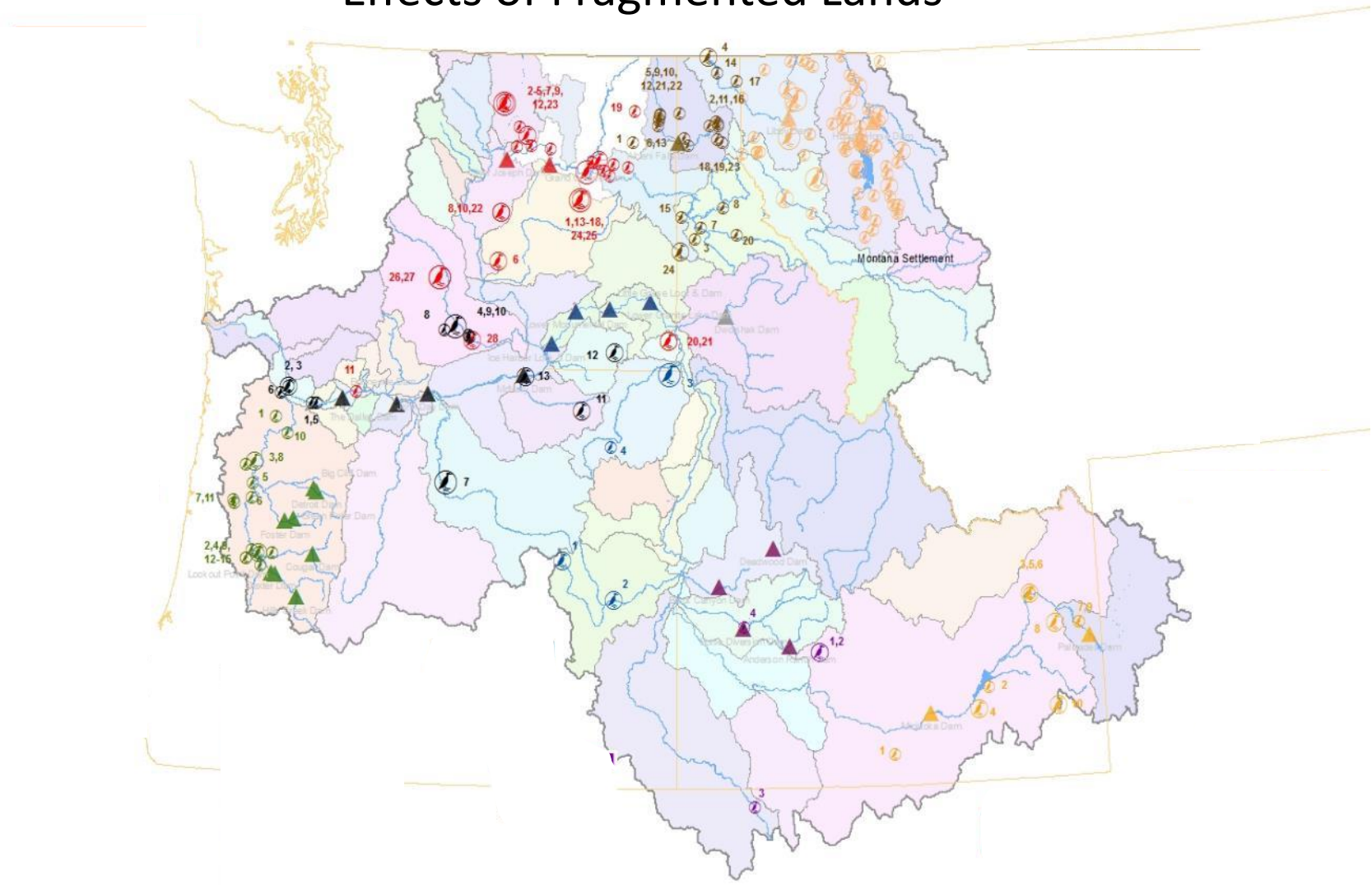
# Recommendations for Adaptive Management

- Use a decision matrix to establish monitoring levels for a proposed action
    - Clarity on what should be monitored, both habitat and wildlife responses are needed
    - Determine level of monitoring needed for focal species—especially large game animals
- Regional monitoring programs that evaluate numerous projects should be developed
- Convene a workshop with practitioners & co-produce a formal adaptive management plan

Photo from ODFW

# BPA's Wildlife Mitigation Lands

## Effects of Fragmented Lands




Map from Columbia Basin Fish & Wildlife Authority

# Effects of fragmented lands
## "Ecological Islands"

### Ecologically Small

- Dispersal can be limited
  - Lack of connectivity to needed habitats
- Creates isolated populations
  - Loss of genetic diversity
  - Inbreeding
- Carrying capacity exceeded
- Subject to continuous invasions by pest and predator species
- Influenced by human activities (e.g., agriculture, roads, fences)

Photo from IDFG

# Effects of fragmented lands

## Some Possible Solutions

### Identify & Prioritize Areas Important to Wildlife Connectivity

Photo from Colville Confederated Tribes

Photos from Joe Riis WyoFile

Photo from Spokane Tribe of Indians

# Effects of fragmented lands

## Some Possible Solutions

- Remove non-native species
  - predators
  - invasive plant species
- Reintroduce & nurture native species
- Expand the range of rare species
- Maintain borders to prevent the introduction of non-native species
- Control public access

Spalding's Catchfly

"Precious Lands" wildlife project

Photo from Sondenaa et al. (2017) Nez Perce Tribe

# Effects of fragmented lands

## Expanding the range of rare species

## The beautiful buzzards of the Columbia (Lewis & Clark)

Precious Lands—Joseph Canyon
Lower Snake River Dams Mitigation Area
Photo from Sondenaa et al. (2107) Nez Perce Tribe

alchetron.com/California-condor-2018374-W#demo

# A Recommendation: treat Wildlife Mitigation as an integrated program

## Why?

Evaluate overall status of wildlife status across all parcels

Evaluate restoration actions across habitat types & species

Evaluate the benefits of the collective restoration actions & land purchases on wildlife

Quantify human alterations/uses
- miles of road
- herbicide applications
- number of wildlife harvested
- recreational visits

Malheur Wildlife Area
Lower Snake River Mitigation Area
Photo from Malheur Wildlife presentation 2017

# Controlling weeds--Approaches

## Steps

- Restore native plant communities
  - increases resilience
  - decreases weed control
- Coordinate with adjacent landowners for regional weed control (31% of the projects)

Rainwater wildlife area

Lower Columbia Dams Mitigation Area

Photo from J. Middel, L. Chiono, A. Pond, & C. Scheeler (2017)

# Controlling weeds—Approaches

## Steps

- 70% of the projects are using **Integrated Pest Management** & weed management plans

## Includes:

- Mechanical (mowing, handpulling, machine removal)
- Chemical (application of herbicides)

Swanson Lakes Wildlife Area
Photo from Juli Anderson & Mike Finch
WDFW presentation (2017)

Hellsgate Wildlife Mitigation Project
Photo from Coville Confederated Tribes
presentation (2017)

# Controlling weeds--Approaches

## Steps

- **Integrated Pest Management** & weed management plans

## Includes:

- Cultural (seeding of natives, tillage, cover crops, improving soil)

Shillapoo Wildlife Mitigation Project
Lower Columbia Dams Mitigation area
Photo From Shillapoo wildlife mitigation presentation 2017--WDFW

# Controlling weeds--Approaches

## Steps

- **Integrated Pest Management** & weed management plans

## Includes:

- Biological (insects, mites, nematodes, seed pathogens, bacteria, rusts, grazing, controlled burns, inundation or flooding, etc.)



Rainwater Wildlife Area
Lower Columbia Dam Mitigation Area
Photo from Middel et al. (2017) presentation--CTUIR

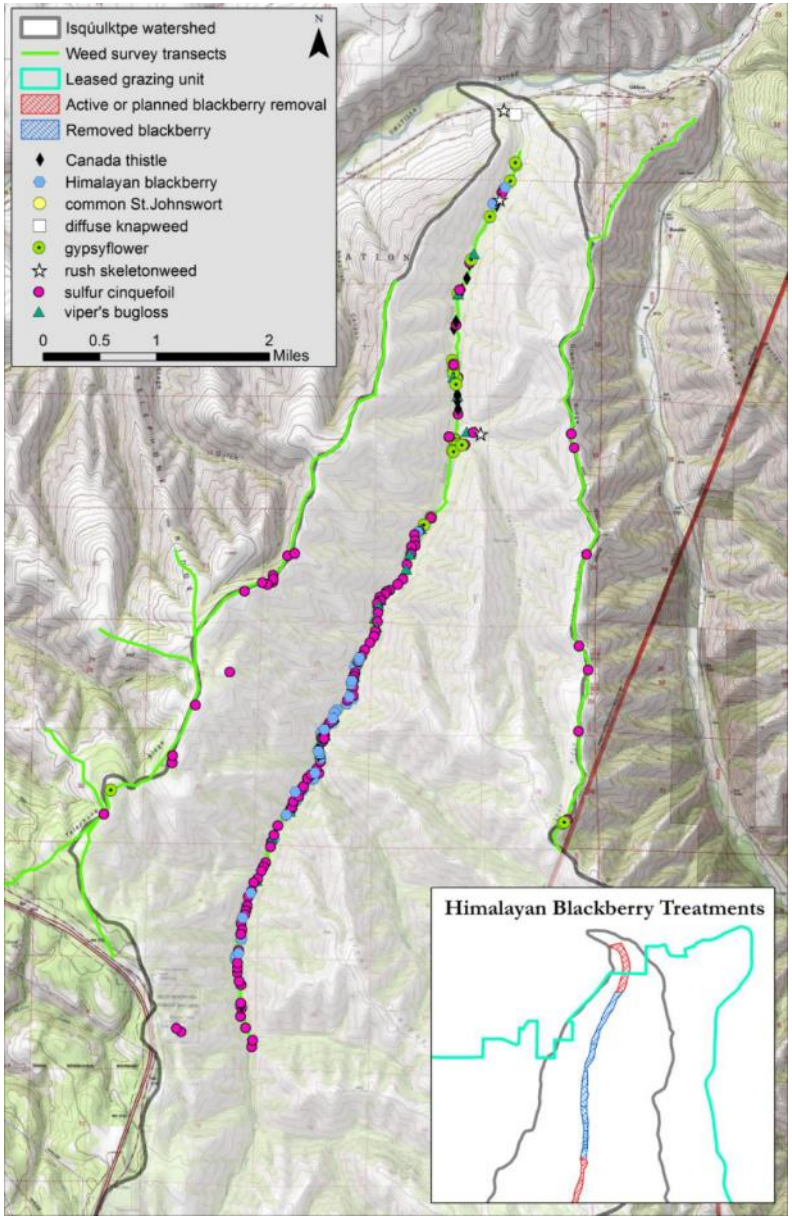
# Controlling weeds—Surveillance

## Steps

- Integrated Pest Management & weed management plans

## Methods

- 80% of the projects have annual or multi-annual surveys for weeds
- 54% of the projects use GPS & GIS to map location and size of weed infestations




Isquulktpe Watershed Project
Lower Columbia River Dams Mitigation Area
Map from Peckham, S. and L. Chiono (2017) CTUIR

# Controlling weeds—Clean Practices

## Steps

- Clean practices
  - Road closures
  - Inspections prior to entry
  - Multi-inspections per year:
    - In parking areas
    - Along roads & trails

Photo: North Dakota State University


Albeni Falls Wildlife Area
Albeni Falls Mitigation Area

Photo from Albeni Falls Wildlife Mitigation Project—Kalispel Tribe

# Controlling weeds

## Challenges & Research Opportunities

Repeated annual applications
of
herbicides

Effects of Glyphosate
(Roundup)

- Decreases species diversity
- Modifies food chains
- Changes community structure
- Alters energy flow
- Affects nutrient cycling
- Reduces resilience & stability

From Perez et al. (2011)

Sunnyside wildlife area mitigation project
Chief Joseph/Grand Coulee mitigation area
Photo from Sunnyside wildlife area mitigation presentation--WDFW

# Planting native grasses, forbs, and shrubs

## There is a demand for locally adapted plants & seeds

Logan Valley Wildlife Mitigation Project

Lower Snake Dams Mitigation Area

Photos from Logan Valley Mitigation presentation 2017 Burns- Paiute Tribe

# Native Plant Nurseries

- Several exist in the Basin
  (Confederated Tribes of the Umatilla Reservation, Kalispel Tribe, & Confederated Tribes of the Warm Springs)
- The opportunity exists to establish regional nurseries that could serve multiple projects

Confederated Tribes of the Umatilla Reservation
Native Plant Nursery
Photo S. Schroder

Kalispel Tribe Native Plant Nursery
Albeni Falls Mitigation Area
Photo from Albeni Falls Wildlife Mitigation Project—Kalispel Tribe

# Future Project Reviews

- Improve annual progress report quality
- Continue presentations, programmatic discussions, and response loop
- Reinstate site visits
- Organize project development workshops
- Integrate program-level analysis


Pygmy Rabbit: Sagebrush flat wildlife area
Chief Joseph/Grand Coulee Mitigation area
Photo from Sagebrush Flat presentation (2017). Credit—Betsy Demay

# In Summary:

Current program benefits fish & wildlife

Project managers are dedicated & creative

The use of quantitative objectives & formal adaptive management will increase future benefits

Sagebrush flat wildlife area
Chief Joseph/Grand Coulee Mitigation area
Photo from Sagebrush Flat presentation D. Peterson manager WDFW

# EXTRA SLIDES

# FRAGMENTED LANDS: Jared Diamond (1975)

A system of natural reserves, each surrounded by altered habitat, resembles a system of islands from the point of view of species restricted to natural habitats. Recent advances in island biogeography may provide a detailed basis for understanding what to expect of such a system of reserves. The main conclusions are as follows:

1) **The number of species that a reserve can hold at equilibrium is a function of its area and its isolation. Larger reserves, and reserves located close to other reserves, can hold more species.**
2) **If most of the area of a habitat is destroyed, and a fraction of the area is saved as a reserve, the reserve will initially contain more species than it can hold at equilibrium. The excess will gradually go extinct. The smaller the reserve, the higher will be the extinction rates.**
3) **Different species require different minimum areas to have a reasonable chance of survival.**

Estimates of these extinction rates for bird and mammal species have recently become available in a few cases. Some geometric design principles are suggested in order to optimize the function of reserves in saving species.

# Controlling weeds
## Challenges & Research Opportunities

### Restoring degraded soils

### Methods

- Green manure/cover crops
- Organic compost
- Phytoremediation (using plants to absorb contaminants)
- Gypsum (reduces salinity)
- Importing microorganisms from healthy soils

Soil microbiome
photo from Smithsonian.com

# Questions that can help management

Is coordination among wildlife managers sufficient to maintain viable populations over time?

Succession is a natural process—what actions are needed to maintain habitat in a desired state?

How many target species can exist within a parcel?

Is connectivity adequate?

Are target species resilient to catastrophic changes, e.g., fire, climate change etc.?

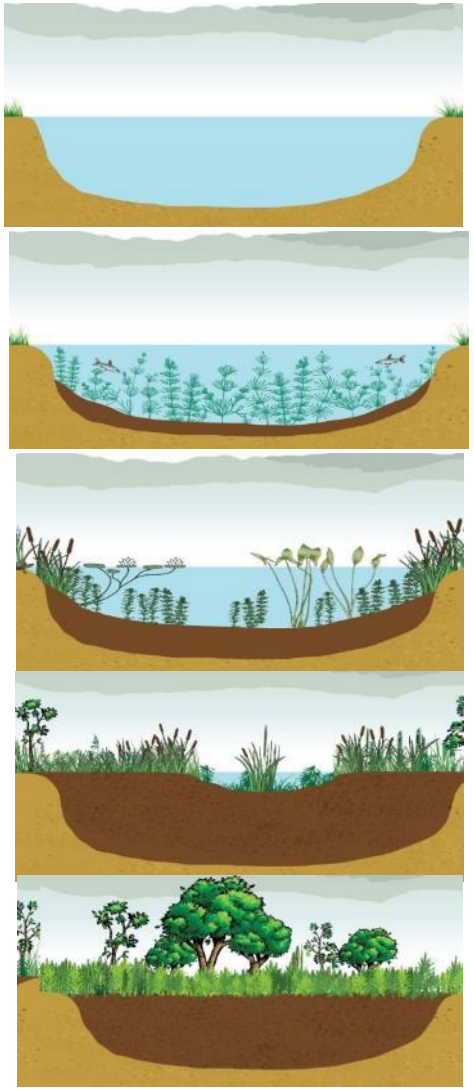


Image from: www.texasgateway.org

# Presentation to the Council on the Wildlife Mitigation Project Review: July 11, 2017

| No. | Description | Narrative |
|---|---|---|
| 1 | Title Slide—cover of Wildlife Project Review | This past spring and early summer we had the opportunity to review BPA's wildlife mitigation projects. |
| 2 | List of ISRP members, Erik, and Rich | All the members shown here participated in reviewing the projects and in developing programmatic comments about the wildlife program. |
| 3 | Summary of the habitat caused by the construction and operation of the dams by BPA | A presentation by BPA summarized the impacts of the FCRPS dams and the efforts to mitigate these effects<br>1) An estimated 376,000 acres were lost due to dam construction and inundation<br>a. Most of the lands lost were continuous riparian wetlands, floodplains, and associated forests<br>2) To mitigate that loss, > 700,000 have been protected for fish and wildlife on over 800 parcels |
| 4 | Map showing BPA's mitigation areas by dam | The mitigation lands are spread throughout the basin. This map gives a very general idea where the wildlife mitigation properties are located. |
| 5 | # Of projects reviewed and when a review last occurred<br>Image of Logan Valley | 29 projects were reviewed, the last review of these projects occurred in 2009 |
| 6 | Results of our review<br>Image of pintail ducks in flight | 6 of these projects met scientific review<br>21 met criteria with some qualifications<br>2 did not meet criteria |
| 7 | Results continued—break out of what the qualifications were<br>Image of Precious Lands | All the projects had overarching goals or desired future conditions for their properties<br>1) 90% however need to develop quantitative and time explicit objectives<br>2) 70% need a formal adaptive management plan<br>3) 60% need to revise or develop project management plans |
| 8 | Quantitative Objectives<br>Task-based | There are two basic types of quantitative objectives. One is task-based. Examples would include general annual maintenance and specific work tasks, like building 1 mile of fence during a set period of time. |
| 9 | Quantitative Objectives<br>Biologically based | The other type looks at the effects of carrying out task-based tasks. (what benefits do this tasks provide to habitat and wildlife—what is their ultimate purpose) In this example, the Shoshone Paiute Tribes worked with IDFG River menders to stabilize a river bank. The expected outcomes are:<br>1) A reduction in erosion and suspended sediment<br>2) An increase in riparian vegetation<br>3) Decrease in water temperature<br>4) A decrease in the diel fluctuation of water temperature<br>Time-specific, quantitative objectives would characterized as: |

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| | | 1) Riparian vegetation - By 2022 increase ground cover of riparian vegetation to at least 80% within 150 feet of the stream channel.<br>2) Water Temperature - By 2022 reduce the number of days where maximum stream temperature exceeds 68F to 10 or less. |
| 10 | Monitoring & Evaluation | Two types of monitoring are needed to assess project objectives. Implementation monitoring is used to see if tasks were completed and done in the expected time period. Effectiveness evaluations are performed to see if work brought about desired conditions. In this example 11 nesting/resting platforms were placed in the Chesaw Wildlife unit for Great Grey Owls. Subsequent effectiveness monitoring was done to see if they were being used as expected. |
| 11 | RM&E Challenges & questions | During our meeting with the wildlife managers, a number of questions and concerns related to monitoring and evaluation were raised.<br>1) Many proponents felt that there wasn't adequate monetary support to carry out monitoring<br>2) Some proponents believed that no monitoring was allowed<br>3) There was confusion regarding a 5% cap. Some projects used more than 5% for monitoring, others used outside dollars. Resolution over the 5% cap is needed<br>Because of confusion over M&E there was a large amount of variation in the information that could be used to evaluate the success of project actions. |
| 12 | Some recommendations for RM&E | Three recommendations are made:<br>1) Determine where, when, and what habitat actions increase or sustain habitat and biodiversity<br>2) Compare active vs. passive management<br>3) Coordinate monitoring among projects (could apply similar treatments across multiple projects using suitable statistical designs)<br>Why:<br>1) There is uncertainty on how species respond to restoration actions<br>2) Focus is on habitat—also need to evaluate wildlife responses |
| 13 | Adaptive Management | M&E will reveal problems as well as successes.<br>If problems exist, alternatives will need to be implemented.<br>If success or failure occurs the methods used should be shared.<br>Alternative approaches will also need to be evaluated, repeat as needed.<br>About 70% of the projects need to establish a formal adaptive management cycle. Once a project has established quantitative objectives developing an adaptive management process will be relatively straight forward. |

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| 14 | Recommendations for Adaptive Management | 1) Use a decision matrix to decide how much monitoring should occur. How much monitoring is needed will vary by project. Those that are simply maintaining habitat will require less than those that are restoring it<br>2) Clarity is needed on what should be monitored—both habitat and wildlife responses should be evaluated<br>3) How much effort should be made in monitoring focal species—especially large game animals that are likely transitory and difficult to measure<br>4) Recommends developing regional management plans that can be used by multiple projects. Some supplemental project-specific monitoring will be needed<br>5) Convene a workshop to co-produce a formal adaptive management plan |
| 15 | Fragmented Lands<br>Detailed map showing the location and relative size of the mitigation properties | The properties that BPA has purchased or is helping to protect are scattered across the landscape and some are relatively small in size. They represent what ecologists call ecological islands or mainland islands |
| 16 | Effects of fragmented lands | Ecologically small mitigation areas can cause a number of problems<br>1) Depending on how close they may be to other reserves they can create isolated populations with loss of genetic diversity and inbreeding risks<br>2) Subject to continuous invasions by pest and predator species<br>3) Influenced by human activities<br>4) Can lead to local extinctions if the carrying capacity is exceeded<br>5) Edges are diverse habitats whereas interior portions are relatively homogenous areas. If a species needs interior conditions, these may be limited due to edge effects especially for small properties<br>6) Dispersal can be limited due to a lack of connectivity to needed habitats |
| 17 | Effects of Fragmented lands—some solutions | Identify and prioritize areas that are important to wildlife connectivity. Gives several examples, an underpass for wildlife and the buck-n-pole fencing that allows wildlife to pass but prevents trespass livestock from doing so. Also the buck-n-pole fence is safe for grouse which can be killed by barbed wire fencing |
| 18 | Effects of Fragmented lands | Other possible approaches include: |

| | | |
|---|---|---|
| | some possible solutions as recommended by the ecological literature | 1) Removing non-native species, predators and invasive plant species<br>2) Reintroduce and nurture native species<br>3) Expand the range of rare species<br>4) Maintain borders to prevent the introduction of non-native species<br>5) Control public access |
| 19 | Fragmented Lands<br>An example of expanding the range of a rare species—California condor | The Nez Perce tribe is working with the USFWS to reintroduce the California Condor into Joseph Canyon in their Precious Lands property<br>Greatest danger to these birds is lead poisoning—eating carcasses with lead shot or lead fragments |
| 20 | Treating the wildlife mitigation program as an integrated program | Each wildlife mitigation project was evaluated as a stand-alone project. We see real value in treating all 800 properties as an integrated whole.<br>1) It would allow the overall status of wildlife across all parcels to be evaluated<br>2) Could evaluate the effectiveness of restoration actions across habitat types and species<br>3) Could measure the benefits of the collective restoration actions and land purchases on wildlife<br>4) Quantify human alterations and uses on wildlife mitigation lands |
| 21 | Controlling Weeds--Approaches | A long enduring and persistent problem for the wildlife mitigation projects has been the control of invasive weed species<br>1) The best approach is to restore native plant communities which will increase resilience and decrease the need for weed control. But how to do this?<br>2) Coordinate with adjacent landowners, weed boards, etc. and develop and participate in regional weed control efforts (31% of the projects do this) |
| 22 | Controlling Weeds—Approaches<br>Integrated Pest Management Strategy—70% of the projects are using this approach | In the ISRP's 2009 review it was recommended that the projects use an integrated pest management strategy.<br>1) 70% of the projects are now using this approach—where multiple methods of weed control are applied simultaneously or sequentially.<br>2) Control methods include:<br>a. Mechanical removal<br>b. Chemical—application of herbicides. Some projects rotate the herbicides used to avoid developing resistance in the weed species being treated |
| 23 | Controlling Weeds—Cover crops | c. Cultural –planting of native grasses, forbs, shrubs, and cover crops. Cover crops are typically left in place and can out-compete most weed species. The idea is plant an area for 4 to 5 years to diminish the weed seed bank. |
| 24 | Controlling Weeds—Biological | d. Biological—a host of biological control methods are |

| | | |
|---|---|---|
| | methods | being applied. They range from releasing seed pathogens to controlled grazing. Here you can see the Umatilla Tribes are using 1,200 goats to attack infestations of yellow star thistle. Biological methods will depress weed populations but are not likely to eradicate them. |
| 25 | Controlling weeds--surveillance | Another part of the Integrated Pest Management strategy is to monitor and locate weeds. Almost all (80%) of the projects perform annual or multi-year surveys for weeds on their properties<br><br>GPS and GIS are used by over half the projects to map the locations and extent of weed infestations. This information is used to prioritize weed control |
| 26 | Controlling weeds—Clean Practices | Clean practices—can also be used to control weeds. This approach calls for road closures, inspections of cars, boats, etc. and multi inspections per year in areas where weeds are likely to show up. For example, parking areas, trails, etc. |
| 27 | Controlling Weeds—Challenges and research opportunities—herbicide applications | Herbicides are widely used on wildlife mitigation lands. They are often the most effective control method available. However, we don't really know what the cumulative effects may be of repeated annual applications. Some recent work on the effects of Glyphosate (or Roundup) showed that this herbicide did have some negative ecological effects.<br><br>Because the wildlife projects keep good records of where, what, and when herbicides are applied they may offer sites where the cumulative effects of repeated applications of herbicides could be examined. |
| 28 | Planting native grasses, forbs, and shrubs | Many of the projects are planting native grasses, forbs, and shrubs in order to restore habitats. A challenge for them is obtaining locally adapted plants. There are a few commercial growers, but the demand for native plants is high. |
| 29 | Native Plant Nurseries | To meet that demand some native plant nurseries have been developed. For example, the CTUIR, Kalispel Tribe, and Warm Springs have all established and operate native plant nurseries. It seems to us that an opportunity exists to establish regional nurseries on mitigation lands that could serve multiple projects |
| 30 | Future Reviews | We recommend that annual reports possess a section that summarizes quantitative and cumulative results for a project. This will make the production of a Summary Report less onerous for project managers. The other points are clear. |
| 31 | Summary slide | Three points<br>1) Projects are providing fish and wildlife benefits<br>2) Project managers are dedicated and creative<br>3) Use of quantitative objectives and formal adaptive |

| | | |
|---|---|---|
| | | management will increase future benefits |
| EXTRA SLIDES | | |
| A | Quote from Jared Diamond | Ecological Islands—gives three conclusions<br>1) Number of species that a reserve can hold is a function of its size and how isolated it is<br>2) If most of the habitat is destroyed and fraction is saved the reserve will have more species than it can hold. The excess will slowly go extinct. The smaller the reserve the higher the extinction rate<br>3) Different species require different minimum areas to survive |
| B | Controlling Weeds—soil restoration | One of the challenges that many of the wildlife projects have to deal with is soil restoration. The organic farming movement has led the way in agricultural settings. A list of some of the methods that can be used is shown here. The importation of microorganisms is new method that may have application in the Columbia Basin |
| C | Questions that can help management<br>Shows succession from pond to forest in 5 steps | Five questions<br>1) Is coordination among managers sufficient to maintain viable populations over time?<br>2) Succession is a natural process—what actions are needed to maintain habitat in a desired state?<br>3) How many species can exist within a parcel?<br>4) Is connectivity adequate?<br>5) Are target species resilient to catastrophic changes—e.g., fire, climate change etc. |