HABITAT EVALUATION PROJECT

RHT Final Assessment And Analysis Of The NW Power Act Funded By BPA

Columbia River Wildlife Mitigation HEP Process Review

HEP Project Number: 2006-006-00

HEP Contract Number: 64637

Work Element 141

Paul R. Ashley – Regional HEP Team

Pacific States Marine Fisheries Commission

September 25, 2015

Table of Contents

List of Tables

Table of Figures

Habitat Evaluation Procedures

Purpose

The purpose of this document is to identify and discuss technical variances in the application of Habitat Evaluation Procedures (HEP) tenets that were supported by Columbia River Wildlife Mitigation Program management agencies and tribes. In addition, changes to HEP protocols that were not agreed to by all parties involved in program wildlife mitigation will also be addressed. Discussion is limited to technical aspects and ramifications rather than political or philosophical arguments. Opinions held by the Regional HEP Team (RHT) (Appendix A) are noted.

Only HEP tenets associated with discussion points in this paper are discussed at length. Stiehl (1995) provides a comprehensive overview of the HEP process and HEP precepts in: "Habitat Evaluation Procedures Workbook". Detailed HEP information is also located in ESM 101[1], ESM 102, and ESM 103 (USFWS 1980, 1980a, and 1980b). These documents describe each step of the HEP process along with supporting principles. In addition, an overview of the Region's HEP process including modifications can be viewed at: http://www.streamnet.org/wp-content/uploads/2015/08/February-2010-HEP-PowerPoint-Presentation.ppt

Introduction

Prior to the Northwest Power Act of 1980, official mitigation efforts in response to Federal Columbia River Power System (FCRPS) impacts were undertaken by Federal water resource managers (U.S. Army Corps of Engineers, Bureau of Reclamation) and the U.S. Fish and Wildlife Service. Some mitigation actions go back as far as the 1910s, and in many cases are very difficult or impossible to fully document and assess. The limited wildlife mitigation prior to 1980 was in part generated through consultation with the U.S. Fish and Wildlife Service under the Fish and Wildlife Coordination Act of 1934, and the subsequently more rigorous requirements from amendments in 1946 and 1958 (NPCC 2011).

Under the Northwest Power Act of 1980 (Act) Bonneville Power Administration (BPA) was directed to protect, mitigate, and enhance fish and wildlife and associated habitats affected by the development and operation of the Federal Columbia River Power System (Ashley 2008). The Act also authorized Washington, Idaho, Montana, and Oregon to develop a regional power plan and fish and wildlife program to balance the Northwest's environment and energy needs. The states created the Northwest Power Conservation Council (NPCC or Council)[2] to implement the Act. The NPCC's key fish and wildlife role was to develop and review the Columbia River Wildlife Mitigation Program (Program) in concert with state, federal and tribal resource agencies; BPA and its utility customers; and the general public.

[1] ESM refers to Ecological Services Manual.
[2] Paraphrased from information found on the NPCC website.

Habitat Evaluation Procedures were developed by the U.S. Fish and Wildlife Service (USFWS) in the 1970s. The Council selected HEP as the primary tool to quantify the impacts of both BPA hydro development and compensatory actions. HEP is a relatively straightforward, rapid, repeatable habitat assessment tool that was developed as a nonmonetary evaluation procedure for use in project planning (Stiehl 95). As discussed below, however, HEP results can vary considerably for the same parcel of land depending on which guild species are selected; what models are used and whether they are modified appropriately to site conditions; and how habitat or cover types are delineated.

As a scientific method for impact and compensation analyses used world-wide, HEP was designed to answer the question, "How much will it cost in habitat units[3] (HUs) if we build it"? As an accounting tool, HEP is used to quantify impacts to terrestrial and aquatic habitats due to development (habitat losses) and habitat protection and restoration efforts (habitat gains) by assessing changes in habitat quality and quantity[4] (USFWS 1980, 1980a, 1980b).

Habitat quality is assessed through use of habitat species models and suitability indices (HSIs). The HSI value is derived from an evaluation of the ability of key habitat components to provide the life requisites of selected wildlife and fish species and is an index to habitat carrying capacity for a specific species or guild of species based on a performance measure (e.g. number of snowshoe hares per hectare) described in HEP species models. An example HEP model is located at: http://www.nwrc.usgs.gov/wdb/pub/hsi/hsi-101.pdf[5].

HSI values range from 0.0 to 1.0. Each increment of change is identical. For example, a change in HSI from 0.1 to 0.2 represents the same magnitude of change as a change from 0.2 to 0.3, and so forth. A HSI of 0.3 indicates that habitat quality/carrying capacity is marginal while a HSI of 0.7 suggests that habitat quality/carrying capacity is relatively good for a specific species (Table 1)[6].

Table 1 Habitat suitability verbal rating comparison

Habitat Suitability Index	Verbal Equivalent
0.0 < 0.2	Poor
0.2 < 0.4	Marginal
0.4 < 0.6	Fair
0.6 < 0.9	Good
0.9 ≤ 1.0	Optimum

[3] Rather than dollars or acres/hectares, HEP uses HUs as a metric.
[4] HEP is not a wildlife/fish population based modeling tool. HEP only infers potential species response to changing habitat conditions.
[5] Add to browser if unable to view.
[6] Table 1 was developed by the RHT to provide a relative comparison of HSI ratings.

Habitat units (HUs) are the "currency" used in HEP to quantify habitat losses and gains. HUs are determined by multiplying the evaluation species' HSI by the number of acres of habitat (cover type) protected. For example, if the snowshoe hare HEP model's HSI output is 0.50 and the number of acres of conifer forest habitat protected is 100, then the number of snowshoe hare HUs are 50 (0.50 HSI x 100 acres = 50 HUs).

HEP teams stratify both hydro project and compensation sites by cover types which are used, in part, to identify the HEP evaluation species models used to determine HU losses and gains. The preferred HEP alternative is to replace cover types that were lost with the same cover types on compensation sites; i.e., in-kind compensation. When this is not physically possible or socially desirable, HEP allows for two additional compensation alternatives including "equal replacement," whereby HU losses are offset through a gain of an equal number of HUs – (all HUs have the same value, the "an HU is an HU" concept); and "relative replacement"- that is, a gain of one target species HU is used to offset the loss of one evaluation species HU at a differential rate depending on subjective values ascribed to the species involved by project planners or resource managers. The trade-off rate is determined through use of a relative value index (RVI) (USFWS 1980a) (Appendix B). Although wildlife mitigation selected by resource managers under the Program included both in-kind and equal replacement compensation, the FCRPS wildlife mitigation resource managers advocated was predominantly equal replacement compensation.

Columbia River Wildlife Mitigation Program HEP Process Overview

Environmental law defines mitigation as, and follows the sequence of, first avoiding environmental impacts, then taking measures to minimize the impacts that cannot be avoided, and finally compensating for those unavoidable impacts. Since hydro facility construction took place prior to creation of the 1980 Northwest Electric Power and Conservation Act, there were no opportunities to either avoid or minimize the impacts associated with FCRPS hydro facilities, nor were the extent of impacts to wildlife habitat known.

Under the Council's program, BPA funded the creation of HEP-based habitat loss assessments by resource managers, to identify construction and inundation HU losses associated with FCRPS dams. The Council amended the HU losses and gains into its program to create a "crediting ledger", which served as a HU debit account for tracking FCRPS wildlife mitigation (see Appendix C). To offset HU losses, compensation sites were acquired/protected, improved and enhanced, and managed by natural resource management agencies and non-government organizations (NGOs) with funding provided by BPA. HEP surveys were conducted on each compensation site to determine the number of HUs gained, which were then subtracted from the HU debit crediting ledger as illustrated in Figure 1.

Full mitigation compensation is achieved when compensation site HU gains equal or surpass the hydro facility construction and inundation HU losses listed in NPCC's Table C-4 (included in Appendix C). Note that while they are relatively few, the HU losses listed in Table C-4 are not without error; e.g., the "sharp-tailed grouse" HUs listed under Black Canyon Dam in Table C-4

should be removed as the sharp-tailed grouse was not an evaluation species at Black Canyon Dam (NPCC 2011).

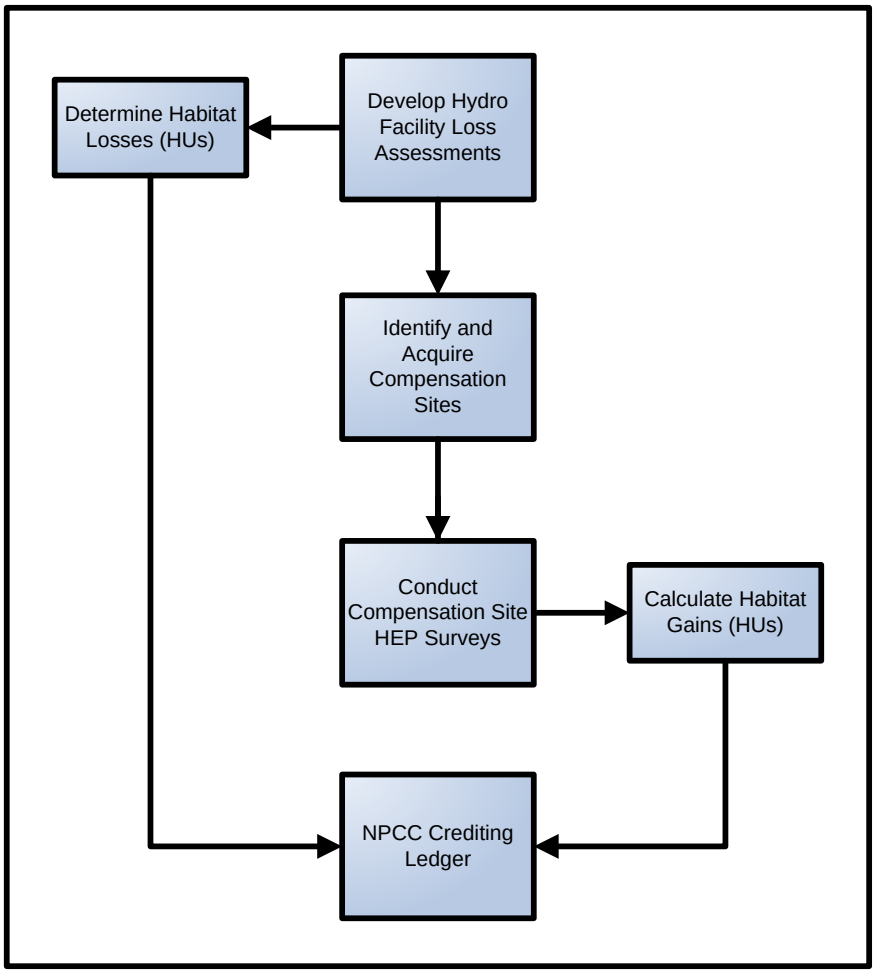


Figure 1 Simplified HEP process overview

Columbia Basin natural resource managers used one or more of the following three options to mitigate habitat losses:

1. Fee title acquisitions
2. Easements and leases
3. Habitat enhancement of extant federal, state, or tribal property

Habitat protection measures are described in Table 2. Project sponsors often combined several habitat protection alternatives to acquire/protect wildlife habitat on a single compensation project site.

Table 2 Habitat protection type descriptions and examples

Protection Type	Description	Examples
Fee Title	Private land is purchased by project sponsors with BPA wildlife mitigation funds - occasionally in partnership with non-BPA funding sources. Property is managed by project sponsors to benefit wildlife as described in project management plans. Funding for O&M[a] activities is generally provided exclusively by BPA. BPA generally receives full baseline and enhancement HU credit.	WDFW's[c] Swanson Lakes Wildlife Area and STOI's[d] Turtle Wildlife Area
Easements and Leases	Project sponsors/BPA acquires land development and management rights from private landowners, NGOs[b], and tribes with wildlife mitigation funds. Land ownership remains with lease/easement holder. Property is managed by project sponsors to benefit wildlife as described in project management plans. Funding for O&M activities is provided by BPA or in partnership with project sponsors. BPA generally receives both baseline and enhancement HU credit.	TNC's[e] Willow Creek Project and YN's[f] Yakima River Wetland Project
Extant Federal, State, and Tribal lands	Project sponsors use parcels not acquired with BPA funds as compensation sites. Funding for O&M and enhancement activities, described in wildlife management plans, is provided by BPA or in partnership with project sponsors. BPA either does not receive baseline HU credit, or it takes partial baseline HU credit in proportion to its share of funding plus all enhancement HU credit.	CTUIR's[g] Isqúulktpe Watershed Project and WDFW's Wenas Wildlife Area

[a] Operations and maintenance

[b] Non-government organizations

[c] Washington Department of Fish and Wildlife

[d] Spokane Tribe of Indians

[e] The Nature Conservancy owns the property-BPA maintains a management lease with TNC

[f] Yakama Nation

[g] Confederated Tribes of the Umatilla Indian Reservation

Compensation sites were stratified by cover types that were further classified as either “in-kind” or “out –of-kind” relative to the hydro facility loss assessments. Compensation site cover types identical to those listed in a given hydro facility loss assessment were considered “in-kind” cover types while cover types not listed were considered dissimilar or “out-of-kind”.

Columbia River wildlife mitigation was largely, though not exclusively, out-of-place and out-of-kind, which means the areas and species used for mitigation were not necessarily the same as those lost through the construction and inundation (C&I) of Federal Columbia River Power System dams. Thus, the habitats and species used in the loss assessments were in many cases not the same as those needing crediting on the mitigation compensation sites (NPCC 2011). This means that compensation was mainly “equal replacement”.

Over the course of 30 years use of the HEP tool in Columbia River Wildlife mitigation changed and evolved, and interpretation and application varied in the field, across different sub-regions, and as entered in the NPCC’s habitat unit ledger (NPCC 2011)[7]. During the same period the NPCC has occasionally modified the Program. Some changes were not uniformly interpreted by project sponsors or BPA.

HEP programmatic modifications and the evolution of HEP protocols resulted in significant issues in many cases. Issues ranged from how HU losses were calculated in loss assessments to the NPCC’s 2:1 HU crediting decision that, in theory, increased the number of HU losses requiring mitigation, without a clear HEP based rationale for doing so, and without agreement by all parties.

HEP discussion points and issues for this document are presented in two broad categories:

1. Loss assessment inconsistencies
2. Compensation project HU crediting and habitat acquisition/protection issues

[7] In addition to HEP based compensation, extensive wildlife mitigation has been accomplished that is not reflected on the Council’s website or HU ledger, Table C-4 in the program, or in BPA’s mitigation project website, Columbia Basin Fish. BPA covered its C&I wildlife mitigation responsibility for half the FCRPS dams using long-term, comprehensive agreements with Montana (in 1989 for Libby and Hungry Horse Dams); Idaho and the Nez Perce Tribe (in 1993 for Dworshak Dam); Oregon (in 2010 for nine Willamette Basin dams); and with Idaho (in 2014 for five southern Idaho dams). These dams and their mitigation are outside the HEP driven HU crediting process and are therefore not discussed in this paper.

Loss Assessments

Background

Hydro facility habitat loss assessments, used to identify and quantify habitat losses, were developed for BPA hydro facilities by state, federal, and tribal wildlife management agencies with jurisdictional and wildlife/fish management responsibilities in the area impacted by each dam. Nearly all loss assessments were developed in the mid- to late-1980s.

Hydro facility loss assessments were occasionally "grouped" based on geographical area or state boundaries. Lead Agencies/authors varied across the Columbia Basin as shown in Table 3.

Table 3 Hydro facility loss assessment lead agencies

Lead Agency[a]	Hydro Facility Loss Assessments[b]
WDFW	Grand Coulee Dam
WDFW/CCT	Chief Joseph Dam
IDFG	Albeni Falls Dam, Anderson Ranch Dam, Black Canyon Dam, Deadwood Dam, Minidoka Dam, Palisades Dam, Dworshak Dam
USFWS	Bonneville Dam, John Day Dam, The Dalles Dam, McNary Dam (Lower Four)
ODFW	Big Cliff Dam, Cougar Dam, Dexter Dam, Green Peter Dam, Hills Creek Dam, Lookout Point Dam (Willamette Basin)
USACE	Lower Snake River Dams

[a] Washington Department of Fish and Wildlife (WDFW), Confederated Tribes of the Colville Reservation (CCT), Idaho Department of Fish and Game (IDFG), US Fish and Wildlife Service (USFWS), Oregon Department of Fish and Wildlife (ODFW), US Army Corps of Engineers (USACE)

[b] Includes only hydro facilities listed in the Northwest Power Conservation Council's Mitigation Program Table C – 4.

In all cases, loss assessments were developed after construction and inundation occurred. Cover type determination and habitat quality assessments were based on pre-construction aerial photo imagery of limited quality, photographs, and input from natural resource managers and other public and private stake holders[8]. Consequently habitat suitability indices and associated HU estimates were based largely on "best scientific judgment" and memory/opinion without the benefit of pre-construction, on-site, measured or ocular habitat evaluations to support reported conclusions[9].

[8] Global Information System (GIS) and other computer assessment tools were in the early stages of development in the mid- to late-1980s when most loss assessments were produced.

[9] Although limited, habitat quality was occasionally estimated by comparing inundated sites identified on pre-C&I aerial photographs with remnant reference sites.

In contrast, HEP protocols call for "pre-project" habitat assessments to accurately determine habitat losses (USFWS 1980, 1980a). Since pre-project loss assessments were not possible, natural resource agencies agreed to estimate habitat losses as previously described and, in so doing, accepted that HU loss results reported for a specific hydro facility could be under or over reported[10].

The RHT believes that if loss assessments were written using current technology and present-day understanding of biological resources and habitat functional relationships, loss assessment HU results would be much different. That said, nothing in this paper is meant to diminish the work accomplished by those who drafted the loss assessment documents. To the contrary, their work was visionary and a daunting task given the technology and resources available at the time.

To examine and try to address these HEP inconsistencies in the loss assessments for the FCRPS, the NPCC chartered a Wildlife Crediting Forum. After a year of work, the forum issued a final report, which the Council adopted, recommending that the region not reconsider prior loss assessments, except as noted in its report (Appendix D). The Forum also generally accepted the *Wildlife Crediting Program Table C-4* (published in the NPCC-approved 2009 Program) as the agreed-to measure of habitat loss from the FCRPS dams. Given the inconsistent application of HEP throughout the region, and disagreements over appropriate crediting methodologies, the forum did not reach consensus on how much wildlife mitigation had been accomplished to date, or how much remained to fully address construction and inundation losses from the FCRPS.

Loss Assessment Issues

Loss assessment inconsistencies occurred between natural resource managers and at times were also contrary to HEP protocols. The RHT identified three loss assessment issues affecting wildlife mitigation crediting throughout the Columbia Basin Region including:

1. Differences between project sponsors in how HU losses were calculated
2. Not annualizing HU loss results i.e., lack of futures analyses
3. HEP model variations and application

Issue 1: Differences in how HU losses were calculated

The construction and inundation associated with a project, such as a hydro facility, significantly alters or eliminates extant wildlife habitat and can permanently change the physical characteristics of the landscape. However, over time wildlife habitat will regenerate in areas

[10] Acknowledging the concern expressed by some project sponsors that construction and inundation impacts were under reported, the RHT's opinion is that given the suite of HEP models used and the state of the science during that period, loss assessment HU results likely were a wash. That is, some HEP model HU results were likely high while others were low.

where geomorphologic, hydrologic, and edaphic conditions support the establishment of vegetation.

HEP principles require that like HUs generated over time on a project site be subtracted from the initial number of baseline HUs to calculate the "net" HU loss for each evaluation species. As a result, a "futures" analysis should be conducted as part of a HEP analysis to estimate post project habitat conditions, which could partially or totally offset the loss of habitat/HUs eliminated due to a project. For example, if baseline HEP results showed a loss of 200 wetland mallard HUs in a riverine system due to project development, and the analysis shows that newly formed inundation pool wetlands could eventually provide 50 wetland mallard HUs, the "net" mallard HU loss is 150 HUs (200 HUs – 50 HUs = 150 HUs).

This futures analysis tenet was not applied by the region's wildlife managers to all loss assessments, thus creating an inconsistency in how loss assessment HUs were calculated and reported. Only loss assessments prepared by IDFG consistently and clearly applied this principle. As a result, the loss HUs shown on NPCC's crediting ledger (Appendix C), which defines BPA's wildlife mitigation obligation, reflects both "net" HU losses reported by IDFG and "gross" HU losses reported by most other participants.

Consequently, HU losses reported for hydro facilities located in Idaho are either "under stated" relative to HU losses reported in loss assessments developed for hydro projects located elsewhere or "over stated" for all hydro facilities outside of Idaho. Reconciling this inconsistency would require either recalculating loss HUs reported in loss assessments prepared by IDFG or those developed by other entities. However, since all parties agreed not to modify the loss assessments (NPCC 2011), the RHT suggests that reconciliation, if needed, could be part of settlement discussions between effected project sponsors and BPA. Such discussions would have to rely on subjective opinion and professional judgements, because no HEP tools or data exist to facilitate a more objective resolution for such situations.

Issue 2: Annualization

HEP's authors recognized that landscapes change over time due to anthropogenic influences such as agricultural development and/or stochastic events like wildfires. Annualizing was developed to estimate and account for these impacts. The process of annualizing requires conducting a "futures" analysis for each year of a proposed project's expected life, and then netting the HUs in each year and averaging them. In this way HEP provides a tool for estimating changes in habitat quality and quantity that would likely occur at a project site over time with or without the project. The HEP "annualization" process is summarized below.

HEP Annualization Process Summary

The HEP "annualization" process is a "futures analysis" of potential habitat quality and quantity over a defined period of time. HSIs and HUs are determined for target year zero (TY0) for each evaluation species and then projected for each target year analysis period (Figure 2).

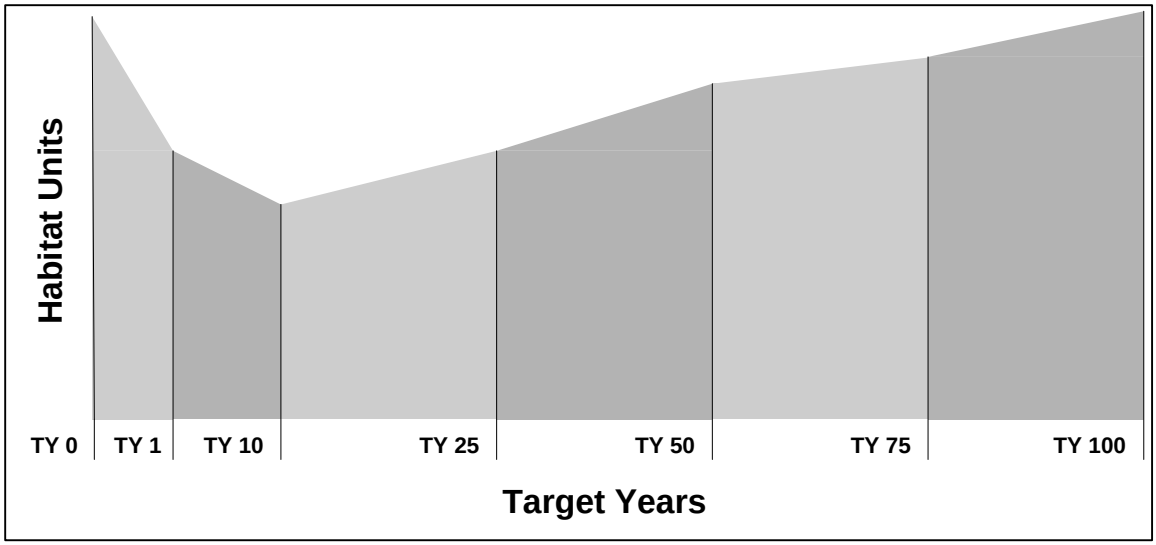


Figure 2 The projected number of habitat units for each target year analysis period

The number of HUs for each target year period is summed to obtain the total number of habitat units (∑ TY 1….TY nth) as illustrated in Figure 3. The number of HUs for each year in each target period varies based on a projected HSI and estimated amount of habitat available for each species.

The total number of habitat units is then divided by the period of analysis (generally the “life of the project”) to determine “average annual habitat units” (AAHUs). For example, if 138,000 HUs were projected over the 100 year period of analysis as depicted in Figure 3, then there are 1,380 AAHUs (138,000 HUs ÷ 100 years) accumulating each year for the life of the project (Figure 4).

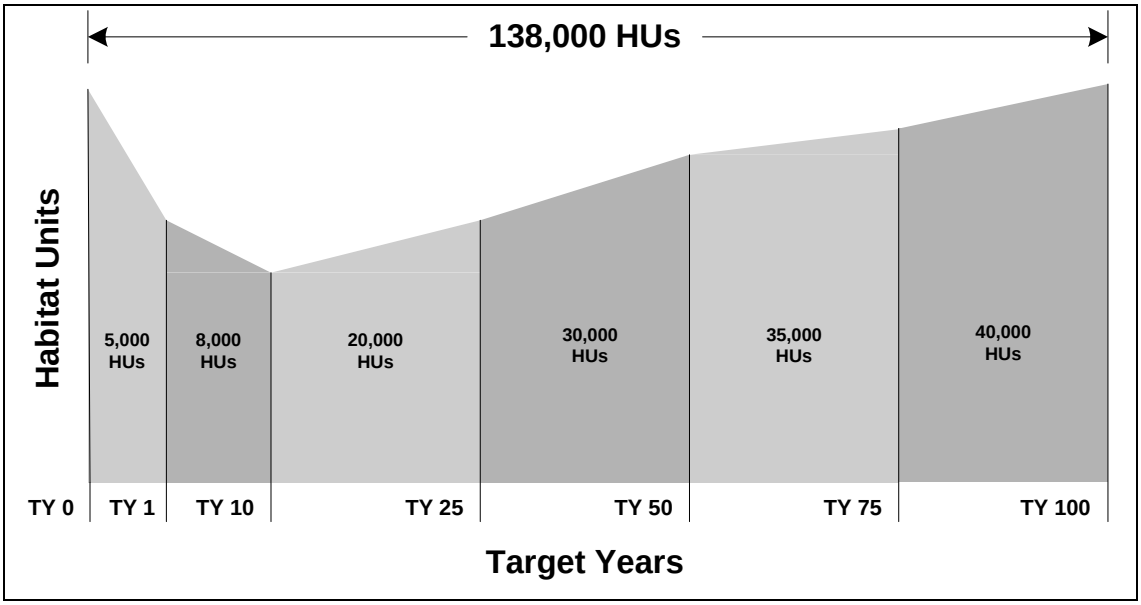


Figure 3 An example of calculating the number of HUs for the "life of a project"

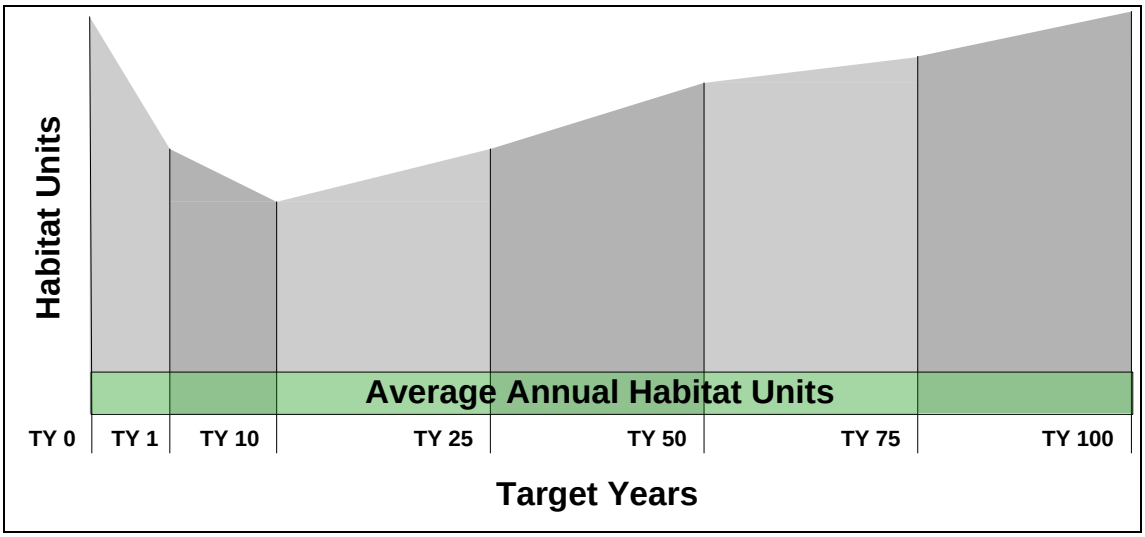


Figure 4 AAHUs relative to target period HU totals

This process is applied to both "with project" and "without project" conditions. The "net" impact of the project is determined by subtracting the "with project" AAHUs from the "without project" AAHUs. For example, if 1,380 AAHUs represent "without project" conditions and "with project" conditions resulted in a loss of 2,000 AAHUs, then the "net" loss is 620 AAHUs (1,380 AAHUs – 2,000 AAHUs = [-620] AAHUs). Over the 100 year life of the project 62,000 AAHUs would require mitigation (620 AAHUs x 100 years = 62,000 AAHUs)[i].

The challenge for an effective annualization analysis is that loss assessment HEP team members have to accurately estimate/predict future changes to project area habitat conditions and associated acres for the life of the project. They consider potential land use changes resulting from urban, agricultural, industrial, and recreational development as well as habitat changes that may occur due to wild fires, plant succession, floods, and other stochastic events. If the life of the project is 100 years, team members project how impact area land use and habitat conditions might change over that period.

For instance, based on research, expert knowledge, area growth projections, successional models, and comparative measurements (Stiehl 1995), the HEP team could project that a 100,000 acre impact area would likely sustain habitat losses equaling 20,000 acres due to development during the proposed life of the project - even if the hydro facility was not built ("without project"). As a result, the size of the project impact area is reduced over time from 100,000 acres to 80,000 acres, which decreases the potential number of loss HUs since HUs are calculated by multiplying HEP model HSIs by the number of acres impacted.

Similarly, potential changes to HEP model habitat variables would also be estimated for the life of the project. HEP team members may conclude that over the life of the project extant, mature cottonwood (*Populus* spp.) tree stands will largely be replaced by shrubs and regenerated cottonwood groves due to succession and/or stochastic flood/fire events. Thus, habitat quality

(HSI) and HUs could decrease for some HEP evaluation species such as pileated woodpeckers (*Hylatomus pileatus*) that require large diameter trees and simultaneously increase for other species like yellow warblers (*Setophaga petechia*) that thrive under earlier successional conditions.

The same process is used to determine the number of annualized HUs over the life of the project if the hydro facility is built ("with project"). The total impact of the project is then determined by subtracting the number of annualized "with project" HUs from annualized "without project" HUs.

In summary, the annualization process takes into account potential changes in land use and habitat quality that occurs over time which, consequently, effects the number of HUs that require mitigation. The annualization process is fully explained in HEP document ESM 102 (USFWS 1980a) and excerpted in Appendix E.

Discussion

Loss assessment HEP results were not annualized as part of the Columbia River Wildlife Mitigation Program. All project managers and participants agreed to exclude the process citing concerns over the accuracy and uncertainty associated with "forecasting" future habitat conditions along with the amount of time and effort needed to complete the task[11].

Since FCRPS dam loss assessment HUs were not annualized over the estimated life of the project[12], the assessments all estimated HU losses (and sometimes gains) from a hypothetical single point of time, usually decades after the dams were constructed. If that point in time was earlier or later in a dam's history, the assessment would undoubtedly have been different.

Had the HUs been annualized, the number of HUs subject to mitigation would have been reduced to account for:

1. HUs remaining after dam construction and from areas within the "project (dam) area" but not impacted by construction and inundation.
2. Projected HUs resulting from the natural re-establishment of habitat along the shoreline of the inundation pool or enhancement of habitat in areas temporarily affected by construction activities.
3. HUs that would have been lost due to changes in land use and development that would likely have occurred without the project.

[11] HEP allows for the modification of HEP principles as long as all parties agree to the changes (R. Stiehl, pers. comm.).
[12] The projected "life of a dam" would likely have been 100 years.

The HU reductions resulting from the annualization process are shown in Figure 5. Note that construction period and residual[13] HUs, projected HUs, and HUs lost to development reduced the number of HUs requiring mitigation by approximately 25% in this example.

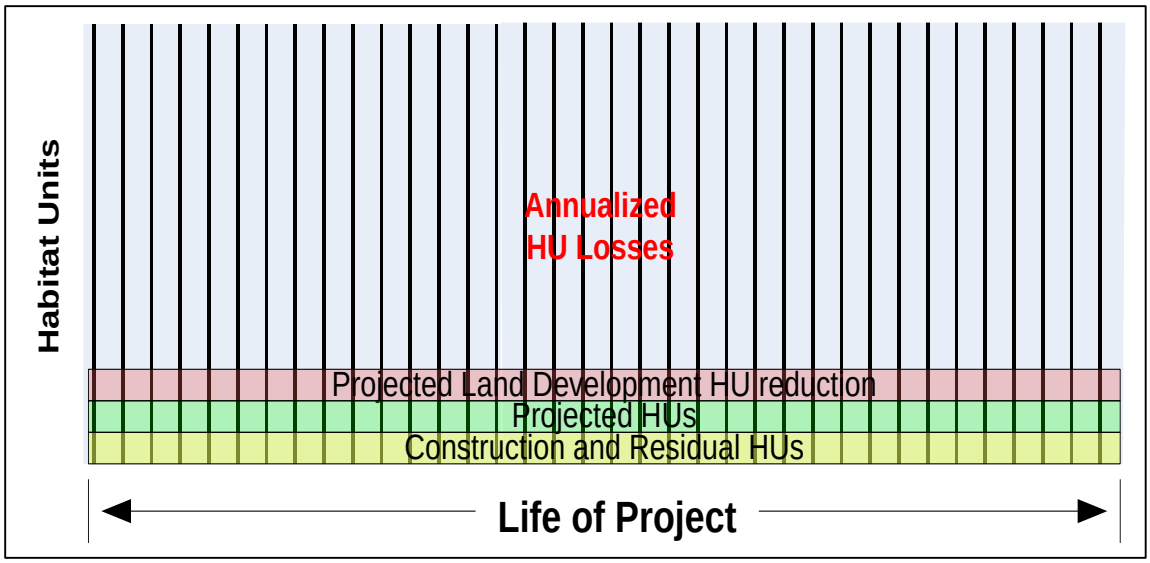


Figure 5 Annualized net HU loss example

Continuing this example, applying the annualization process across the projected life of a hydro facility would result in the HU reductions for the target years displayed in Figure 6[14]. In contrast, FCRPS dam HU losses were not annualized and, therefore, were not offset by HU losses that would have been lost due to changes in land used and development that would likely have occurred without the project.

[13] It is assumed that not all wildlife habitat within a project's boundary is impacted. Residual HUs are generated on non-impacted areas.

[14] The RHT recognizes that the "magnitude" of the HU losses and construction, residual, and projected HUs are open to debate in the example depicted in Figure 7; however, the RHT believes the "general" trend would have been similar to that shown.

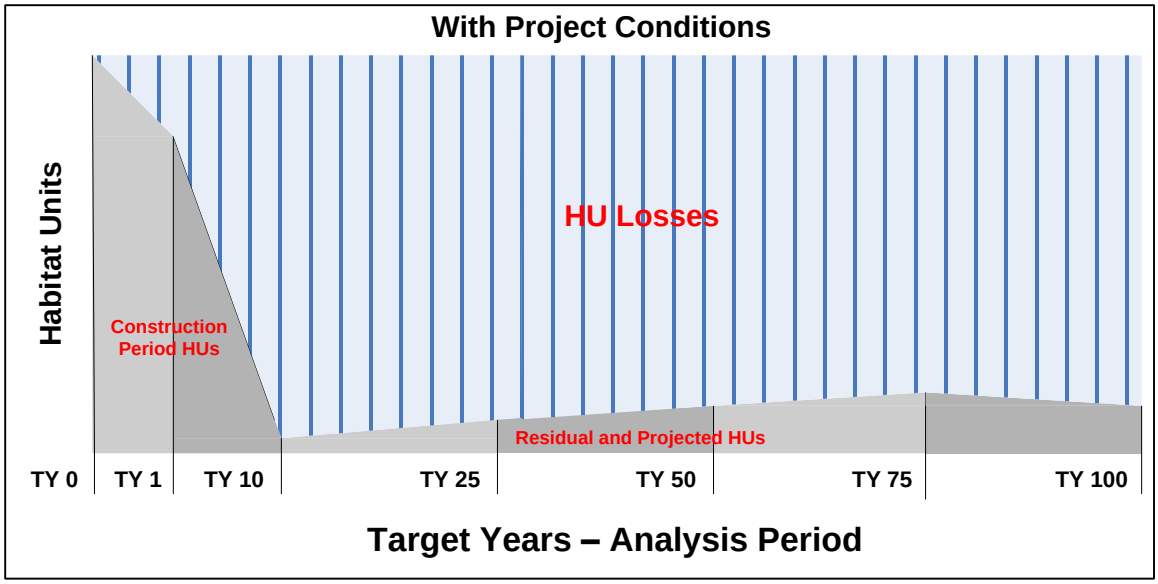


Figure 6 An example of loss assessment annualized HU reductions and fewer HUs requiring mitigation

Issue 3: HEP model variations and application

HEP models are used to estimate the value of habitat within a project area for a selected evaluation species using HUs as a metric or "currency" (Stiehl 1995). Starting in the early 1980s the USFWS developed numerous "Blue Book" HEP models following the guidelines described in ESM 103 (USFWS 1980b). These models were applied "as is" or modified as necessary to meet habitat conditions found in the Columbia Basin Region. In cases where a published HEP model for a desired evaluation species did not exist, project sponsors constructed HEP models (see http://www.nwrc.usgs.gov/wdb/pub/hsi/hsi-101.pdf[15] to view a standard HEP model).

Few if any HEP models existed for the evaluation species selected by ODFW to assess losses from Willamette Basin dams - leaving the agency with little choice but to construct new HEP models. Since there is no one correct way to build a HEP model (Stiehl 1995), ODFW constructed HEP models based on a "check list" approach (Appendix F) rather than the format included in ESM 103 (USFWS 1980b), which was used by most if not all other project sponsors throughout the Columbia Basin Region. Consequently, two different HEP model types were used to determine habitat losses across the Columbia Basin.

Using the "checklist" HEP models to evaluate potential compensation sites, or conduct follow-up HEP surveys to gauge mitigation progress and effectiveness, was problematic for the RHT and others as little, if any, information was included with each model. Not having the underlying precepts supporting the habitat condition/spatial choices presented in the model checklists made applying the models extremely subjective and largely not repeatable by anyone other than those that developed the models. As a result, the limited number of HEP surveys conducted in the Willamette Basin by the RHT, which used a mix of ODFW and standard HEP models,

[15] Add to browser if unable to view.

largely did not capture the losses associated with Willamette Basin dams. As such, the RHT agrees that the settlement approach based on acres and used by BPA and Oregon to mitigate C&I habitat losses in the Willamette Basin was probably the best option.

Compensation Site HU Crediting and Habitat Acquisition/Protection

Background

This section focuses on compensation site HU crediting and habitat acquisition/protection issues. Standard HEP HU crediting protocols were independently modified by Columbia River Wildlife Mitigation Program managers to create a method for tracking FCRPS HU credit[16] that they would acknowledge in exchange for BPA funding for mitigation and enhancement projects. All agencies and tribes implementing projects under the program used FCRPS HU crediting to calculate compensation site HU gains that were credited towards BPA's mitigation obligation. In addition, the YN and WDFW further adapted FCRPS HU crediting to fit agency specific perspectives and needs. These adaptations are discussed separately. HU crediting topics include:

1. FCRPS HU crediting
2. YN HU Crediting Method
3. WDFW crediting formula
4. NPCC 2:1 Crediting Ratio

HEP protocols were also modified to allow acquisition/protection of out-of-kind cover types. Habitat acquisition/protection issues include:

1. Cover type definitions and delineation
2. HEP loss assessment models
    a. HU stacking
    b. Species model substitution
    c. HEP model modification

Habitat acquisition/protection issues are interrelated and will be discussed as such. Standard HEP crediting practices are summarized below to provide the reviewer with a basic understanding of HEP crediting tenets.

Standard HEP Crediting

Baseline HEP analyses are conducted to determine present habitat conditions (HSI) and the associated number of HUs. HEP protocols do not allow compensation site baseline HUs to be used to offset HU losses as the protection action i.e., acquiring/protecting the compensation site does not add to the net wildlife habitat value of the property (Stiehl 1995). Conceptually, whatever baseline HUs existed at the time the property changed ownership or came under

[16] "FCRPS HU crediting" was "coined" by the RHT.

lease or easement management agreements would continue to exist even if no protection action took place. Therefore, there is no net HU gain as shown in Figure 7.

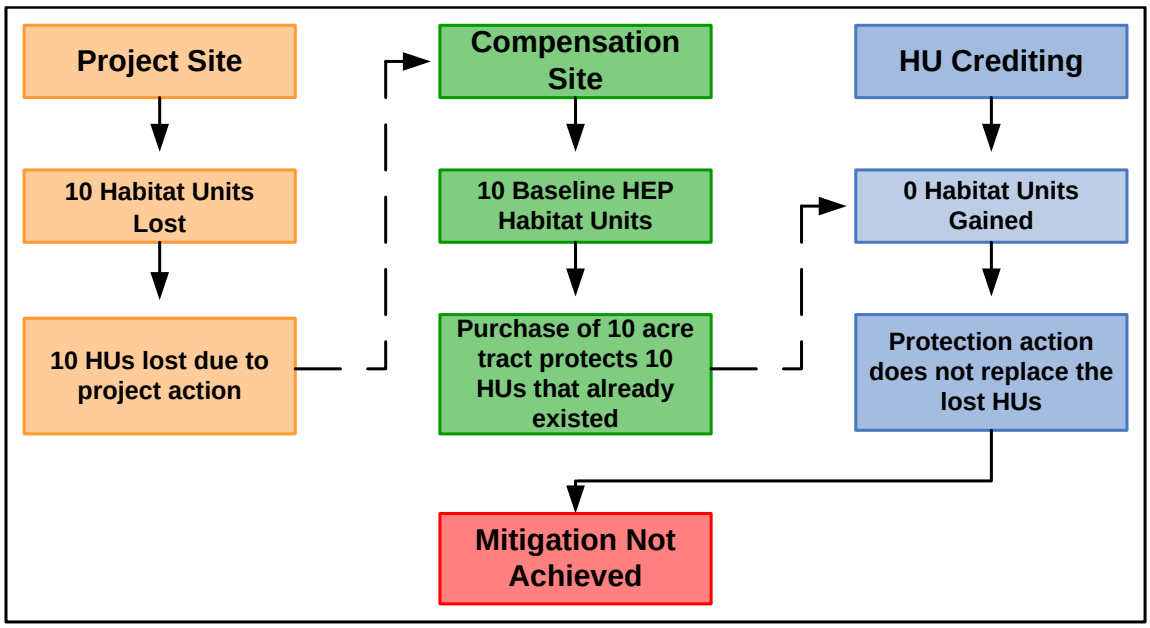


Figure 7 HEP habitat unit crediting precept diagram

HEP was designed to consider only enhancement HUs resulting from passive and active habitat restoration actions[17] to offset HU losses. For example, if ten baseline HUs and an additional five enhancement HUs were generated on a compensation site, the site would yield 15 total HUs ("gross" HUs). However, because the "net" HU gain due to enhancement activities is only five HUs, only the five enhancement HUs are used to offset HU losses. This principle is illustrated in Figure 8.

[17] Removing livestock to allow grassland to recover is an example of passive restoration while planting shrubs and trees and spraying weeds are considered active restoration activities – both result in improved habitat quality (HSI) and increased HUs ("enhancement" HUs).

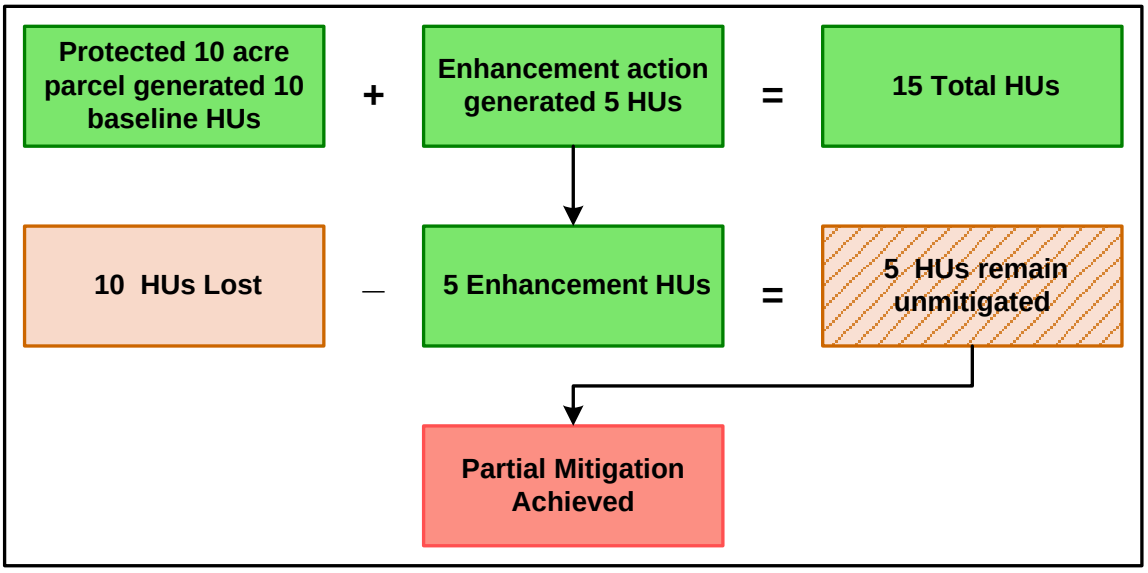


Figure 8 HEP accounting example showing "enhancement HUs" credited against HU losses

Columbia River Wildlife Mitigation HU Crediting

FCRPS HU Crediting

The HEP principle regarding credit for enhancement HUs was modified to address the unique circumstances presented by the FCRPS wildlife mitigation program. State and tribal wildlife managers wanted the flexibility to acquire/protect out-of-kind cover types and tracts that had significant ecological, cultural, and recreational value, or that were already in optimum habitat condition[18].

In a "standard" HEP analysis, the mitigation funding agency generally takes an active role in selecting compensation sites, but BPA rarely did. Because HEP only allows enhancement HU gains to be credited against HU losses, there is little incentive for the mitigation funding agency to acquire habitat in good condition as there may be only a slight HU gain over time while the initial cost of acquiring a parcel is relatively high compared to acquiring a parcel in "poor condition" that has the potential to achieve the desired habitat conditions - given enough time and/or enhancement activities. In addition, the mitigation funding agency is only obligated to acquire "in-kind" cover types.

Wildlife managers largely drove the choice of mitigation with the support of the Council. BPA took a subordinate position allowing wildlife managers to select out-of-kind mitigation sites or parcels that were ecologically or culturally significant provided BPA received full credit; that is, credit for acquiring and protecting the baseline habitat and its associated HUs and credit for each HU gained through enhancement— regardless of what kind of habitat was affected by the FCRPS dams. Although taking baseline HU credit is contrary to how HEP was designed to be used, wildlife managers throughout the Columbia Basin Region agreed to modify HEP HU

[18] Acquiring "optimum habitat condition" sites is an example of "protecting the best of what remains".

crediting conventions - giving BPA both baseline and enhancement HU credit for all compensation sites unless otherwise agreed by BPA and individual wildlife management agencies[19] . As a result, both baseline and enhancement HUs generated on the majority of compensation sites are credited against FCRPS dam HU losses as depicted in Figure 9.

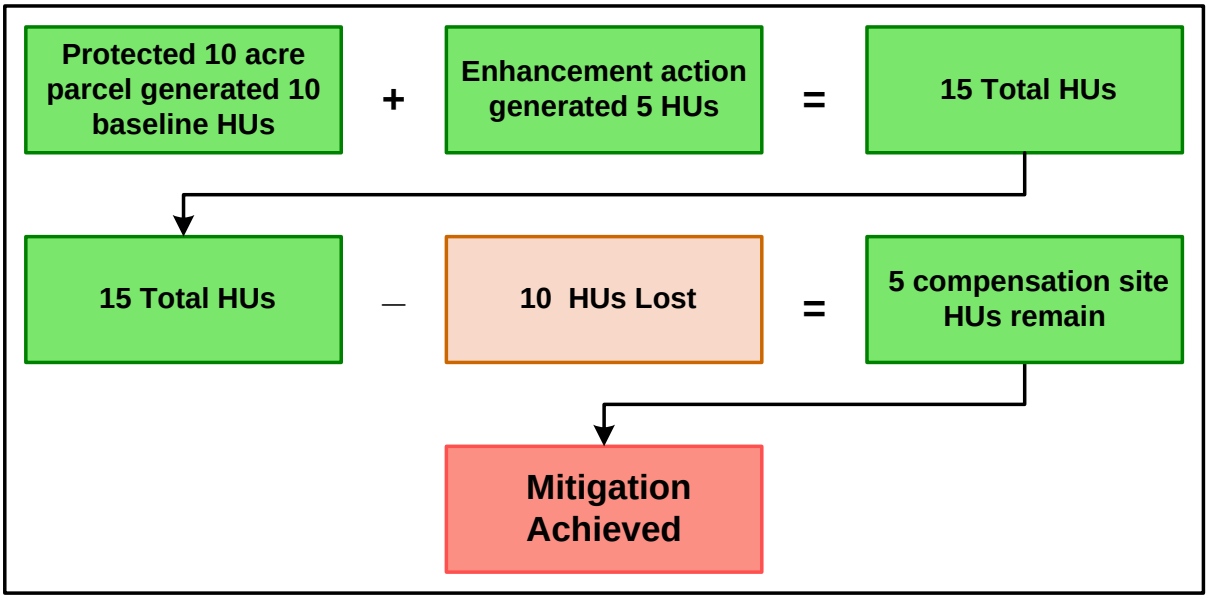


Figure 9 HEP accounting example showing FCRPS modified crediting

This HU crediting compromise benefitted wildlife managers, BPA, and rate payers alike. Specifically, wildlife managers had flexibility to acquire/protect the cover types and parcels important to each agency while BPA credited both baseline and enhancement HUs towards FCRPS dam HU losses listed on NPCC's "crediting ledger", which resulted in reduced rate payer mitigation costs as more HUs per mitigation parcel were credited towards BPA's mitigation obligation compared to applying only enhancement HUs towards the mitigation debt.

YN HU Crediting Method

The YN did not consider the habitat unit concept as a legitimate method for determining when BPA has met its wildlife mitigation obligation. The YN asserted its 1992 project proposal agreement with BPA was acre based, not HEP/HU based; that is, BPA was supposed to fund the protection and maintenance of up to 27,000 acres[20] of wildlife habitat on the Yakama Reservation (T. Hames, pers. comm.).

Consistent with this perspective, the YN elected not to take a position on HEP - specifically the development of compensation site cover type/species matrices that are based on individual

[19] An example is the Umatilla Tribe's Isqúulktpe mitigation project whereby BPA received only enhancement HUs generated on extant tribal lands.
[20] Specifically, the Yakama Nation Wetlands and Riparian Restoration Project (WRRP). To date, approximately 22,000 acres have been protected.

Lower Columbia River dam loss assessments, and the disbursement of habitat units generated on compensation sites (T. Hames, pers. comm.). The YN, however, had a contractual obligation with BPA to account for mitigation actions at the Program level; therefore, the Tribe agreed to allow HEP surveys as necessary to provide HU data for NPCC's crediting ledger.

To support the Regional HEP effort and fulfill BPA mitigation contractual obligations, the YN contracted with Raedeke Associates Inc. (Raedeke) in the early 1990s to conduct baseline HEP surveys on the Yakama Nation Reservation. The YN, however, opted not to follow standard HEP crediting practices used by other project managers and directed Raedeke to develop and apply an alternate cover type/species matrix (Raedeke and Raedeke 2000) that generally combined Lower Four loss assessments evaluation species for like cover types[21].

This became problematic for the RHT, other wildlife managers, and BPA because HEP model evaluation species selection and stacking is linked directly to individual hydro facility loss assessments and mitigation credit (see Appendix G for brief explanation). In most cases, Raedeke either matched the maximum number of evaluation species listed per cover type in one of the Lower Four loss assessments or exceeded that number as shown in the YN/Raedeke loss assessment matrix. The net effect was that most YN compensation site baseline HEP results credited against Lower Four HU losses were over-reported and would have been less if compensation sites had been paired with a specific hydro facility and proper HEP model stacking had been applied.

Because the YN also elected not to participate in crediting HU gains against specific Lower Four Dams, that task defaulted to BPA and later the RHT. Without additional guidance or the use of appropriate cover type species matrices to "match" compensation HU results with a specific hydro facility's loss assessment, McNary Dam became the default "parking lot" for a significant number of baseline HEP HUs. This interim approach resulted in McNary Dam being nearly 200% credited while other Lower Four Dams had significantly fewer HU gains credited – creating a significant HU crediting logistics issue[22].

Beginning in 2004, YN, WDFW, and CTUIR compensation site baseline and follow-up HEP surveys were conducted by the RHT. The RHT followed appropriate crediting practices, crediting HEP results to specific hydro facilities as per Washington Coalition guidelines and later Crediting Forum recommendations (NPCC 2011). The YN remained neutral regarding this change in crediting protocols (Hames, pers. comm.). Note that the total number of HUs generated on WDFW and CTUIR compensation sites were relatively small compared to the number of HUs generated on YN compensation projects at that juncture.

[21]The YN considered all C& I wildlife habitat losses at McNary, John Day, The Dalles, and Bonneville Dams as a single, linked, landscape level habitat loss that was greater than summing up habitat losses for individual dams (Hames, pers. comm.).

[22] Both BPA and the RHT recognized that any future attempt to redistribute the HUs would require significant effort and likely not be acceptable to all involved parties.

In 2007 with support from BPA, the RHT redistributed compensation site HUs credited towards Lower Four HU losses[23] in an effort to reconcile Lower Columbia River FCRPS dam HU crediting assignment issues with HU crediting practices used elsewhere in the Region[24]. This preliminary effort showed that although unmitigated HUs remained at some hydro facilities, the Lower Four Dams were collectively over-mitigated by 2,510 HUs.

In 2010, the RHT updated the 2007 Lower Four compensation site HU data to include 2008 through 2010 HEP results. The RHT assigned compensation site HEP results to individual hydro facilities using appropriate HU stacking for each dam. The results showed that no HUs remained un-mitigated at Lower Four Columbia River Dams[25]. Like the 2007 effort, the 2010 HU redistribution exercise occurred prior to establishment of the Crediting Forum (NPCC 2011); however, the RHT believes differences resulting from applying Crediting Forum guidelines to the 2010 analysis would be insignificant.

HEP surveys conducted since 2010 generated a significant number of HUs that the RHT credited towards BPA's Lower Four wildlife mitigation obligation. The RHT estimates Lower Four Columbia River Dams are nearly 36,000 HUs over-mitigated—without the *pre-Act* mitigation described in the Giger Report to the Council (Giger 1991) and summarized below:

> *Limited wildlife mitigation occurred prior to passage of the Northwest Power Act. The majority of the pre-Act mitigation is associated with the McNary and John Day dams. The 1991 Geiger Report (1991) and 2004 USFWS Coordination Act Report identified 50,938 acres of Pre-Act mitigation and recommended that 14,032 HUs be credited as mitigation (NPCC 2011).*

As of August 2015, *pre-Act* HUs have not been credited towards BPA's Lower Columbia River wildlife mitigation obligation. Determining a precise number of compensation site HUs to credit towards HU losses was and remains a challenge given how YN compensation site baseline HUs were calculated and the uncertainty surrounding crediting *pre-Act* mitigation. That said, the RHT estimates that 107,878 compensation site HU gains (excluding *pre-Act* HUs) have been generated to offset 72,304 HU losses attributed to Lower Columbia River dams (see Ashley 2015 for additional discussion on wildlife mitigation and crediting Lower Four Columbia River Dams).

[23] Primarily YN project HUs credited towards McNary Dam HU losses
[24] At this juncture, HUs were assigned to multiple dams.
[25] The 2010 HU redistribution results consist of a series of "draft" spreadsheets and not included in this document. A final report was not completed due to RHT workload priorities.

WDFW Crediting Formula

Although WDFW utilized a combination of new land acquisitions, purchased with BPA wildlife mitigation funds, and enhancement of extant state and federal lands[26] to offset FCRPS dam HU losses, WDFW primarily used existing wildlife areas (WAs) as mitigation compensation sites due to:

1. County commissioners that opposed further acquisition of private land by state and federal government agencies, which removed property from county tax rolls
2. Significant internal funding issues - WDFW considered BPA wildlife mitigation funds as a viable option to bolster/replace limited WDFW WA management funds.

WDFW agreed BPA should receive full baseline and enhancement HU credit (FCRPS HU Crediting) on sites purchased and managed with BPA mitigation funds. They also agreed that BPA would receive partial HU credit for funding only O&M activities that preserved and enhanced habitat on extant WDFW wildlife areas. WDFW developed the *WDFW Crediting Formula* (WCF), with BPA support, to address HU crediting for extant wildlife areas that were used as wildlife mitigation compensation sites[27]. WDFW often applied both FCRPS HU Crediting and the WCF to calculate compensation site HU gains. HU calculations varied based on whether a compensation site included:

1. New land acquisitions.
2. DNR lands.
3. Bureau of Land Management (BLM) parcels
4. Extant WDFW wildlife management areas.

BPA received full baseline HEP HU credit generated on new land acquisitions and all concomitant enhancement HU credits. Likewise, BPA received full baseline and follow-up HU credit for Washington Department of Natural Resource (DNR) lands[28] and BLM property managed by WDFW (FCRPS HU Crediting).

BPA also received both protection and enhancement HUs on WDFW wildlife management areas already owned by WDFW or acquired through funding sources other than BPA[29]; however, HU credit calculations were based on the WCF (Appendix H). As a result, BPA received only partial HU credit.

[26] State lands included wildlife areas owned by WDFW that often included Washington Department of Natural Resources (DNR) land. Federal property (Bureau of Land Management) was limited and occurred on the Wenas Wildlife Area.
[27] WDFW wildlife area parcels were acquired prior to the 1980 Act.
[28] BPA received full baseline and enhancement HU credit because WDFW used BPA wildlife mitigation funds to pay annual DNR lease fees.
[29] There is one exception to this policy. BPA received full baseline credit on new acquisitions at West Foster Creek that were acquired with State funds in order to make BPA whole for funds and HUs associated with removing the Cleman Mountain Unit from the Wenas WMA mitigation project.

Initial WCF calculations were based on projecting habitat quality (HSIs) for a ten year period. WDFW and BPA, however, agreed to extend WCF HSI projections and HU crediting out 20 years in lieu of WDFW having to conduct follow-up HEP surveys on extant WDFW wildlife areas used as mitigation compensation sites. In summary, WDFW used both FCRPS HU Crediting and the WDFW Crediting Formula to calculate HU credit generated on WDFW wildlife mitigation compensation sites.

NPCC 2:1 Crediting Ratio

Beginning with the 2000 Program and carried forward to the 2014 Program, NPCC called for mitigation agreements to equal 200 percent of the remaining unmitigated habitat units (2:1 ratio). As stated in both the 2000 and 2014 Programs, NPCC chose the 2:1 crediting ratio to, "Address the inability to precisely determine the habitat units resulting from acquiring an interest in property that already has wildlife value or the additional losses represented by annualization of the losses". In effect, NPCC doubled the number of unmitigated HUs remaining as of April 2001.

HEP protocols are technical measurement tools, and this policy guidance from NPCC further complicated the application of HEP and the region's ability to agree on how to credit BPA's wildlife mitigation efforts. HEP does allow modifications to the process as long as there is unanimous agreement between all involved parties – which was not the case, as BPA did not concur with the NPCC action. In addition, this raised a "fairness" issue between dams that BPA mitigated fully prior to 2000, and dams where mitigation remained to be completed after 2000. Project sponsors that mitigated prior to 2000 did not benefit from the Council's "2:1" decision, while those with unmitigated HUs doubled their remaining HUs.

FCRPS HU Crediting Synopsis

The RHT developed the HU crediting synopsis displayed in Table 4 from data provided by the RHT, BPA (Pisces data base and COTRs), and in a few cases, directly from project managers. The RHT believes the summarized HU data "reasonably" reflects the current/final status of FCRPS HU crediting at the sub-region scale. As depicted, the Lower Columbia, Upper Columbia (Washington), and Lower Snake Sub-regions are clearly over-mitigated while unmitigated HUs remain in the Southern Idaho and Upper Columbia (Idaho) Sub-regions.

Table 4 FCRPS HU crediting summary by sub-region

Sub-region	Hydro Facilities	Total HU Losses	Mitigated HUs	Unmitigated HUs	Over-mitigated HUs
Lower Columbia[a]	Bonneville, McNary, The Dalles, and John Day Dams	72,304	107,878	0	35,574
Upper Columbia (Washington)	Grand Coulee and Chief Joseph Dams	120,543	136,263	0	15,720
Upper Columbia[b] (Idaho)	Albeni Falls Dam	28,658	16,686	11,972	0
Southern Idaho[c]	Minidoka, Palisades, Black Canyon, and Anderson Ranch Dams	58,830	44,676	14,154	0
Lower Snake River[d]	Ice Harbor Dam, Lower Monumental, Little Goose, and Lower Granite Dams	26,774	37,467	0	10,693
Totals		**307,109**	**342,970**	**26,126**	**61,987**

[a] The 107,878 Mitigated HUs include 74,528 HUs credited against Washington's HU share and 31,866 HUs credited against Oregon's HU share. The Lower Four loss assessment habitat units (HUs) were evenly divided between Washington State and Oregon State except at McNary Dam where 80% of the HUs were allocated to Washington.

[b] The RHT believes the actual number of mitigated HUs is under reported due to crediting inconsistencies; therefore, the unmitigated HU total is also inaccurate.

[c] The 44,676 mitigated HUs include IDFG's 50% share of the C&I mitigation debt for the Upper and Mid Snake River Provinces, which BPA and IDFG have settled through a negotiated agreement.

[d] The NPCC amended the 1994-1995 Fish and Wildlife Program to include 26,774 unmitigated Lower Snake River HUs, which were mitigated by the Nez Perce and Burns-Paiute Tribes.

Lower Snake River wildlife mitigation was begun by the US Army Corps of Engineers. In the 1994 program amendment process, the Council decided to subtract the pre-Act mitigation done by the Corps from the C&I losses (Section 11.3H.1 in the December 1994 Program). The result was 26,774 unmitigated Lower Snake HUs recommended for BPA to mitigate under the Program. The RHT and/or project sponsors conducted compensation site HEP surveys on the BPA-funded projects, which determined the number of HU gains used to offset these Lower Snake River HU losses.

Columbia River Wildlife Mitigation Acquisition/Protection Issues

Inconsistencies occurred between project sponsors and at times were contrary to HEP protocols or conflicted with either or both Program specific HEP practices/adaptations and Crediting Forum guidelines (NPCC 2011). The RHT identified the following issues that impacted the consistent application of HEP across the Region:

1. Cover type definitions and delineation
2. HEP loss assessment models
    a. Cover type pairing and HU stacking
    a. Species model substitution
    b. HEP model modification

In many cases these issues overlap and are addressed accordingly below.

Cover Types

Background

Occasionally problems occurred when cover types (Appendix I) were misidentified or defined/delineated broadly to include a wide range of floristic conditions. An example of misidentifying a cover type is delineating a site as the shrubsteppe cover type when the shrub component is less than five percent cover[30]; at which point the site is biologically functioning more as grassland and should be identified as such. Left uncorrected, this effects HEP model species selection and ultimately impacts HU results. Because the RHT worked through this issue with project sponsors, HEP HU results were not affected.

Discussion

In situations where the floristic composition of a compensation site did not or will not support one or more of a target species' life requisite needs, HEP model species selection became problematic. For instance, even though the sage grouse HEP model was used to evaluate shrubsteppe cover type[31] HU losses in a number of loss assessments, using the sage grouse HEP model to evaluate compensation site HU gains in shrubsteppe habitat devoid of

[30] The RHT delineated sites with less than five percent shrub cover as grasslands.
[31] The shrubsteppe cover type is generally dominated by sagebrush (*Artemisia* spp.), rabbitbrush (*Ericameria* spp.), bitterbrush (*Purshia tridentata*), or a combination thereof interspersed with grasses and forbs.

sagebrush[32] is inappropriate if site edaphic conditions don't support sagebrush or the desired management condition is to maintain the site as mule deer winter range comprised of bitterbrush.

If the sage grouse HEP model is used to evaluate "shrubsteppe habitat" that is devoid of sagebrush, sage grouse HEP model results are 0.00 HSI. Therefore, HUs gained are also zero and will likely remain so in perpetuity. In this example, HEP protocols call for replacing (i.e., species substitution) the sage grouse HEP model with a more appropriate HEP model.

HEP Loss Assessment Models

Issues involving the use, substitution, and modification of loss assessment HEP models are related. In several situations, projects sponsors either strongly objected to the RHT's use of substituted/modified HEP models, which was supported by Crediting Forum guidelines, or insisted on using only loss assessment models. Where loss assessment models were used inappropriately on out-of-kind compensation sites, the practice resulted in under-reported HU credit for BPA and crediting inconsistencies between project sponsors that credited HU gains to the same dam(s).

Disagreements between several project sponsors, the RHT, and BPA staff over HEP model species substitution and modification and associated HU crediting created an impasse that held up the completion of final HEP survey reports and the reporting of compensation site HU gains for several years. Acknowledging these issues will likely remain unresolved, BPA asked the RHT to complete final HEP reports and report HU gains, which was done by January 2015.

A consequence of not reaching agreement on the application of these and other fundamental principles is that consistent, fair, and complete HU crediting is not possible, which further supports the use of negotiated settlement agreements.

Cover Type Pairing and HU Stacking

Background

Cover type "pairing" was a concept developed in the early years of the Columbia River Wildlife Mitigation Program as a method to guide how Bonneville Power Administration (BPA) received credit for acquiring "out of kind/dissimilar" cover types[33]. BPA and the Northwest Power Conservation Council (NPCC) supported Columbia River wildlife mitigation project managers who wanted the ability to acquire high quality functional habitat and important high value "out of kind" cover types. In exchange, wildlife managers agreed to give BPA credit for all lands acquired with BPA wildlife mitigation funds, thus establishing the need to develop the cover type

[32] Sage grouse are dependent on sagebrush as winter forage.
[33] "Out of kind/dissimilar cover types" are cover types that are not identified as "losses" in a given loss assessment document.

"pairing" concept[34]. Cover type "pairing" addressed the question, "how are out of kind/dissimilar cover types, HEP models, and habitat units credited against a given loss assessment"?

Discussion

Pairing "in kind" loss assessment and compensation site cover types is a HEP precept and is simply aligning "like" cover types and, in most cases, evaluating like cover types with the same species and number of HEP models (species stacking) listed in the credited loss assessment. For example, the compensation site grassland cover type corresponds to the loss assessment grassland cover type. If four HEP models were used to evaluate the grassland cover type in the loss assessment, then four HEP models are used to evaluate the compensation site grassland cover type. In most cases compensation site and loss assessment HEP species models are identical for a given cover type.

Likewise, "out of kind" cover types were "paired" with loss assessment cover types. HEP protocols, however, do not provide specific guidance for addressing "out of kind" cover types. Therefore, the RHT developed a metric for aligning "out of kind" cover types based on "pairing" compensation site cover types with loss assessment cover types comprised of "similar" habitat attributes or structural conditions such as shrubs, trees, and snags.

For example, the RHT "paired" the upland shrub cover type at CTUIR's Isqúulktpe compensation site with the riparian shrub cover type listed in the McNary Dam loss assessment matrix (Rasmussen and Wright 1989). The "similar" habitat attribute/structural condition shared by both cover types was the shrub component; specifically, deciduous shrubs. The number of HEP models used to evaluate the "out of kind" upland shrub cover type was the same number used to evaluate habitat conditions for the "paired" loss assessment riparian shrub cover type.

The RHT used loss assessment models to evaluate "out of kind" cover types if the models were a good biological fit. The RHT added and substituted HEP species models only when needed to ensure a scientifically credible fit between compensation sites and guild species, and to be consistent in stacking as per Crediting Forum guidelines (NPCC 2011). Note that "pairing" dissimilar cover types does not automatically equate to total HEP model species substitution.

Project managers agreed with HEP model "pairing" and "stacking" for "in kind" cover types. Not all agreed, however, with the RHT's "pairing" construct when applied to "out of kind" cover

[34] Standard HEP protocols (USFWS 1980) suggest that compensation acquisition and easement cover types should be identical (in-kind) to the cover types identified in the applicable loss assessment document unless another alternative is agreed upon by the involved parties. The mitigation program that BPA funds has, by the project selection choices of wildlife managers, become an out-of-kind mitigation program, which the Council and BPA agree with, so the mitigation habitats are not identical to those identified in the loss assessments.

types; citing concerns over HU stacking[35] and, in a few cases, questioning the biological soundness of the "pairing" concept when applied to "out of kind" cover types (no biologically based or scientifically principled alternative was ever suggested).

In a few cases, project managers and the RHT were unable to resolve this issue and both parties, with support from BPA, "agreed to disagree". By 2011, nearly all HEP surveys and reports completed by the RHT and input into PISCES reflected this pairing construct and calculations as appropriate.

HEP Species Model Substitution

Background

HEP model species substitution is simply replacing one HEP evaluation species model with another HEP model. HEP model substitution may be warranted when dissimilar cover types[36] are acquired and the HEP models listed in the credited hydro facility's "species/cover type matrix" are not a "good fit." Substituted HEP model selection criteria could include[37]:

- The importance of the HEP species to management agencies/local constituents
- How well model variables "capture" local habitat conditions
- The presence/absence of the species on the site

HEP protocols (Stiehl 1995, USFWS 1980, and USFWS 1980a) allow for HEP model species substitution. Likewise, the Crediting Forum Technical Team (NPCC 2011) clearly supported species substitution by stating, *"Use tools, models, and methods that most accurately reflect the quality and quantity of the habitats being protected and managed".* The Technical Team further stated that, *"HEP methods used should reflect the site specific habitat parameters and management goals of the property and may differ from the HEP methods used in determining the losses".*

In the FCRPS wildlife mitigation program, species substitution was used to replace biologically inappropriate loss assessment HEP models with biologically fit species models as needed to evaluate compensation site conditions. The RHT applied species substitution when warranted and did not consider HU crediting ramifications when selecting substitute HEP models – the selection process was biologically driven. The RHT's primary species selection

[35] Some project managers were concerned that compensation site "out of kind" cover types would arbitrarily be "paired" with loss assessment cover types that had the most evaluation species; thus, increasing the number of HUs credited against NPCC's HU ledger and increasing an entity's HU "burn" rate. Similarly, some suggested that "out of kind" cover types could be paired against the loss assessment cover type with the fewest evaluation species, which if applied to all projects would be a consistent approach to resolving the issue without considering biological merit.

[36] Dissimilar cover types are cover types that are acquired that are different from those specified in the credited loss assessment.

[37] This short criterion list is just an example as is not meant to be all inclusive.

principle was to ensure that modified/substituted HEP models accurately reflected compensation site environmental conditions. Not all project sponsors, however, agreed or supported species substitution – nor did they accept the RHT's HEP results.

Discussion

Regardless of whether the loss assessment models from the 1980s and early 1990s were a good biological fit, several project sponsors insisted that only those loss assessment models should be used to evaluate compensation sites. They argued this was necessary to ensure "comparability" between loss assessment HEP results and compensation site HEP results. While these arguments were contrary to Wildlife Crediting Forum standard operating procedures and HEP principles, the disagreements remain unresolved.

HEP Model Modification

Background

HEP model modifications may be necessary to ensure HEP model applicability and integrity are maintained. HEP model modification is needed when loss assessment HEP model habitat variables are based on a different set of ecological, biological, and/or habitat structural conditions or assumptions than those found on a given compensation site. The over-arching principle guiding the HEP model modification process is that changes must make biological sense. Stiehl (1995) stated that HEP model modification is appropriate:

- In response to the results of model testing
- When relationships are believed to be incorrect, illogical, or incomplete
- When the desired standard of comparison differs from that in the model
- When the required level of resolution differs from that in the model
- When the available data differ from those required by the model, or are measured differently than recommended in the model

Stiehl (1995) further stated that modified HEP models should:

- More accurately reflect the expected responses of the species to changes in habitat, or
- Better meet the objectives and/or constraints of the study

HEP model modifications can range from adjusting habitat suitability index mathematical equations to "tweaking" and/or dropping/adding habitat variables. For example, a winter habitat mule deer HEP model, which includes an evergreen tree habitat variable, should be modified if used to evaluate mule deer winter range that was historically, and currently is, devoid of evergreen trees. Habitat variable modifications could include de-emphasizing the evergreen tree component in the HSI equation, or eliminating the evergreen tree variable(s) altogether and then modify the HSI equation accordingly. Failure to adjust the modeling parameters would result in no mitigation credit despite obvious habitat value to guild species. The number of HUs

(±) that may result from HEP model modification is not a consideration when deciding whether or not to modify a HEP model.

Discussion
As with HEP model species substitution, several project sponsors objected to the modification of loss assessment HEP models. Again, contrary to HEP principles and standard operating procedures, some project sponsors argued this was necessary to ensure "comparability" between loss assessment HEP results and compensation site HEP results. These disagreements are still unresolved.

Several loss assessment HEP models used by one project sponsor to evaluate compensation sites were not modified, due to sponsor objections, resulting in significantly skewed and unrealistic HU results. The RHT reported the HEP results, and logged them into Pisces, noting the RHT's concerns regarding the use of unmodified HEP models. This created an inconsistent and inequitable crediting situation between project sponsors that credited HUs to the same dam(s).

Closing Commentary

In retrospect, it is understandable how those who were not involved in the Columbia River Wildlife Mitigation Program in the late 1980s and early 1990s might have a much different view of HEP and its implementation process than those of us who were present at the beginning when HEP was the best science-based tool available. Early on, the HEP implementation process was a time when project managers and BPA field staff alike relied more on the "handshake" than the "pen" to bind concessions and make changes to the HEP implementation process necessary to keep the Program moving forward. In addition, most project wildlife managers that represented state, federal, and tribal entities during those early years were wildlife biologists that had little, if any, political or business experience - nor did most desire to engage the process beyond the biological sciences.

In addition, BPA did not have an organized structure for the Wildlife Program. Instead, BPA appointed a "leader" that largely had no authority. Consequently, BPA project management staff had a lot of autonomy that allowed them to choose how and at what level they wanted to engage project sponsors and HEP related issues. As a result, HEP surveys and HU accounting practices were not conducted consistently by all project managers. The Wildlife Program and the HEP process continued to evolve through the 1990s.

By 2004, management agencies recognized the lack of consistency regarding how HEP was implemented across the Region. Managers also agreed that all HEP surveys and HU accounting needed to be conducted in a consistent and fair manner. Consequently, project managers with support from BPA and NPCC, established the Regional HEP Team to

standardize HEP surveys and HU accounting practices. The RHT was funded by BPA with contractual oversight provided by the Columbia Basin Fish and Wildlife Foundation (CBFWF)[38].

From 2004 on, the RHT conducted the majority of HEP surveys and calculated HU results. In most cases project sponsors accepted the RHT's HEP study design and HU results; however, they were not obligated to do so[39] - in effect, ensuring that the goal to develop a consistent and fair Regional HEP Program would not be met. Although some suggest that HEP did not provide consistent results across the Region and caused more problems than it solved, the RHT contends that HEP performed as designed and that issues were due primarily to inconsistencies in how the HEP process was applied by some management agencies, that were not corrected, which de-stabilized the HEP process.

For example, several project sponsors chose to ignore established HU stacking and HEP model substitution protocols without consequences or accountability, which by default created a two-tiered HU crediting structure within the Region whereby project sponsors could choose to follow established, consistent HU crediting practices or apply their own crediting criteria without ramifications. Furthermore, in some cases project sponsors elected to circumvent resolving HEP issues with BPA COTRs and the RHT by bringing issues directly to mid and upper BPA management or NPCC staff for resolution; the results of which were always incongruent with established HEP protocols and practices. It is the RHT's opinion that these divisive actions changed the course of the HEP process throughout the Region as other project managers recognized there were no ramifications for not cooperating as well as no benefits for cooperating.

Although the RHT somewhat agrees with the Crediting Forum (NPCC 2011), which suggested that HEP was not designed for a project as large and diverse as the Columbia River Wildlife Mitigation Program, the RHT maintains that the Regional HEP Team construct was possible - but only if all participants agreed to use and follow the same principles and practices. While not perfect, the RHT believes the HEP tool was the best available science at the time and it provided the most objective, cost effective methodology for wildlife managers to quantify habitat losses and gains.

The HEP Program has existed for more than 25 years and has gone from a time when most participants were idealistic, albeit somewhat naive, to the present day whereas the early "handshake" agreements are no longer valid and only what has been preserved in writing[40], as opposed to "spirit", matters. It is the RHT's opinion that, in recent years, the HEP process appeared to have been driven more by political motivation and self-interest than concern for the resource or what is "good for the Region". It is not surprising that many wildlife mitigation

[38] CBFWF was an internal organization within the Columbia Basin Fish and Wildlife Authority (CBFWA). CBFWA and CBFWF largely filled an advisory role to project managers.
[39] Although the RHT was given the responsibility to conduct the HEP surveys, the RHT had no authority.
[40] The documents are subject to interpretation.

participants no longer support the HEP process leaving “negotiated settlements” as the only realistic “tool” to complete BPA’s C&I wildlife mitigation obligation.

The debate over whether the HEP process was the best option to mitigate/compensate C&I habitat losses will likely continue well into the future. However, we must remember that HEP principles and protocols provided wildlife managers with the framework to account for habitat losses and gains that resulted in the protection of more than 327,000 acres[41] of wildlife habitat managed to benefit wildlife resources! In addition, HEP survey results, which are accessible to all at PSMFC’s[42] HEP data repository, will provide future generations a rich legacy of floristic and habitat structure data collected over 25 years throughout portions of Washington, Oregon, Idaho, and northern Nevada.

[41] Source: Crediting Forum’s 2011 report (NPCC 2011)
[42] Pacific States Marine Fisheries Commission located in Portland, OR.

References

Ashley, P. R. 2008. WDFW. A Comprehensive Review of Columbia River Wildlife Mitigation. CBFWA Regional HEP Team. Portland, OR.

_____. 2015. RHT Final Assessment and analysis of the NW Power Act Funded by BPA. Regional HEP Team. Pacific States Marine Fisheries Commission. Portland, OR.

Giger, R. D. 1991. Assigning Mitigation Credit to Residual Wildlife Habitat at Bonneville, The Dalled. John Day, and McNary Dams. USFWS. Portland, OR.

NPCC. 2000. Columbia River Basin Fish and Wildlife Program. Council Document 2000-19. Northwest Power Conservation Council. Portland, OR.

_____. 2011. Wildlife Crediting Forum Report on Forum Deliberations. January 2010 – May 2011. Prepared by Parametrix, Portland, Oregon. September 2011.

Raedeke, K. J., and D. A. M. Raedeke. 2000. Habitat evaluation procedures Wildlife management areas Yakama Nation, Washington. Project number 99023-001. Raedeke Associates, Inc. Seattle, WA.

Rasmussen, L., P. Wright. 1989. Wildlife impact assessment Bonneville, McNary, The Dalles, and John Day Projects. Bonneville Project, Oregon and Washington. Annual Report 1989. USDOE. BPA. Portland, Oregon.

Stiehl, R. B. 1995. Habitat Evaluation Procedures Workbook-revised July 1995. National Biological Service Mid-Continent Ecological Service Center. Fort Collins, CO.

USFWS. 1980. Habitat as a Basis for Environmental Assessment, Ecological Services Manual (ESM) 101. Division of Ecological Services, U. S. Fish and Wildlife Service, Washington, DC: Department of the Interior.

_____. 1980a. Habitat Evaluation Procedures (HEP), Ecological Services Manual (ESM) 102. Division of Ecological Services, U.S. Fish and Wildlife Service, Washington, DC: Department of the Interior.

_____. 1980b. Habitat Evaluation Procedures (HEP), Ecological Services Manual (ESM) 103. Division of Ecological Services, U.S. Fish and Wildlife Service, Washington, DC: Department of the Interior.

Appendix A – Regional HEP Team

The RHT was established in 2004 to fulfill three purposes: to create a region-wide standard for Habitat Evaluation Procedures (HEP) protocols and crediting practices; to independently apply them fairly to all BPA wildlife mitigation projects throughout the Columbia Basin; and to provide HEP technical assistance to agency and tribe project managers and BPA staff. After 2004, the RHT carried out the majority of HEP surveys within the Columbia Basin and conducted HEP and habitat survey training for project managers, BPA staff, and other interested individuals.

In all actions and activities the RHT did the utmost to:

1. Ensure the RHT remained neutral and objective.
2. Ensure consistent application of HEP protocols and scientific principles on all HEP projects.
3. Ensure that HEP projects/sponsors throughout the Columbia Basin and BPA were treated in a consistent, fair manner.
4. Ensure that HEP results were credited appropriately and impartially.

The RHT was funded by BPA with contractual oversight provided by the Columbia Basin Fish and Wildlife Foundation (CBFWF)[43].

[43] CBFWF was an internal organization within the Columbia Basin Fish and Wildlife Authority (CBFWA). CBFWA and CBFWF largely filled an advisory role.

Appendix B – Compensation Type Definitions

In Kind/Equal/Relative Compensation

Three types of compensation i.e., in kind, equal, and relative, as described in HEP manuals, (USFWS 1980a) are listed below along with pertinent comments related to the Columbia Basin Wildlife Mitigation Program's use of HEP.

In-kind (no trade-off)

This compensation goal is to precisely offset the HU loss for each evaluation species. Therefore, the list of target species must be identical to the list of negatively impacted species" (USFWS 1980). Typically, this involves acquiring the same cover types as those impacted. In addition, "in kind" compensation does not suggest that HEP species can be applied to evaluate inappropriate cover types (forcing a "square peg" in a "round hole"), or that HEP models can't be modified if necessary (RHT comment).

Equal replacement (equal trade-off)

This compensation goal is to precisely offset the HU losses through a gain of an equal number of HUs. With this goal, a gain of one HU for any target species can be used to offset the loss of one HU for any evaluation species. The list of target species may or may not be identical to the list of impacted species" (USFWS 1980a). In addition, there is no requirement to acquire the same habitat/cover types lost due to dam construction (RHT comment).

Relative replacement (relative trade-off)

With this goal a gain of one HU can be used to offset the loss of one HU at a differential rate depending on the species involved. The trade-off rates are defined through use of a relative value index (RVI) which establishes values for each species: for example, if the RVI values for a white-tailed deer and ruffed grouse are 1.0 and 0.5 respectively, one white-tailed deer HU can be used to offset two ruffed grouse HUs. The list of evaluation and target species can differ (USFWS 1980a). This procedure was looked at by several project sponsors in the mid-1990s, but was rejected and has not been used for crediting in the Columbia Basin.

Appendix C – Loss Assessment HU Summaries

(Source: NPCC Wildlife Mitigation Program Table C-4)

Table C-4 Estimated Losses and Gains Due to Hydropower Construction
(losses are preceded by a "-", gains by a "+")

Species	Total Habitat Units
Albeni Falls	
• Mallard Duck	-5,985
• Canada Goose	-4,699
• Redhead Duck	-3,379
• Breeding Bald Eagle	-4,508
• Wintering Bald Eagle	-4,365
• Black-Capped Chickadee	-2,286
• White-tailed Deer	-1,680
• Muskrat	-1,756
• Yellow Warbler	+171
Lower Snake Projects	
• Downy Woodpecker	-364.9
• Song Sparrow	-287.6
• Yellow Warbler	-927.0
• California Quail	-20,508.0
• Ring-necked Pheasant	-2,646.8
• Canada Goose	-2,039.8
Anderson Ranch	
• Mallard	-1,048
• Mink	-1,732
• Yellow Warbler	-361
• Black Capped Chickadee	-890
• Ruffed Grouse	-919
• Blue Grouse	-1,980
• Mule Deer	-2,689
• Peregrine Falcon	-1,222 acres*
* Acres of riparian habitat lost. Does not require purchase of any lands.	
Black Canyon	
• Mallard	-270
• Mink	-652
• Canada Goose	-214
• Ring-necked Pheasant	-260
• Sharp-tailed Grouse	-532
• Mule Deer	-242
• Yellow Warbler	+8
• Black-capped Chickadee	+68
Deadwood	
• Mule Deer	-2080
• Mink	-987
• Spruce Grouse	-1411
• Yellow Warbler	-309

Note that sharp-tailed grouse was not a species listed in the Black Canyon loss assessment. This is a typo error.

Table C-4 (cont.) Estimated Losses and Gains Due to Hydropower Construction (losses are preceded by a "-", gains by a "+")

Species	Total Habitat Units
Palisades	
• Bald Eagle	-5,941 breeding -18,565 wintering
• Yellow Warbler	-718 scrub-shrub
• Black Capped Chickadee	-1,358 forested
• Elk/Mule Deer	-2,454
• Waterfowl and Aquatic Furbearers	-5,703
• Ruffed Grouse	-2,331
• Peregrine Falcon*	-1,677 acres of forested wetland -832 acres of scrub-shrub wetland +68 acres of emergent wetland
* Acres of riparian habitat lost. Does not require purchase of any lands.	
Willamette Basin Projects	
• Black-tailed Deer	-17,254
• Roosevelt Elk	-15,295
• Black Bear	-4,814
• Cougar	-3,853
• Beaver	-4,477
• River Otter	-2,408
• Mink	-2,418
• Red Fox	-2,590
• Ruffed Grouse	-11,145
• California Quail	-2,986
• Ring-necked Pheasant	-1,986
• Band-tailed Pigeon	-3,487
• Western Gray Squirrel	-1,354
• Harlequin Duck	-551
• Wood Duck	-1,947
• Spotted Owl	-5,711
• Pileated Woodpecker	-8,690
• American Dipper	-954
• Yellow Warbler	-2,355
• Common Merganser	+1,042
• Greater Scaup	+820
• Waterfowl	+423
• Bald Eagle	+5,693
• Osprey	+6,159
Grand Coulee	
• Sage Grouse	-2,746
• Sharp-tailed Grouse	-32,723
• Ruffed Grouse	-16,502
• Mourning Dove	-9,316
• Mule Deer	-27,133
• White-tailed Deer	-21,362
• Riparian Forest	-1,632
• Riparian Shrub	-27
• Canada Goose Nest Sites	-74

Table C-4 (cont.) Estimated Losses and Gains Due to Hydropower Construction (losses are preceded by a "-", gains by a "+")

Species	Total Habitat Units
McNary	
• Mallard (wintering)	+ 13,744
• Mallard (nesting)	-6,959
• Western Meadowlark	-3,469
• Canada Goose	-3,484
• Spotted Sandpiper	-1,363
• Yellow Warbler	-329
• Downy Woodpecker	-377
• Mink	-1,250
• California Quail	-6,314
John Day	
• Lesser Scaup	+14,398
• Great Blue Heron	-3,186
• Canada Goose	-8,010
• Spotted Sandpiper	-3,186
• Yellow Warbler	-1,085
• Black-capped Chickadee	-869
• Western Meadowlark	-5,059
• California Quail	-6,324
• Mallard	-7,399
• Mink	-1,437
The Dalles	
• Lesser Scaup	+2,068
• Great Blue Heron	-427
• Canada Goose	-439
• Spotted Sandpiper	-534
• Yellow Warbler	-170
• Black-capped Chickadee	-183
• Western Meadowlark	-247
• Mink	-330
Bonneville	
• Lesser Scaup	+2,671
• Great Blue Heron	-4,300
• Canada Goose	-2,443
• Spotted Sandpiper	-2,767
• Yellow Warbler	-163
• Black-capped Chickadee	-1,022
• Mink	-1,622
Dworshak	
• Canada Goose-(breeding)	-16
• Black-capped Chickadee	-91
• River Otter	-4,312
• Pileated Woodpecker	-3,524
• Elk	-11,603
• White-tailed Deer	-8,906
• Canada Goose (wintering)	+323
• Bald Eagle	+2,678
• Osprey	+1,674
• Yellow Warbler	+119

Table C-4 (cont.) Estimated Losses and Gains Due to Hydropower Construction (losses are preceded by a "-", gains by a "+"

Species	Total Habitat Units
Minidoka	
• Mallard	+174
• Redhead	+4,475
• Western Grebe	+273
• Marsh Wren	+207
• Yellow Warbler	-342
• River Otter	-2,993
• Mule Deer	-3,413
• Sage Grouse	-3,755
Chief Joseph	
• Lesser Scaup	+1,440
• Sharp-tailed Grouse	-2,290
• Mule Deer	-1,992
• Spotted Sandpiper	-1,255
• Sage Grouse	-1,179
• Mink	-920
• Bobcat	-401
• Lewis' Woodpecker	-286
• Ring-necked Pheasant	-239
• Canada Goose	-213
• Yellow Warbler	-58

Appendix D – Crediting Forum 2011 Report

Wildlife Crediting Forum Report on Forum Deliberations
January 2010 – May 2011

Northwest Power and Conservation Council
851 S.W. Sixth Avenue, Suite 1100
Portland, Oregon 97204
503.222.5161

Facilitated by Parametrix
700 NE Multnomah, Suite 1000
Portland, OR 97232-4110
T. 503.233.2400 T. 360.694.5020
www.parametrix.com

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The Council chartered the Forum to provide advice on the crediting and accounting of wildlife habitat mitigation associated with the construction and inundation impacts of the Federal Columbia River Power System (FCRPS). The Forum consists of wildlife program managers representing tribes (14 in all) and state fish and game departments (Oregon, Washington, Idaho) impacted by the FCRPS, the U.S. Fish and Wildlife Service (USFWS), and representatives from the Bonneville Power Administration (BPA) and BPA Customers. The State of Montana is not a participant as wildlife mitigation issues relating to the FCRPS have been settled by prior agreement between BPA and the state.

The instructions to the Forum were to make recommendations regarding the NPCC Wildlife Crediting Program (Program) with respect to:

- Developing a commonly accepted “ledger” of habitat units acquired by BPA
- Developing a common database for tracking, assigning and recording habitat units
- Resolving issues about accounting for habitat units
- Other issues related to wildlife crediting, including the use of Habitat Evaluation Procedures (HEP) or alternative evaluation procedures

The charter also allowed for the development of strategies that will allow the parties to achieve long-term agreements.

The Forum and several subcommittees have been meeting since January, 2010 to address Program issues. Much of the Forum’s early deliberations focused on the difficulty of coming to collective agreement on all issues posed by the Council’s Fish and Wildlife Program. Crediting issues were found to differ depending on geographic area, specific hydropower projects, and the entities involved in specific crediting decisions. The methodologies involved in crediting decisions have also changed and evolved over time, been interpreted and applied in differing ways, and in some cases crediting has been resolved through individual project agreements. Reflecting on these factors, the Forum felt that the many technical and recordkeeping issues with the ledger, overlaid with unresolved policy issues, would make full resolution at the Forum level difficult, and decided that “agreements” were more likely to be an effective means of resolution. At the same time, the Forum indicated that the technical analysis of the ledger should continue in order to help

resolve or make clear as many outstanding issues as possible. The Forum dedicated considerable effort over several months and while not every issue or dispute was resolved, and while significant anomalies remain, the commonalities developed by the Forum provide a solid basis for bringing this portion of the Program to a successful conclusion. Major areas of accomplishment include:

- Establishment of a ledger depicting the current status of Bonneville-funded wildlife mitigation activities
- Development of Standard Operating Procedures for future applications of HEP
- Development protocols for determining the amount of credit Bonneville should receive for management actions that occur on Federal lands
- Development of protocols for determining the amount of credit that Bonneville should receive for fish mitigation projects that benefit wildlife
- Acceptance of the Fish and Wildlife Program loss assessments as the agreed upon measure of wildlife losses

However, several policy-related issues remain unresolved including:

- Agreement on the application of the crediting ratio established in the Fish and Wildlife Program
- Agreement on how to deal with wildlife species benefiting from open water habitats resulting from reservoirs associated with dam construction
- Agreement on how to account for mitigation that occurred prior to the 1980 Northwest Power Act

While these issues remain unresolved, the report provides important background information on them which can form the basis for negotiations focused on agreements and for future Council policy deliberations associated with future Fish and Wildlife Program amendment processes.

PURPOSE

The purpose of this summary report is to capture the work conducted by the Wildlife Crediting Forum (**Forum**). The Forum was chartered in late 2009 by the Northwest Power and Conservation Council (**NPCC**) to provide input on the Council's Columbia River Basin Fish and Wildlife Program (Program). This summary report provides an overview of the Forum's discussions and direction through December 2, 2010. This summary report and appendices also reflect the additional work conducted in January and February 2011 with Bonneville Power

Administration (BPA) and Columbia Basin Fish and Wildlife Authority (CBFWA) staff to further analyze Program records by subbasin.

This summary report only reflects the input of individual Forum members and does not necessarily represent the policy position(s) of the tribes, agencies, and stakeholders they represent. Forum members have been made aware that they serve only in an advisory role to NPCC.

BACKGROUND

NPCC chartered the Forum to provide advice on the quantifying and accounting system (informally known as the **Ledger**) for the wildlife habitat mitigation credits associated with the construction and inundation impacts of the Federal Columbia River Power System (**FCRPS**) within the Columbia River Basin (**Basin**). The database that currently houses the Ledger is called **Pisces**. The Program was initiated in 1981, and has been modified from time to time (most recently in 2009) by NPCC in updating the overarching **Northwest Power Plan, which by law includes the Program as a component**.

The Forum consists of wildlife co-managers representing the 14 tribes and 3 state fish and game departments (Oregon, Washington, Idaho) impacted by FCRPS; and representatives of the U.S. Fish and Wildlife Service (USFWS), BPA, and BPA Customers. The State of Montana is not a Forum participant, as wildlife mitigation issues relating to FCRPS have been settled by prior agreement between BPA and that state. CBFWA and NPCC staff acted as advisors to the Forum. A private consulting firm (Parametrix) was engaged to facilitate Forum processes and to provide for augmented technical analysis of the Ledger.

The original Forum charter called for the development of recommendations with respect to:

- Developing and recommending to the Council a commonly accepted ledger of habitat units acquired by the Bonneville Power Administration.
- Recommendations to the Council on ways to resolve issues about accounting for habitat units.
- Developing a common data base for tracking, assigning and recording habitat units.
- Reviewing issues related to wildlife crediting, such as the frequency and use of the Habitat Evaluation Procedure (HEP) following the initial baseline evaluation. The forum could also provide recommendations on acceptable alternative evaluation procedures.

The Forum met eight times in 2010 to address the Program issues. The Forum also convened three sub- committees to discuss specific issues (credits for fish projects, Federal lands, and general Ledger issues). Each of these subcommittees met one or two times, and produced

reports which were provided to the full Forum. The Forum conducted wildlife crediting issues orientation and reviews over the course of its first three meetings. Starting in May 2010, the Forum focused on the difficulty of coming to collective agreement on the resolution of even the first issue specified in its NPCC charter (see above). Several factors contributed to this challenge:

- Over the course of nearly 30 years, the NPCC has modified the Program from time to time. In addition, some changes have not been uniformly interpreted by the co-managers or BPA.

- Wildlife mitigation is largely, though not exclusively, out-of-place and out-of-kind, which means the areas and species used for mitigation are not necessarily the same as those lost through the construction and inundation of FCRPS dams. Thus, the habitats and species used in the loss assessments were in many cases not the same as those needing crediting on the mitigation sites.

- Crediting issues were found to differ depending on geographic area, specific hydropower projects, and the tribes or agencies involved.

The database system housing the Ledger has also changed and evolved, and some ad-hoc “workarounds” have been made to fit data into database formats.

- The methodologies involved in the Program have changed and evolved, and interpretation and application has varied in the field, across different sub-regions, and as entered in the ledger.

- The tool used to evaluate the quality of habitat being acquired or enhanced (the Habitat Evaluation Procedure or HEP) was not designed to provide comparability across a region as large and diverse as the Columbia River Basin.

In some cases, (e.g. Montana, Dworshak, Willamette) crediting has been resolved through individual wildlife mitigation agreements. Generally, these types of agreements have resulted in a comprehensive resolution of wildlife mitigation issues. *NOTE: the use of individual agreements is permitted by the Program.*

Reflecting on these factors, the Forum concluded that the many technical and recordkeeping issues with the Ledger, overlaid with unresolved policy issues, would make full resolution in accordance with the original NPCC charter difficult. The Forum discussed, therefore, the possibility of “settlement agreements” as a more effective means of resolution. At the same time, the Forum indicated that the technical analysis of the Ledger should continue to help resolve or make clear as many outstanding issues as possible. NPCC concurred with this overall “revised” approach and goals at its July 2010 meeting.

NOTE: The possibility of shifting to a "settlement agreement" option is referenced as an acceptable alternative in the original Forum charter: ".... or strategies that will allow parties to achieve long-term settlement agreements." In October 2010, a settlement for the Willamette River Subbasin of the FCRPS was signed between BPA and the State of Oregon (Oregon participated during the early phases of the Forum, but discontinued participation following completion of the Willamette Wildlife Agreement).

On December 2, 2010, the Forum met and discussed ongoing issues and concerns. NPCC staff and the consultants recommended that additional basinwide technical analysis was becoming more costly than merited by the resulting understanding or improvements to the ledger. The suggestion was made that the most valuable additional analysis would be that conducted at the subregional level. A considerable effort with respect to this detailed technical analysis was undertaken **up through May 20, 2011**. The outcomes of these subregional reviews are attached as Appendix D.

Also at the Forum's December 2 meeting, a matrix prepared by NPCC and Parametrix staff was presented that estimated the level of agreement (high, medium, low) by sub-region for each of the remaining issue topics. A version of this matrix, revised as per sub-region reviews, is included in each of the attached sub- region appendices.

NOTE: Inclusion of the following issue topics in this summary report does not mean that the Forum has reached full consensus on any given item. Each may require additional discussion on the part of the full Forum and/or at the subgroup level. Accordingly, specific recommendations are not included. Some divergent viewpoints remain (an example being over the 2:1 crediting ratio). It is also important to keep in mind that within the context of developing settlement agreement(s) a full resolution of many of the remaining Ledger issues identified herein may be moot, as settlement(s) may simply supplant the issue irrespective of the degree to which it is technically resolved (or not).

VARIABILITY AND EXPECTATIONS OF HEP

NOTE: This issue was referred to an ad-hoc subcommittee of the Forum. The summary below reflects the deliberations of that subcommittee. In addition, this particular subcommittee addressed other Crediting issues. ***The full report of the subcommittee is attached as Appendix A.***

At the May meeting of the FORUM, the Ledger Subcommittee provided a report that identified a number of technical and policy issues that would need to be addressed in order to develop a comprehensive and consistent crediting ledger based on habitat unit accounting. The subcommittee was tasked with working through known issues such as: lack of consistency in the use of the Habitat Evaluation Procedure (HEP), HEP models, data collection, "stacking" and other related issues.

Inherent Variability in HEP

However, the subcommittee acknowledged at the outset that a major cause of the variation in the region is the nature of the HEP tool itself. The HEP tool was designed and is very effective as a comparative tool to address mitigation for specific losses. The habitat units provided through the HEP process provide relative value, but should not be seen as an absolute value. HEP was not intended as a comprehensive accounting tool tracking progress over a broad geographic area and over a long period of time. For that reason, the group recognized and accepted there is great variation, either positive or negative, in the habitat units attributed to any given property.

Other Issues

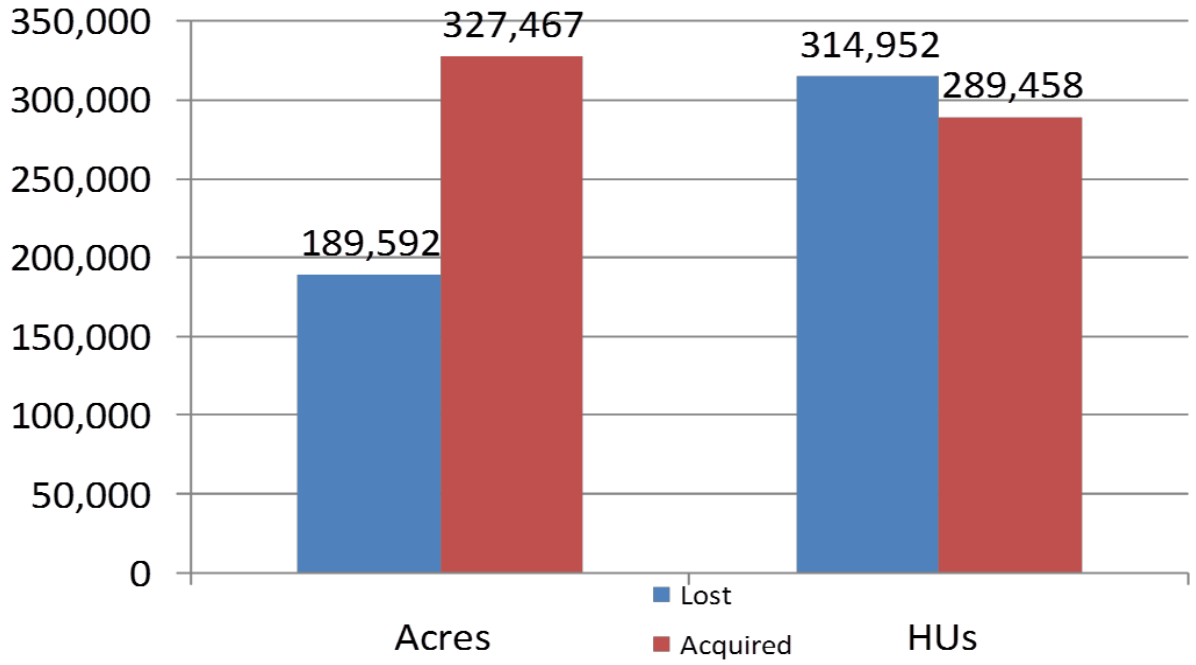
The subcommittee worked through the many issues identified above. Appendix A includes a summary of each of the issues and recommended standard operating procedures for the following:

- HEP Methods
- Stacking
- Crediting

Team Recommendation

In recent years, however, the application of HEP has been relatively consistent among projects. The subcommittee identified that Program crediting issues were found to differ depending on geographic area, specific hydropower projects, and the entities involved in the specific crediting decisions. The methodologies involved in crediting decisions have also changed and evolved over time, been interpreted and applied in differing ways, and in some cases crediting has been resolved through individual project agreements. Reflecting on these factors, the Forum felt that the many technical and recordkeeping issues with the ledger, overlaid with unresolved policy issues, would make full resolution at the Forum level difficult, and discussed the possibility of “agreements” as a more effective means of resolution. At the same time, the Forum indicated that the technical analysis of the ledger should continue to help resolve or make clear as many outstanding issues as possible while recognizing the numerical values from such an exercise are subject to the inherent discrepancies described above.

Figure 1 Acres and Habitat Units Lost and Acquired.



ISSUES RESOLVED

STANDARD OPERATING PROCEDURES FOR HEP

The quality of habitat varies widely between watersheds, subbasins, and major regions across the basin. Thus the number of HUs per acre will also vary from watershed to watershed, subbasin to subbasin, etc. (Figure 1). The type of protection method also varies greatly. These variables were recognized by the Forum as a "fact of life" across such a large region, and such variation cannot be necessarily construed as inequity. The ledger subcommittee's suggestions focused primarily on resolving such issues in future applications of HEP through the development of standard operating procedures to address the following issues:

- Sources of Variation in Crediting Due to HEP Methods: Methodological choices beginning with how habitat types are delineated for analysis and ending with the species models and inputs used can dramatically alter HEP results and therefore the HUs credited.

- Species Stacking: Using fewer species per cover type in the crediting HEP than were used in the loss assessments results in underreporting of HU credit.

- Crediting for Actions on public and other non-Permanent or Unsecured Mitigation: Either HUs on such sites have not been credited yet, or the credit was agreed to absent clear consistent guidance.

See Appendix A for a complete listing of the standard operating procedures recommended by the ledger subcommittee.

CREDITS ON FEDERAL LANDS

NOTE: This issue was referred to an ad-hoc subcommittee of the Forum. The summary below reflects the deliberations of that subcommittee.

Some management actions included in the Program occur on federal lands. This raises the question of how much credit BPA should receive for these actions. The Forum has concluded that for all future projects involving federal lands, the following considerations need to be addressed.

- Whether Bonneville funded actions on federal lands that are generally creditable, but have happened or would have happened anyway based on a Federal agency's usual and customary responsibilities should be included.
- Whether the federal agency's usual and customary responsibilities are such that the protections for wildlife values are assured over time.

This Forum subcommittee suggested that the following standards be applied to the question of crediting of federal land projects:

- Must meet the current Program criteria for wildlife projects
- Must be "permanently" protected – minimum of an easement with a term of equal to the life of the FCRPS, or an appropriately formulated and adopted federal management plan
- Must primarily benefit priority wildlife habitat, species or populations (as defined by federal, state, or tribal wildlife management plans or subbasin plans).
- Subject to a completed wildlife management plan
- Subject to an "adequately funded" long-term restoration and/or maintenance agreement
- Located in the same province as the FCRPS hydroelectric dam against which it is being credited

The subcommittee also suggested that BPA receive credit for any enhancement provided by the management actions taken by the Federal agency, subject to:

- The enhancement credit shall be determined through the use of baseline HEP data if available, or from existing Federal agency data sets if HEP data are not available

- The enhancement credit being in “perpetuity” (e.g.: life of the FCRPS), unless there is a change in the management plan employed by the federal agency that results in the reduction of enhancement values. In such cases, the enhancement credits would be adjusted to reflect the reduced value.

CREDITS FOR FISH MITIGATION

NOTE: This issue was referred to an ad-hoc subcommittee of the Forum. The summary below reflects the deliberations of that subcommittee.

This Forum subcommittee clearly recognized that acquisition and restoration projects primarily, or even exclusively, designed for the purposes of mitigating for fish losses resulting from the FCRPS hydroelectric dam system could and does benefit wildlife. The subcommittee identified the need to develop guidelines for future habitat projects; and the need to state upfront what type of benefits were being sought (e.g.: what are the benefits for fish and wildlife?). The subcommittee also felt that projects that have joint benefits to fish and wildlife should be encouraged.

The subcommittee suggested the following should apply for fish projects to receive wildlife credits:

- Specific wildlife management plans for the project area need to be completed, approved and implemented
- Long-term operations and maintenance funding for wildlife species/habitats must be in place and “adequate”
- Appropriate permanent land protections (easements) should be applied, in perpetuity and with adequate protection language
- The protected wildlife species/populations/habitats should be “priority” and so defined by existing Federal, state or tribal management and subbasin plans
- Located in the same province as the FCRPS hydroelectric dam against which it is being credited

The subcommittee also reviewed a specific list of such projects (Table 1). Projects were classified into four tiers. Tier 1 includes wildlife projects supported by anadromous fish funds that should be credited. The projects shown as Tier 2 were left as subject to “further review.” Projects in the Lower Columbia Estuary were flagged as “special case” and included as Tier 3. These Tier 3 projects were identified by the subcommittee as potentially available as operational loss offsets for projects elsewhere in the FCRPS. Tier 4 projects are special existing projects on federal lands that may be considered for credit but in some cases may be difficult to categorize because they are located in areas not directly affected by hydroelectric development. These three projects (Bear Valley, Deer Creek, and Elk Creek) were moved by the Forum from the Federal Lands topic of this summary report and were directed to be included

in Table 1. These types of projects potentially could lead to “overmitigation” in some sub-regions. However these issues could be addressed as part of an agreement, as was the case with the Dworshak Settlement Agreement or as part of operational losses in the future.

Table 1: Candidate Fish Projects for Wildlife Credits

Parcel Name	Proponent	Subbasin	Acres	Tier
Forrest Conservation Area	CTWSRO	John Day	4,232	1
Oxbow Conservation Area	CTWSRO	John Day	1,022	1
Pine Creek (Wagner Conservation Area)	CTWSRO	John Day	9,000	1
Rainwater Wildlife Area (Part II)	CTUIR	Walla Walla	2,340	1
Yakama Nation Riparian/Wetlands Restoration	Yakama Nation	Yakima	5,000*	1
Yakima Side Channels (Lower Naches)	Yakama Nation	Yakima	376	2
Colville Fish Habitat Projects	Colville Tribes	Okonogan	176	2
Cottonwood Farms / Witte Place	NFWF, Methow Conservancy	Methow	54	2
Hancock Springs	NFWF, Methow Conservancy	Methow	122	2
Heath	NFWF, Methow Conservancy	Methow	140	2
Mid-Methow / Lehman	NFWF, Methow Conservancy	Methow	93	2
Oak Flats (Naches River)	WDFW	Yakima	289	2
Red River Wildlife Area (Little Ponderosa)	IDFG	Clearwater	1,300	2
Sandy River Delta	Forest Service	Sandy	1,400	2
Yakima Side Channels (Upper Yakima)	Yakama Nation	Yakima	544	2
Zumwalt Prairie Preserve (Camp Creek Ranch)	Nature Conservancy	Imnaha	27,000	2
Crims Island	Columbia Land Trust	Columbia Estuary	451	3
Crazy Johnson Creek	Columbia Land Trust	Grays	305	3
Crooked Creek (F&W)	Columbia Land Trust	Columbia Estuary	60	3
Elochoman River	Columbia Land Trust	Columbia Estuary	183	3
Germany Creek	Columbia Land Trust	Columbia Estuary	155	3
Walker Island	Columbia Land Trust	Columbia Estuary	100	3
Willow Grove	Columbia Land Trust	Columbia Estuary	312	3
Bear Valley	IDFG/ShoBan	Salmon	n/a	4

Deer Creek	IDFG/ShoBan	Salmon	n/a	4
Elk Creek	IDFG/ShoBan	Salmon	n/a	4

LOSS ASSESSMENTS

The Forum chose not to reconsider prior loss assessments, and generally accepted *Wildlife Crediting Program Table C-4* (as published in the NPCC-approved 2009 Program) as an agreed to measure of loss assessments (Program Table C-4 is attached as Appendix B to this summary report).

The Forum's determination notwithstanding, in 2009 the Shoshone-Bannock Tribe, Shoshone-Paiute Tribe, Idaho Department of Fish and Game (IDFG) and CBWFA staff re-examined the Anderson Ranch, Palisades, Black Canyon, Minadoka, and Deadwood loss assessments in Southern Idaho for accuracy and consistency relative to other loss assessments across the Basin, and for the number of HUs credited against hydro facilities. HU losses reported in *Program Table C-4* were found by this group to be in error for the number of HUs listed for the Anderson Ranch, Black Canyon, and Palisades projects. In one instance, HUs were listed for sharp-tailed grouse, which was not a target species in any of the SE Idaho loss assessments and yellow-rumped warbler were not listed for Deadwood when they were included in the loss assessment.

NOTE: BPA's position is that it is not responsible for Deadwood Dam mitigation.

Southern Idaho loss assessment calculations subtracted estimated post-project HU gains from the total losses in reporting "net" losses. Because most other loss assessments show just the "total" losses, the "net" HU losses reported in Southern Idaho were 4,835 fewer than if the Southern Idaho loss assessments had listed only the "total" HU losses (as was the case in other parts of the Basin). Wildlife managers now believe that Habitat units gained from Southern Idaho mitigation projects should be examined and subtracted from the losses shown in *Program Table C-4*. .

NOTE: Program Table C-4 as published also included habitat gains.

ISSUES UNRESOLVED

CREDITING RATIO

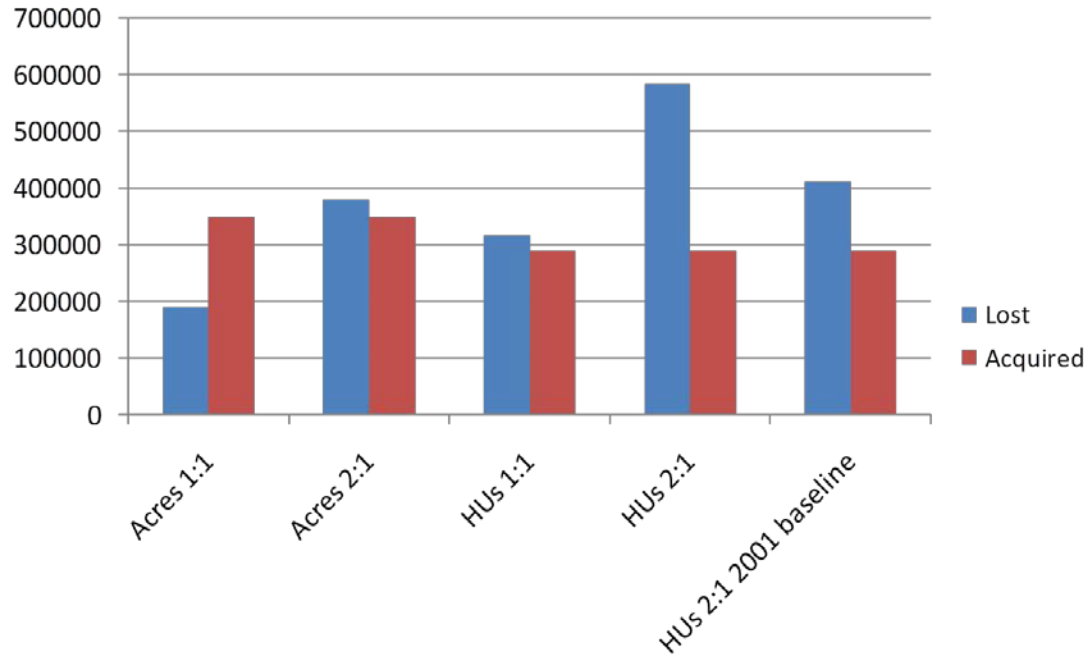
The 2000 Program applied a 2:1 ratio to all remaining habitat units (HUs) in the Ledger that had not been previously satisfied by habitat acquisitions and projects, and went into effect on April 1, 2001. The balance of HUs that remained on April 1, 2001 were to be doubled as a means of "settling" questions over the actual mitigation work remaining to reach full compensation for dam inundation and construction losses. NPCC specified that all credits from projects prior to April 2001 were to remain at the levels previously agreed to by BPA and project proponents.

Moreover, the findings section of the Program acknowledged that “the Council recognized existing mitigation project agreements, even if such agreements have a crediting ratio of 1:1. The 2009 Program reaffirmed the 2:1 crediting ratio (see Appendix E for 2009 Program language).

At its April 2010 meeting, the NPCC responded to questions put by some Forum members with respect to this policy, and confirmed its earlier policy decision establishing a 2:1 ratio effective April 1, 2001. Notwithstanding the NPCC’s recent confirmation, Forum members indicated that there is either disagreement with or different interpretations of the Council’s position. Further, members indicated that not all entities had made a formal policy decision relative to the Council’s 2:1 position. (See Appendix F for a more complete discussion of this issue).

The application of the 2:1 mitigation ratio and its varying interpretations results in changes in the total habitat units outstanding for mitigation. Figure I-2 shows the increase in habitat units or acreage needed to meet the mitigation obligation with the 2:1 ratio applied.

Figure 2.



HYDROELECTRIC FACILITY CREDIT ASSIGNMENTS

Credits are assigned to specific FCRPS hydroelectric facilities. In some cases, credits have been assigned to hydro facilities in different subbasins from the actual project, to facilities that are more distant from projects than other hydro sites or to more than one facility. Although to an extent a recordkeeping issue, this practice has resulted in uncertainty over what HUs remain in any given subregion, whether mitigation has been adequately met for a given dam (or even over-mitigated), and concern that other sub-regions may end up being "short changed" when mitigation responsibilities are rolled up to the system-wide total. Figure 3 maps the location of wildlife projects and shows the relationship with facilities mitigated by the projects.

Forum members asked that the assignment of wildlife projects to multiple dams be evaluated. The available data does not specify the specific division of HUs to each dam. The way the data is stored in the ledger prevents double counting of credits when applied to multiple projects, but it does create new groupings of dams in addition to individual dams. Accordingly, a single dam may not easily be reviewed based on mitigation projects. Another concern raised by the Forum was the sets of species used for HEP evaluation when spread across multiple dams. The available data does not indicate the species used, or if the species at the dam site are the same as at the wildlife project site.

It also should be noted that the Loss Assessments for the Lower Snake River Dams included in the Fish and Wildlife Program are aggregated for all four dams. Because of the complex relationship of these projects with the Lower Snake River Compensation Plan and other federal responsibilities no individual loss assessments were performed.

Ideally, the geographic distribution of projects effectively assigns projects to the closest dam. In some cases this can be a considerable distance, such as in the lower Snake. However, these projects are in the watershed nearest to the facilities. The Forum has indicated a preference that projects assigned to a hydro facility should at a minimum be in the same province as that hydro facility.

Additionally, it is also important to note that BPA does not believe that it has a mitigation responsibility for losses caused by the construction and operation of Deadwood Dam.

INUNDATION GAINS

The permanent dam reservoir pools resulting from inundation created a significant expansion of open- water habitat on the Columbia River. Not all wildlife species benefiting (and expanding) from new open water were those that lost suitable habitat due to inundation. Tribes and agencies (WDFW and IDFG) concurred that allowing credit for such species did not appear to be appropriate. The following species appear to have increased as a result of open-water gains created by inundation:

Table 2: Species and Gains from the 2009 Wildlife Program

Species	Habitat Units
Bald Eagle	5,693
Black-capped Chickadee	68
Common Merganser	1,042
Greater Scaup	820
Lesser Scaup	20,577
Mallard	174
Mallard (wintering)	13,744
Marsh Wren	207
Osprey	6,159
Redhead	4,475
Other Waterfowl	423
Western Grebe	273
Yellow Warbler	8
Total	**53,663**

PRE-ACT MITIGATION

Prior to the Northwest Power Act of 1980, official mitigation efforts in response to FCRPS system impacts were undertaken by Federal water resource managers (U.S. Army Corps of Engineers, Bureau of Reclamation) and the U.S. Fish and Wildlife Service. Some mitigation actions go back as far as the 1910s, and in many cases are very difficult or impossible to fully document and assess. Wildlife mitigation prior to 1980 was in part generated through consultation with the U.S. Fish and Wildlife Service under the Fish and Wildlife Coordination Act of 1934, and the subsequently more rigorous requirements from amendments in 1946 and 1958. The majority of the pre-Act mitigation is associated with the McNary and John Day dams. The 1991 Geiger Report and 2004 USFWS Coordination Act Report identified 50,938 acres of Pre-Act mitigation and recommended that 14,032 HUs be credited as mitigation (see Appendix D for Giger Report). Because this issue affects each of the sub-regions differently, the impact of the recommended credits will be addressed among the parties within each of the sub-regions.

AGREEMENTS

Following a lengthy discussion of the issues related to the use of HEP, the Forum agreed that resolution of many of these issues would require reevaluation and assessment of many of the original HEPs and a number of the subsequent project HEPs. The Forum concluded that these efforts likely would be both labor intensive and time-consuming, and that it was likely that a better course of action would be to focus on long-term agreements that address the unique situations represented in the various geographic areas. HEP analysis to date can form the underpinnings of agreements. The intent of this report is to help guide the resolution of these issues.

Agreements can provide benefits to both the wildlife managers and to BPA. For managers, they provide an assured funding stream for project implementation and maintenance and greater management flexibility. For BPA the advantages are greater certainty in budgeting and the ability to complete its mitigation responsibility for wildlife construction and inundation losses.

AGREEMENT SUB-REGIONS

The Forum suggests that several agreements are more feasible than a single basin-wide settlement agreement. Several sets of sub-regions based on groupings of hydroelectric projects were identified. The Forum decided on the following sub-regions on which to base further technical analysis and potentially to define agreement groups:

- Lower Columbia (Bonneville, The Dalles, John Day, McNary)
- Lower Snake (Ice Harbor, Little Goose, Lower Monumental, Granite)

- Upper Snake (Anderson Ranch, Palisades, Black Canyon, Minidoka, and Deadwood)
- Northern Idaho (Albeni Falls)
- Upper Columbia (Chief Joseph, Grand Coulee)

AGREEMENT LENGTH & "CURRENCY"

The term of the mitigation is either in perpetuity or for the life of the hydro project(s) to which losses are credited. However, the term of any agreement(s) conceptually could range from 10 years, as with the Fish Accords to the life of the federal hydroelectric system (FCRPS). The recent Willamette River Basin Memorandum of Agreement Regarding Wildlife Habitat Protection and Enhancement (Willamette MOA)specifies a term of 15 years to complete the purchases associated with the agreement which was deemed to be an adequate period for remaining mitigation obligations to be satisfied in that sub-basin.

An issue to consider is the consequences of any events, natural or human-made, that may change habitat conditions over the term of the agreement(s). This requires predicting those natural events that would increase or change the calculations of the remaining habitat needed for "full" mitigation, or identifying the impacts of other agreements in the basin, such as the Fish Accords.

The value of the agreement could also vary based on the term and the type of losses to be mitigated. For example, the value of the Willamette MOA varies across several increments within its overall term. Settlement agreement(s) could also potentially use a variety of "currencies," including habitat units, acres, or funding. Agreements based on lump-sum payments are considered most desirable by many Forum members although there are challenges around how this may occur based on appropriate Federal funding levels and regulatory compliance issues for BPA.

PRIOR AGREEMENTS

Prior BPA-to-tribe/agency agreements, Memoranda of Agreements, or contracts may inform and/or affect how agreement(s) are reached. Some of these prior agreements include specific decisions about issue topics discussed in this summary report (for instance the 2:1 ratio), as well as including differing terms and requirements. The Forum recognizes the impact such prior agreements may have on settlement considerations.

OPERATION AND MAINTENANCE (O&M)

The success of mitigation projects often relies on active and ongoing management to maintain the habitat benefits obtained from land acquisition and restoration. Properties are purchased based on a number of criteria and. many properties purchased are not in pristine

condition so O&M costs may vary considerably, particularly for the first several years after purchase. However, the 2007 Independent Economic Analysis Board (IEAB) report, “Investigation of Wildlife O&M Costs” concluded that Program costs for O&M are generally comparable to other land management agencies costs Settlement agreements should address this issue.

Other key findings relevant to the charter of the Forum include:

- O&M cost data in Pisces is very coarse and needs to be more detailed to provide support for informed comparisons. Current data on O&M does not allow for parcel to parcel comparisons.
- IEAB recommended data be added to Pisces to capture the other non-BPA cost shares and the expected life of investments.

AGREEMENT PROCESS

For any settlement agreement(s) to be funded, a series of steps must first occur, including NEPA review, budgeting and inclusion in a future rate case for BPA. These steps are identified in Appendix C as requested by the Forum, including estimated time requirements for each step. Appendix C assumed a certain timeframe for initiating negotiations, but as these are not definitive, this information should only be treated as an EXAMPLE of the relative time scale of any settlement process.

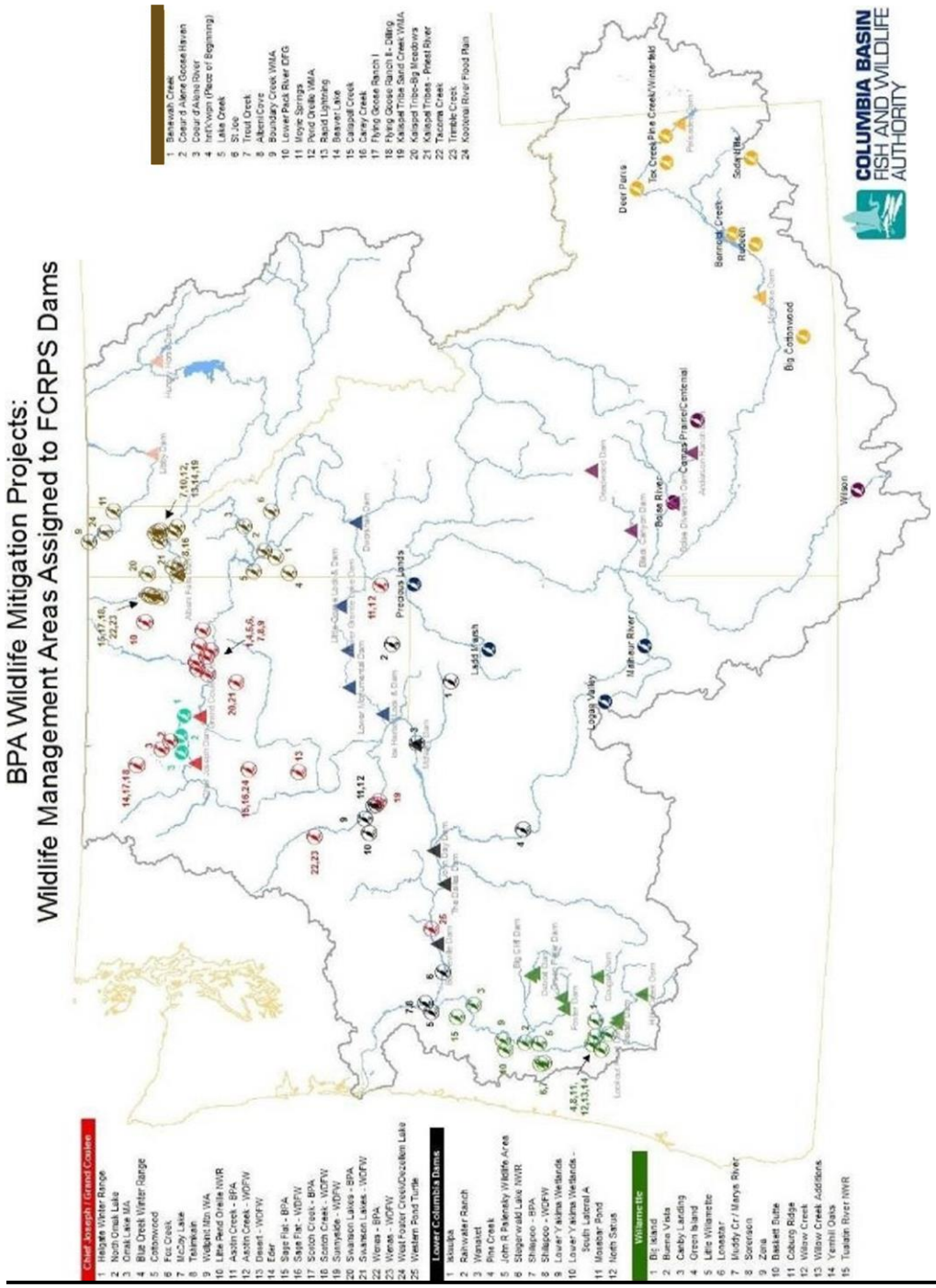


Figure 3: Projects and Facilities Mitigated

April 20-21, 2010 Crediting Forum Technical Team Meeting

The Crediting Technical Team addressed technical HEP issues that make reconciling the crediting ledger difficult and contribute to the different interpretations within the region on crediting. We identified issues in three tiers with the first tier representing technical HEP issues, the second tier focusing more on subregional issues that have policy implications for some but not all managers or areas in the region, and the third tier being primarily overarching, regional policy issues needing resolution. We sought to establish a foundation for greater consistency to the extent possible while recognizing the limitations of existing agreements. The following are working notes from the meeting and have not received regional peer review or input.

Tier 1 Issues: Technical HEP w/ little or no policy implications Sources of Variation in crediting due to HEP methods

1. Cover Typing - Delineation of cover type boundaries
2. Similarity (or lack thereof), between habitats characterized in losses and compensation lands
3. Choice of HEP species- for original losses and compensation lands
    - *Should be a good representation of habitat quality*
4. Lack of peer review or consistency of HEP models chosen for losses or compensation lands.
5. Choice of substitute HEP species when out of kind-
    - Covering same habitat attributes with same number of species
6. Modification or lack of suitable modification of HEP models.
    - Appropriate/inappropriate selection of model
    - Use of updated models for mitigation while losses are static with old models.
    - Appropriate/inappropriate alteration of equations to address site specific realities.
    - Real world differences in application of model from original area

7. Field Data Collection techniques

    - Changes in Techniques and intensity of survey
    - Changes in survey staff
    - Season of survey/phenology
    - Under represented or over represented cover types

Variation SOP

- *Use tools, models, and methods that most accurately reflect the quality and quantity of the habitats being protected and managed.*
- *HEP methods used should reflect the site specific habitat parameters and management goals of the property and may differ from the HEP methods used in determining the losses.*
- *When disagreements arise, the project proponent should seek resolution through consultation with BPA, HEP team, and subbasin or provincial co-managers to assure consistency and accuracy.*
- *Consider validating new or significantly modified models with appropriate testing and review.*

Species Stacking

Stacking occurs when multiple species are used to characterize the quality of a single cover type. It becomes a crediting issue when the same number of species used to assess losses is not in turn used to characterize the compensation lands. *Stacking is an issue of how you adjust the credits of the mitigation sites to be in balance with the number of species used to characterize the losses. Loss assessments are what they are and should not be revised or replaced to address stacking issues.*

Stacking SOP

- *SOP options to address staking issues include:*

    a. Use the same number of species to characterize the out of kind cover types as were used to characterize the loss assessment cover types.

b. If using fewer species to characterize the mitigation site cover type than were used to characterize the losses, average the HSIs of the out of kind mitigation cover types and multiply by the number of species used in the losses. However, species selection must be peer reviewed and approved by the regional HEP team, BPA and the project proponent.

c. If incidental out of kind cover types (inclusions) are associated with a mitigation acquisition, assume the same HSI as the adjacent cover type.

d. Do not credit the same acres of a given cover type between two or more hydro projects with a combination of species from both.

Tier 2 Issues: Sub-regional issues with policy implications

Crediting public lands actions, trust lands, and non-permanent or unsecured lands mitigations

- How to credit BLM lease for range lands.
- How to credit State DNR Land mitigations.
- How to credit BIA Trust lands leases or easements
- How to credit leases or easements on fee lands
- How to credit areas where BPA contributed to but did not fully provide protection or operations and maintenance funding.
- How to credit BPA where they were not involved in the protection of the habitat but provide all or part of the O&M and enhancements.

Crediting SOP

- *Project proponents must provide minimum irreducible HU letter for each compensation site including statements on each of the following issues:*

  a. Hydro project being mitigated

  b. Cover type(s) and target species used to characterize habitat quality on the compensation site

c. Commitment to follow SOPs to quantify and qualify habitat

d. Minimum number of habitat units being credited from the site

- *Crediting of Non-permanent protection- The Crediting Technical Team recommends that the region have a Crediting SOP covering sites without permanent protection. The specific operating procedure adopted needs to be further defined and agreed to.*

- *Partial purchase- credit for proportion of protection funding provided.*

- *Partial O&M or enhancements- credit for HU increases proportional to 10 year average investment.*

- *Credit for leases that may not provide permanent protection- credit against operational or secondary losses or normal full credit when the protection and credit from a non- permanent compensation site gets rolled over to another non-permanent site with an equal or greater amount of habitat value*

- *Credit for lands protected with partial lease such as the purchase of an annual grazing lease on Indian trust lands or a federal grazing allotment - receive credit for cover types enhanced by the annual protection and O&M. Assumption of replacement with similar lease if lease terminated.*

Tier 3 Issues: Policy level resolution required

1. Socio-political issues of crediting projects that are out of kind and out of place from impacts.

2. Allocation HUs among resource managers.

    a. Crossing political boundaries with mitigation actions.
    b. Crossing ecological/population boundaries.

3. Crediting of fish projects against construction and inundation wildlife losses.

4. Crediting non-permanent or unsecured lands

5. How to deal with “over mitigation”?

Where do we go from here?

1. Regional Agreements on SOPs after vetting through all Forum members.

2. Direct the HEP team to work with project managers at each compensation site to address technical shortcomings identified above.

    - For new projects, do this with baseline HEPs.
    - For existing projects, do this with follow-up HEPs.
    - Consider adding to HEP team’s contract an express mandate and responsibility to identify inconsistencies in technical HEP applications throughout the region.

3. Incorporate fish credit findings and recommendations as appropriate.

4. Reassign credits within lower four mainstem Columbia River dams.

    - Unlike other areas in the basin, the lower four crediting can be reassigned based on existing HEP reports, so no need to wait or gather additional data.

5. Develop draft ledger for recommendation to Council for review and approval.
    - The ledger will report HUs protected and enhanced through the Council’s Fish and Wildlife Program.

Appendix B - Loss Assessment Summary, Table C-4, 2009 Program

Table C-4 Estimated Losses and Gains Due to Hydropower Construction
(losses are preceded by a "-", gains by a "+")

Species	Total Habitat Units
Albeni Falls	
• Mallard Duck	-5,985
• Canada Goose	-4,699
• Redhead Duck	-3,379
• Breeding Bald Eagle	-4,508
• Wintering Bald Eagle	-4,365
• Black-Capped Chickadee	-2,286
• White-tailed Deer	-1,680
• Muskrat	-1,756
• Yellow Warbler	+171
Lower Snake Projects	
• Downy Woodpecker	-364.9
• Song Sparrow	-287.6
• Yellow Warbler	-927.0
• California Quail	-20,508.0
• Ring-necked Pheasant	-2,646.8
• Canada Goose	-2,039.8
Anderson Ranch	
• Mallard	-1,048
• Mink	-1,732
• Yellow Warbler	-361
• Black Capped Chickadee	-890
• Ruffed Grouse	-919
• Blue Grouse	-1,980
• Mule Deer	-2,689
• Peregrine Falcon	-1,222 acres*
* Acres of riparian habitat lost. Does not require purchase of any lands.	
Black Canyon	
• Mallard	-270
• Mink	-652
• Canada Goose	-214
• Ring-necked Pheasant	-260
• Sharp-tailed Grouse	-532
• Mule Deer	-242
• Yellow Warbler	+8
• Black-capped Chickadee	+68
Deadwood	
• Mule Deer	-2080
• Mink	-987
• Spruce Grouse	-1411
• Yellow Warbler	-309

Table C-4 (cont.) Estimated Losses and Gains Due to Hydropower Construction (losses are preceded by a "-", gains by a "+")

Species	Total Habitat Units
Palisades	
• Bald Eagle	-5,941 breeding -18,565 wintering
• Yellow Warbler	-718 scrub-shrub
• Black Capped Chickadee	-1,358 forested
• Elk/Mule Deer	-2,454
• Waterfowl and Aquatic Furbearers	-5,703
• Ruffed Grouse	-2,331
• Peregrine Falcon*	-1,677 acres of forested wetland -832 acres of scrub-shrub wetland +68 acres of emergent wetland
* Acres of riparian habitat lost. Does not require purchase of any lands.	
Willamette Basin Projects	
• Black-tailed Deer	-17,254
• Roosevelt Elk	-15,295
• Black Bear	-4,814
• Cougar	-3,853
• Beaver	-4,477
• River Otter	-2,408
• Mink	-2,418
• Red Fox	-2,590
• Ruffed Grouse	-11,145
• California Quail	-2,986
• Ring-necked Pheasant	-1,986
• Band-tailed Pigeon	-3,487
• Western Gray Squirrel	-1,354
• Harlequin Duck	-551
• Wood Duck	-1,947
• Spotted Owl	-5,711
• Pileated Woodpecker	-8,690
• American Dipper	-954
• Yellow Warbler	-2,355
• Common Merganser	+1,042
• Greater Scaup	+820
• Waterfowl	+423
• Bald Eagle	+5,693
• Osprey	+6,159
Grand Coulee	
• Sage Grouse	-2,746
• Sharp-tailed Grouse	-32,723
• Ruffed Grouse	-16,502
• Mourning Dove	-9,316
• Mule Deer	-27,133
• White-tailed Deer	-21,362
• Riparian Forest	-1,632
• Riparian Shrub	-27
• Canada Goose Nest Sites	-74

Table C-4 (cont.) Estimated Losses and Gains Due to Hydropower Construction (losses are preceded by a "-", gains by a "+")

Species	Total Habitat Units
McNary	
• Mallard (wintering)	+ 13,744
• Mallard (nesting)	-6,959
• Western Meadowlark	-3,469
• Canada Goose	-3,484
• Spotted Sandpiper	-1,363
• Yellow Warbler	-329
• Downy Woodpecker	-377
• Mink	-1,250
• California Quail	-6,314
John Day	
• Lesser Scaup	+14,398
• Great Blue Heron	-3,186
• Canada Goose	-8,010
• Spotted Sandpiper	-3,186
• Yellow Warbler	-1,085
• Black-capped Chickadee	-869
• Western Meadowlark	-5,059
• California Quail	-6,324
• Mallard	-7,399
• Mink	-1,437
The Dalles	
• Lesser Scaup	+2,068
• Great Blue Heron	-427
• Canada Goose	-439
• Spotted Sandpiper	-534
• Yellow Warbler	-170
• Black-capped Chickadee	-183
• Western Meadowlark	-247
• Mink	-330
Bonneville	
• Lesser Scaup	+2,671
• Great Blue Heron	-4,300
• Canada Goose	-2,443
• Spotted Sandpiper	-2,767
• Yellow Warbler	-163
• Black-capped Chickadee	-1,022
• Mink	-1,622
Dworshak	
• Canada Goose-(breeding)	-16
• Black-capped Chickadee	-91
• River Otter	-4,312
• Pileated Woodpecker	-3,524
• Elk	-11,603
• White-tailed Deer	-8,906
• Canada Goose (wintering)	+323
• Bald Eagle	+2,678
• Osprey	+1,674
• Yellow Warbler	+119

Table C-4 (cont.) Estimated Losses and Gains Due to Hydropower Construction (losses are preceded by a "-", gains by a "+"

Species	Total Habitat Units
Minidoka	
• Mallard	+174
• Redhead	+4,475
• Western Grebe	+273
• Marsh Wren	+207
• Yellow Warbler	-342
• River Otter	-2,993
• Mule Deer	-3,413
• Sage Grouse	-3,755
Chief Joseph	
• Lesser Scaup	+1,440
• Sharp-tailed Grouse	-2,290
• Mule Deer	-1,992
• Spotted Sandpiper	-1,255
• Sage Grouse	-1,179
• Mink	-920
• Bobcat	-401
• Lewis' Woodpecker	-286
• Ring-necked Pheasant	-239
• Canada Goose	-213
• Yellow Warbler	-58

(Appendices C through G not included due to data download issues)

Appendix E – HEP Annualization Explanation Excerpt

(Source: USFWS - ESM 102)

5. Habitat Assessments Using Habitat Units

Habitat assessments involve measurement and description of habitat conditions for baseline (present) assessments and impact (future with and without action) assessments. For baseline assessments, different areas can be compared in terms of HU's as a guide to further land use planning. Baseline assessments are point-in-time comparisons. For impact assessments, alternative future land use actions can be compared based on predicted future availability of HU's. The net impact of a proposed land use action is the difference in predicted HU's between the future with the action and the future without the action.

5.1 Habitat Unit analysis for one point in time - Baseline assessments. Baseline assessments are used to describe existing ecological conditions. The results of baseline assessments provide a reference point from which resource planners can: 1) compare existing conditions in two or more areas in order to define management capabilities or as a guide to future land use planning; 2) predict and compare changes that may occur without the proposed action, with the proposed action, or with compensation measures; and 3) design monitoring studies. Baseline assessments play a critical role in wildlife planning by identifying wildlife resource capabilities at one point in time so that proposed future actions can be directed toward or away from specific areas. A baseline assessment involves: 1) definition of the study limits, including definition of the study area, delineation of cover types, and selection of evaluation species (Chapter 3); and 2) characterization of the study area in terms of HU's (Chapter 4).

The objective in performing a baseline assessment is to calculate the number of HU's at one point in time for each evaluation species. The area of available habitat (Section 4.1) is multiplied by the mean HSI (Section 4.2) for each evaluation species to determine the total HU's for that species in the study area. The baseline HU's are evaluated and compared directly if the baseline assessment is designed to compare existing conditions in two or more areas. Additional calculations are required (Section 5.2) if the baseline data are to be used as a reference point for impact assessments.

5.2 Habitat Unit analysis for multiple points in time - Impact assessments. Impact assessments are performed by quantifying habitat conditions at several points in time throughout some defined period of analysis. Points in time (target years) can be selected at fixed intervals such as every year, or according to some other schedule.

The assessment of land use impacts is facilitated by dividing the study area into impact segments. An impact segment is defined as an area in which the nature and intensity of the future land use can be considered homogeneous, such as the flood pool area in a reservoir project, a recreational area, or the area of a particular agricultural practice. The advantage of dividing the study area into impact segments is that only one condition need be considered for each cover type within each impact segment. The effects of a

particular action may be analyzed over a large area by assuming that the same condition exists throughout each impact-segment-cover-type zone.

Habitat Units must be calculated for the evaluation species at each of the future points in time for future-with and future-without project conditions; this process includes predicting total available habitat and HSI for each evaluation species, using the same HSI models that were used for the baseline year.

A. Use of target years for future predictions. The impact assessment can be simplified by selecting target years (TY's) for which habitat conditions can be reasonably defined. At a minimum, target years should be selected for points in time when the rates of loss or gain in HSI or area are predicted to change. Rates of loss or gain in HSI or area are assumed to occur linearly between target years.

There are several requirements for the selection of target years. The HU-time analysis must begin at a baseline year (TY-0). A baseline year is defined as a point in time before proposed changes in land and water use result in habitat alterations in the study area. In most cases, the baseline year will be existing or current year conditions. However, in some cases, current habitat conditions may reflect proposed action influences. For example, landowners or managers may begin clearing bottomland timber from flood prone sites located downstream from an anticipated flood control project before baseline studies can be initiated. In such cases, baseline year conditions will be those that existed in some previous year. Judgment is required in defining baseline year habitat conditions when present conditions reflect proposed action influences.

In addition to a baseline year, there must always be a target year 1 and an ending target year which defines the future period of analysis. Target year 1 is the first year land and water use conditions are expected to deviate from baseline conditions. The habitat conditions (HSI and area) described for each target year are the expected conditions at the end of that year.

B. Predicting future area of available habitat. For each proposed action, the area of available habitat must be estimated for future years. Some cover types will increase in total area, others will decrease, and in some cases new cover types will be created or existing ones totally lost under projected future conditions.

The user must constantly check to ascertain that the total area of the study does not vary from the baseline area. The recommended method for determining the future area of cover types is the use of cover type maps. The method of developing a cover type map for a future year is to overlay impact segment boundaries on the baseline cover map previously developed (Section 3.2). Baseline cover types will either be unaltered, altered (i.e., variables such as % vegetation cover may change), or converted to new cover types depending on such factors as land use within the impact segment, vegetation successional trends, and management. Areas converted to new cover types through succession or impacts are given a new cover type designation. Altered cover types are designated a subtype (e.g., deciduous forest altered by flooding). An overlay of impact segment boundaries may be required for each target year. Each proposed action requires its own series of overlays in order to determine changes in area of available habitat between selected target years. Figure 5-1 illustrates how a baseline cover type map could be used in conjunction with impact segments to produce cover type maps for future conditions.

C. Predicting future HSI. The same models that were used to determine baseline HSI values must be used to determine future HSI values. If, for example, a mathematical model was used to calculate baseline HSI, a related word model cannot be used to predict future HSI values, or vice versa.

Estimating HSI values for future years requires predictions of changes in the physical, vegetative, and chemical variables of each cover type. Impact segment overlays can be used as an aid in estimating these variables. For example, seasonal flooding could alter a forest understory but not the canopy closure. Changes in interspersion relationships due to creation of new cover types or conversion of existing cover types also can affect HSI model output and can be easily measured on future cover type maps (impact segment overlays).

D. Annualization of impacts. Most Federal agencies use annualization as a means to display benefits and costs, and the habitat analysis should provide data that can be directly compared to the benefit/cost analysis. The annualization process will be described in detail, although it is not the only mechanism with which to display future habitat changes. Federal projects are evaluated over a period of time that is referred to as the "life of the project" and is defined as that period between the time that the project becomes operational and the end of the project life as determined by the construction, or lead, agency. However, in many cases gains or losses in wildlife habitat may occur before the project becomes operational, and these changes should be considered in

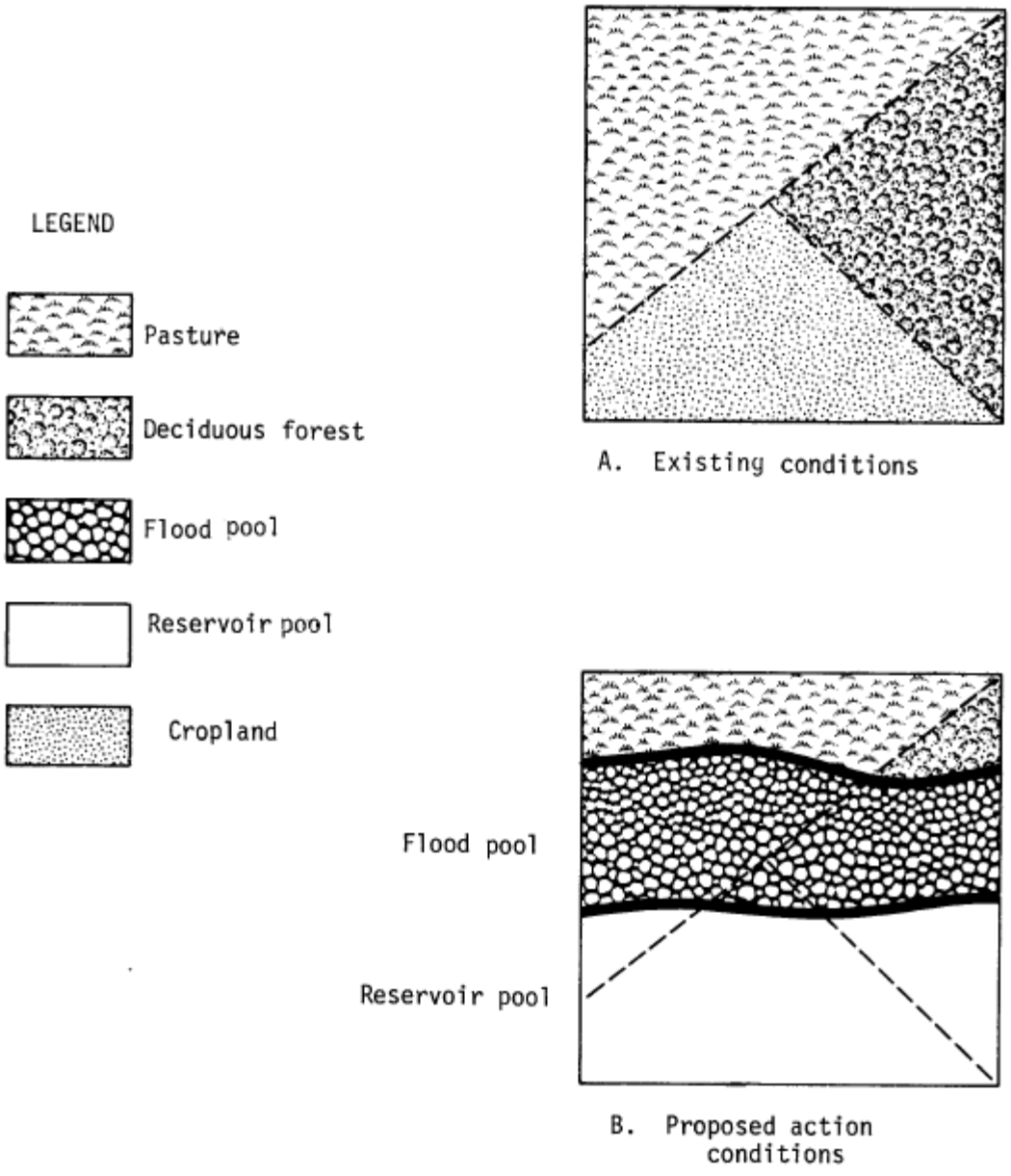


Figure 5-1. An example of a cover type map illustrating existing habitat conditions (A) and predicted conditions for target year 20 with a proposed action (B).

the impact analysis. Examples of such changes include construction impacts, implementation of a compensation plan, or other land use changes. The habitat assessment incorporates these changes by use of a period of analysis that includes prestart impacts (Figure 5-2). However, if no prestart changes are evident, then the life of the project and the period of analysis are the same.

Habitat Unit gains or losses are annualized by summing HU's across all years in the period of analysis and dividing the total (cumulative HU) by the number of years in the life of the project. In this manner prestart changes can be considered in the analysis. This calculation results in Average Annual Habitat Units (AAHU's).

The area of the shaded portion of the graph in Figure 5-3 represents the cumulative HU's for all years in the period of analysis and is calculated by summing the products of HSI and area of available habitat for all years in the period of analysis as follows:

$$\text{Cumulative HU's} = \sum_{i=1}^{p} H_i \, (A_i) \qquad (1)$$

where H_i = HSI at year i

A_i = area of available habitat at year i

p = the period of analysis (e.g., 100 years)

This is a generalized formula and requires that the HSI and area of available habitat be known for each year. However, a formula that requires only target year HSI and area estimates is:

$$\text{Cumulative HU's} = (T_2 - T_1)\left[\frac{A_1H_1 + A_2H_2}{3} + \frac{A_2H_1 + A_1H_2}{6}\right] \qquad (2)$$

where T_1 = first target year of time interval

T_2 = last target year of time interval

A_1 = area of available habitat at beginning of time interval

A_2 = area of available habitat at end of time interval

H_1 = HSI at beginning of time interval

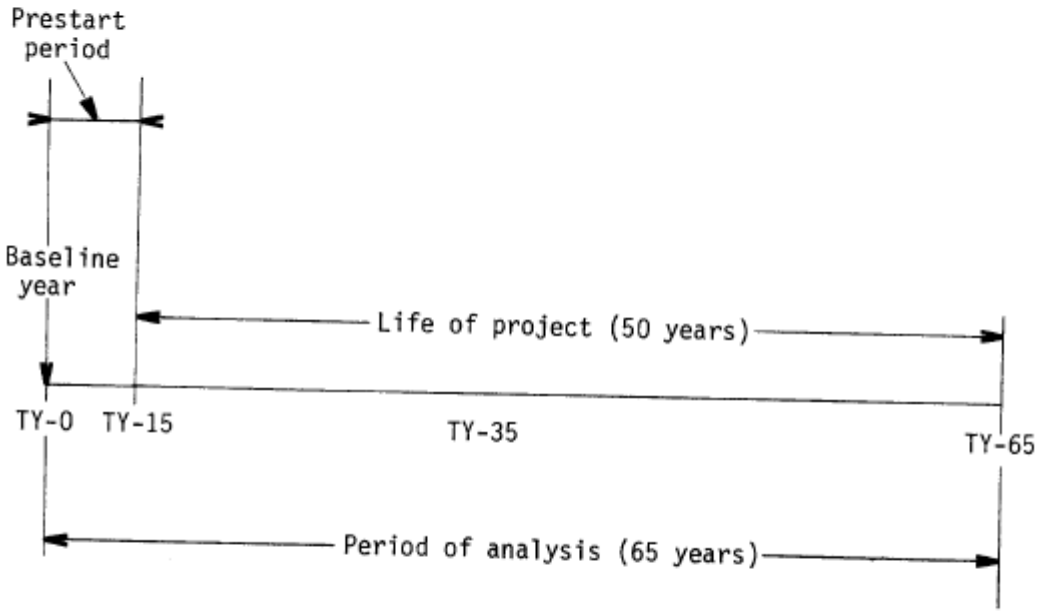


Figure 5-2. Relationship between the "life of the project" and the "period of analysis".

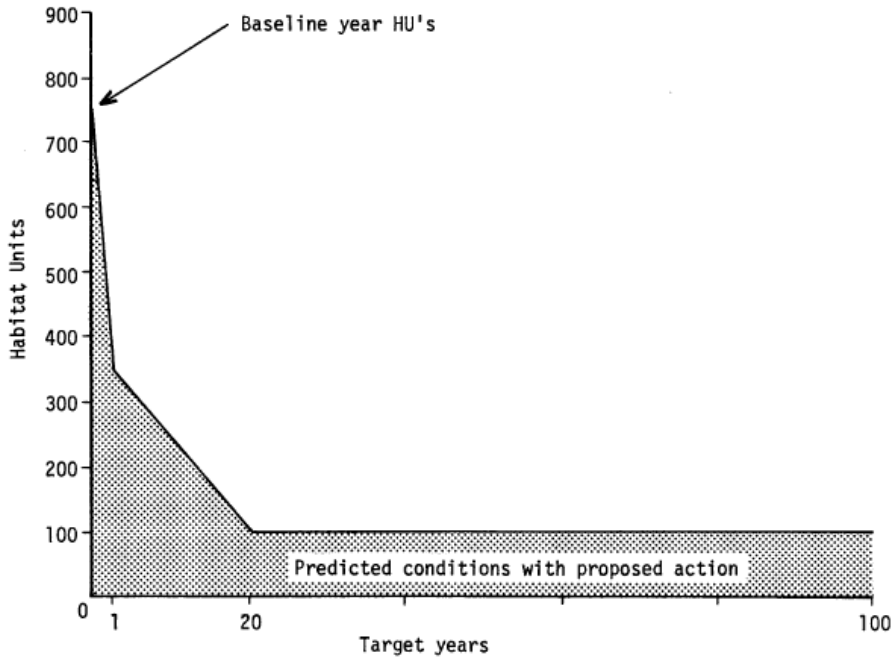


Figure 5-3. Change in white-tailed deer HU's for a hypothetical reservoir project. Shaded area represents the cumulative habitat availability with the proposed action.

H_2 = HSI at end of time interval

3 and 6 = constants derived from integration of HSI x Area for the interval between any two target years

Formula (2) is applied to the time intervals between target years. For the example in Figure 5-3, the formula must be applied for three time intervals: baseline to year 1, year 1 to year 20, and year 20 to year 100. The formula was developed to precisely calculate cumulative HU's when either HSI or area or both change over a time interval. The rate of change of HU's may be linear (either HSI or area is constant over the time interval), or curvilinear (both HSI and area change over the time interval); the formula will work in either case.

E. Calculating net impacts of a proposed action. The preceding example illustrates the calculation of AAHU's for one set of future conditions. However, determining the net impact of a proposed action requires that two future analyses be performed and compared to one another: 1) expected future conditions with the proposed action; and 2) the future without the proposed action. When comparing future conditions, the same baseline year and period of analysis must be used for each. Table 5-1 presents a hypothetical set of data for white-tailed deer habitat for the future with and the future without a proposed action.

Table 5-1. Target year habitat conditions for white-tailed deer for both the future with and the future without a proposed action.

Condition	Target year	Area (acres)	HSI value	Total HU
With proposed action	Baseline	1000	0.75	750
	1	500	0.70	350
	20	500	0.20	100
	100	500	0.20	100
Without proposed action	Baseline	1000	0.75	750
	1	1000	0.75	750
	20	900	0.60	540
	100	600	0.60	360

Using formula (2) for cumulative HU's, the AAHU calculations for the future with the proposed action are as follows:

Baseline - 1

A. $(1 - 0)\left[\frac{1000(0.75) + 500(0.70)}{3} + \frac{500(0.75) + 1000(0.70)}{6}\right] = 545.8$

Years 1-20

B. $(20 - 1)\left[\frac{500(0.70) + 500(0.20)}{3} + \frac{500(0.70) + 500(0.20)}{6}\right] = 4275$

Years 20-100

C. $(100 - 20)\left[\frac{500(0.20) + 500(0.20)}{3} + \frac{500(0.20) + 500(0.20)}{6}\right] = 8000$

Cumulative HU's = 545.8 + 4275 + 8000 = 12820.8

AAHU's = $\frac{12820.8}{100} = 128.2$

The AAHU calculations for the future without the proposed action are as follows:

Baseline - 1

A. $(1 - 0)\left[\frac{1000(0.75) + 1000(0.75)}{3} + \frac{1000(0.75) + 1000(0.75)}{6}\right] = 750$

Years 1-20

B. $(20 - 1)\left[\frac{1000(0.75) + 900(0.60)}{3} + \frac{900(0.75) + 1000(0.60)}{6}\right] = 12,208$

Years 20-100

C. $(100 - 20)\left[\frac{900(0.60) + 600(0.60)}{3} + \frac{600(0.60) + 900(0.60)}{6}\right] = 36,000$

Cumulative HU's = 750 + 12,208 + 36,000 = 48,958

AAHU's = $\frac{48,958}{100} = 489.6$

5. Habitat Assessments Using Habitat Units

The net annual impact of the proposed action on white-tailed deer is calculated by using the formula:

$$\text{NET IMPACT} = AAHU_{WITH} - AAHU_{WITHOUT}$$

$$= 128.2 - 489.6$$

$$= -361.4 \text{ AAHU}$$

The net impact figure reflects in AAHU's the difference between future with and future without the proposed action conditions. An average of 361.4 fewer HU's will be available for deer every year during the life of the proposed action than would be available if the proposed action was not implemented. Figure 5-4 illustrates this relationship.

Appendix F – Willamette Basin HEP Model Example

4. **WESTERN POND TURTLE**

V1 = Percent cover of emergent and submerged vegetation
HSI: 1.0 if ≥ 75%.

V2 = Water velocity and depth
HSI: 1.0 if shallow or moderate deep waters (< 2m depth) without water fluctuations and slow, still (undetectable flow to the eye) waters.

V3 = Amount of in-water woody structure and/or vegetation or other refugia.
HSI: 1.0 if there was an abundance of in-water structure for both basking and cover combined.

V4 = Nesting potential
HSI: 1.0 if high quality and abundant nesting areas within 1/4 mile of pond turtle habitat.

The upland prairie and upland old field (1 sample site each); wet pasture, upland pasture, and invaded wet prairie (2 sample sites each) habitats, each in combination with the open water habitat (4 sample sites) were evaluated with this model. The HSI determination is equal to the life requisites for foraging, cover, and reproductive values.

Appendix G – Yakama Nation HU Crediting Example

Source: Excerpt from RHT Final Assessment and analysis of the NW Power Act Funded by BPA (Ashley 2015)

Only the riparian tree cover type is used in this example. This scenario was repeated for other cover types.

The riparian tree cover type was listed in each Lower Four Columbia River Dam cover type/species matrix (see loss assessments below). Two HEP models were used to determine HU losses for this cover type at McNary Dam, The Dalles Dam, and Bonneville Dam while only one evaluation species is listed in the John Day Dam cover type/species matrix. This means that a maximum of two evaluation species were needed to fulfill stacking requirements had standard crediting practices and protocols been followed. Raedeke, however, used five evaluation species to assess the riparian tree cover type (Raedeke and Raedeke 2000) when only a maximum of two species was needed, resulting in over-mitigating the cover type. Taken together, the Lower Four loss assessments list four different HEP models that were used to evaluate the riparian tree cover type. In most cases, Raedeke either matched the maximum number of evaluation species listed per cover type in one of the Lower Four loss assessments or exceeded that number (see Lower Four loss assessment spreadsheets below).

The net result was that the number of HU gains generated on YN compensation site acquisitions/leases and credited against Lower Four HU losses would have been less if compensation sites had been paired with a specific hydro facility and proper HEP model stacking had been followed on baseline HEP surveys. Theoretically, additional unmitigated HUs would have been available to WDFW and the CTUIR.

Source:

Ashley, P. R. 2015. RHT Final Assessment and analysis of the NW Power Act Funded by BPA. Regional HEP Team. Pacific States Marine Fisheries Commission. Portland, OR.

Lower Four loss assessment cover type/species matrices

McNARY DAM COVER TYPE/SPECIES MATRIX									
HEP MODEL	**Rip. Tree**	**Rip. Shrub**	**Rip. Herb**	**Sa/Gr/ Co/Mud[a]**	**Emergent Wetland**	**Shrub-steppe/ Grassland**	**Agricultural**	**Islands**	**Open Water - Riverine**
California Quail		X	X			X	X		
Canada Goose			X	X		X	X	X	
Mallard			X		X	X	X	X	X
Spotted Sandpiper				X					
Mink	X	X	X	X	X				
Western Meadowlark						X			
Yellow Warbler		X							
Downy Woodpecker	X								
TOTAL	**2**	**3**	**4**	**3**	**2**	**4**	**3**	**2**	**1**

[a] Sand, gravel, cobble, and mud cover type.

JOHN DAY DAM COVER TYPE/SPECIES MATRIX									
HEP MODEL	**Rip. Tree**	**Rip. Shrub**	**Rip. Herb**	**Sa/Gr/ Co/Mud[a]**	**Emergent Wetland**	**Shrub-steppe/ Grassland**	**Agricultural**	**Islands**	**Open Water**
California Quail						X			
Canada Goose			X				X	X	
Mallard			X		X			X	
Spotted Sandpiper				X					
Mink		X			X				
Western Meadowlark						X			
Black-capped Chickadee	X								
Yellow Warbler		X							
Great Blue Heron				X					
TOTAL	**1**	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**0**

[a] Sand, gravel, cobble, and mud cover type.

The DALLES DAM COVER TYPE/SPECIES MATRIX						
HEP MODEL	**Rip. Tree**	**Rip. Shrub**	**Sa/Gr/ Co/Mud[a]**	**Shrub-steppe/ Grassland**	**Islands**	**Open Water**
Canada Goose					X	
Spotted Sandpiper			X			
Mink	X	X				
Western Meadowlark				X		
Black-capped Chickadee	X					
Yellow Warbler		X				
Great Blue Heron			X			
TOTAL	**2**	**2**	**2**	**1**	**1**	**0**
[a] Sand, gravel, cobble, and mud cover type.						

BONNEVILLE DAM COVER TYPE/SPECIES MATRIX								
HEP MODEL	**Rip. Tree**	**Rip. Shrub**	**Wetlands, Lakes, and Ponds**	**Sa/Gr/ Co/Mud[a]**	**Open Water, Reservoir, River**	**Islands**	**Conifer-Hardwood Forest**	**Shrub-steppe/ Grassland**
Canada Goose			X	X		X		X
Spotted Sandpiper			X	X				
Mink			X	X	X			
Black-capped Chickadee	X						X	
Yellow Warbler		X						
Great Blue Heron	X		X	X	X			X
TOTAL	**2**	**1**	**4**	**4**	**2**	**1**	**1**	**2**
[a] Sand, gravel, cobble, and mud cover type								

YN/Raedeke HEP loss assessment species per cover type comparison

YN/RAEDEKE HEP STUDY AND LOSS ASSESSMENT SPECIES PER COVER TYPE COMPARISON											
Entity/Hydro Project	**Rip.[a] Tree # Species**	**Rip.[a] Shrub # Species**	**Rip.[a] Herb # Species**	**Riverine # Species**	**Lacustrine Palustrine # Species**	**Sa/Gr/[b] Co/Mud # Species**	**Emergent Wetland # Species**	**Shrub-steppe/ Grassland # Species**	**Agricultural # Species**	**Islands # Species[c]**	**Conifer-Hardwood Forest # Species[c]**
YN/Raedeke	**5**	**3**	**3**	**3**	**3**	**4**	**2**	**5**	**2**	**0**	**0**
McNary Dam	2	3	4	1	0	3	2	4	3	2	0
John Day Dam	1	2	2	0	0	2	2	2	1	2	0
The Dalles Dam	2	2	0	0	0	2	0	1	0	1	0
Bonneville Dam	2	1	0	2	4	4	0	2	0	1	1
[a] Riparian communities											
[b] Sand/Gravel/Cobble/Mud											
[c] These cover types were not present on compensation sites. Therefore, the number of species in the YN/Raedeke HEP assessment was zero.											

Appendix H – WDFW Crediting Formula Example

Excerpt from Ashley (2008)

WDFW Crediting Formula Example/Calculations

Standard baseline HEP surveys were conducted to determine baseline HSI/HUs for each HEP species model. In the following example, baseline HEP survey results generated a 0.50 HSI as illustrated in Figure 10 (line B).

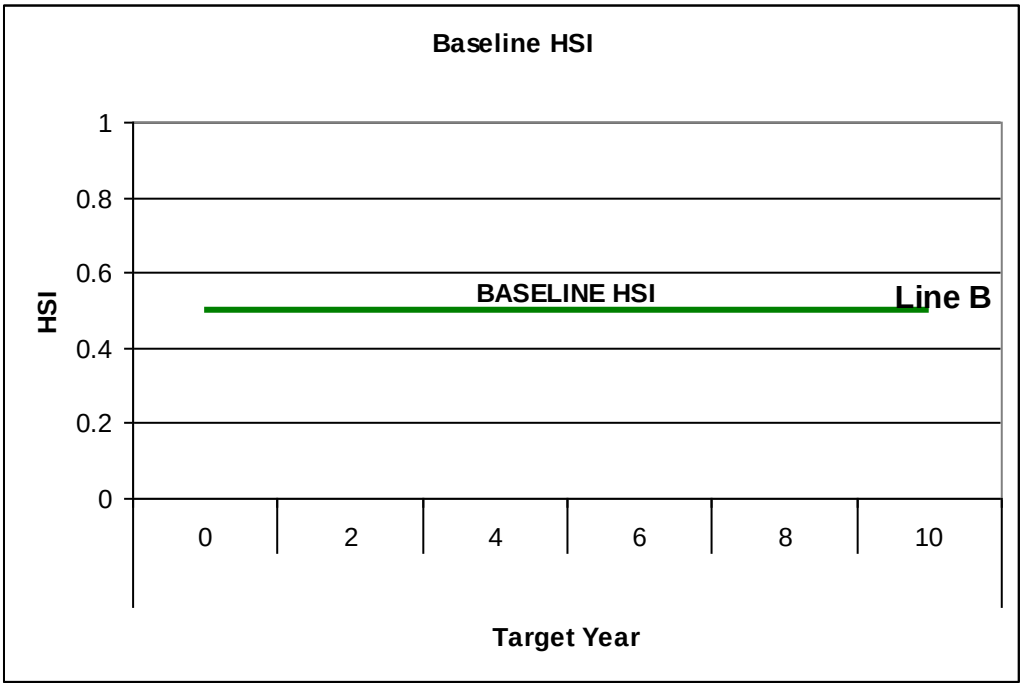


Figure 10 Baseline survey HEP species model 0.50 HSI example

WDFW HEP Team members then reviewed baseline HEP results and projected how HEP model variables might change over a ten year period without the infusion of BPA wildlife mitigation funds for O&M activities. WDFW biologists generally projected that habitat quality would decrease without an increase in O&M funding. Occasionally, however, habitat condition projections did not differ from baseline conditions and were not modified. Individual HEP model habitat variable suitability indices (SIs) were modified accordingly along with the HEP model HSI as shown in Figure 11 (line C).

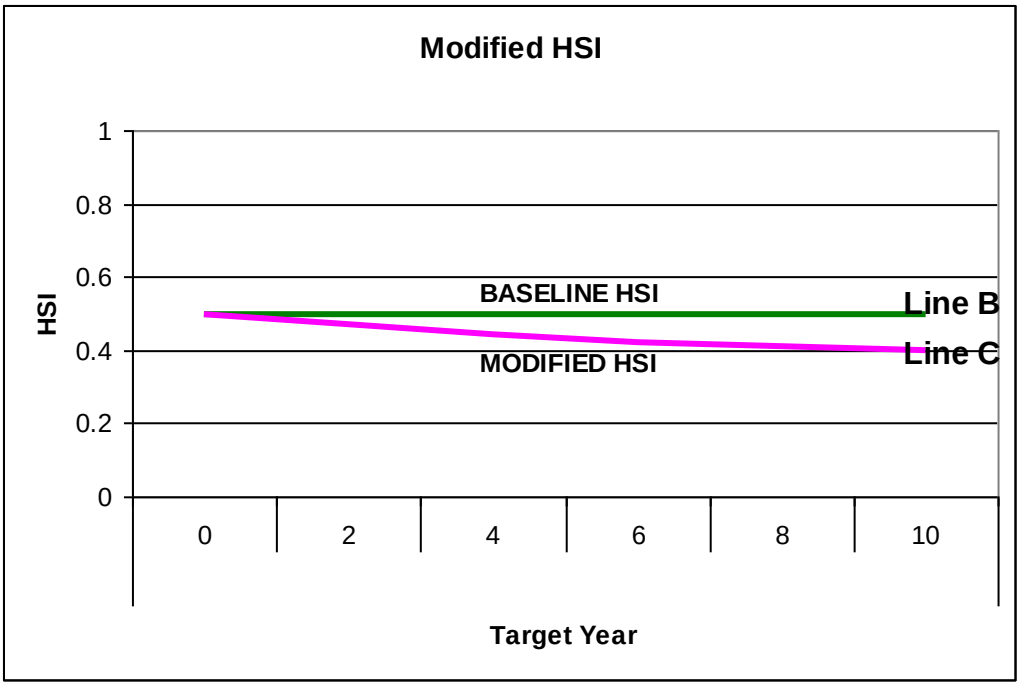


Figure 11 An example of a projected reduction in HEP model HSI

The difference between the baseline HSI of 0.50 (line B) and the modified HSI of 0.40 (line C) is 0.10 HSI. Baseline HUs were then recalculated based on the 0.10 change in HSI. Similarly, If habitat quality/HSI was expected to increase in the next ten years (line A, Figure 12), total credited habitat units were calculated based on the difference between line A (0.65 HSI) and line C (0.40 HSI), or 0.25 HSI as illustrated in Figure 13.

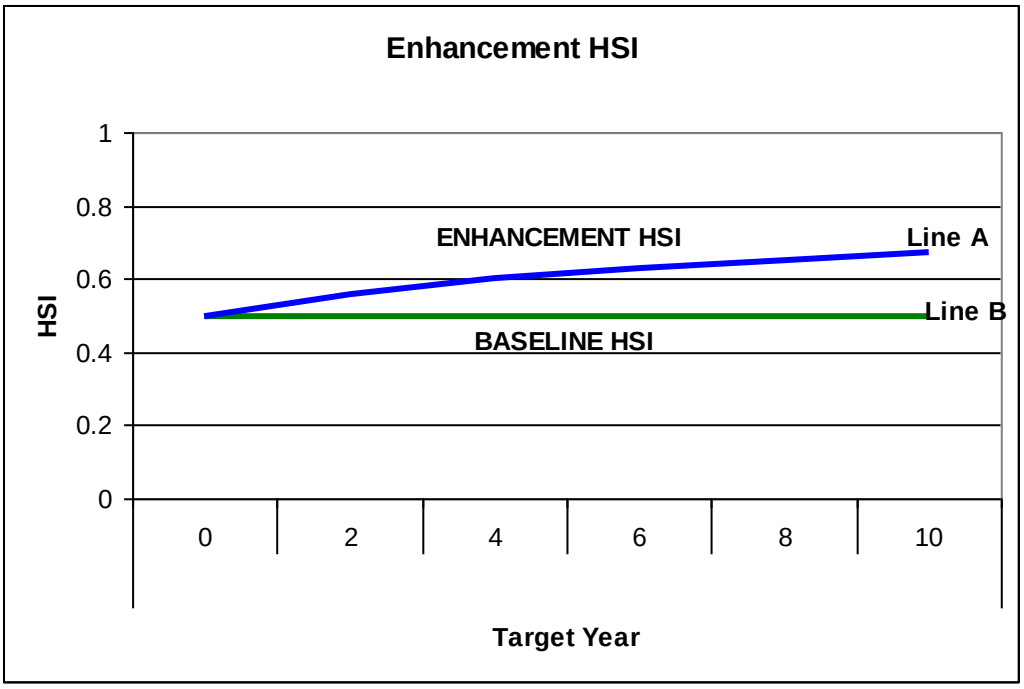


Figure 12 Habitat enhancement suitability example

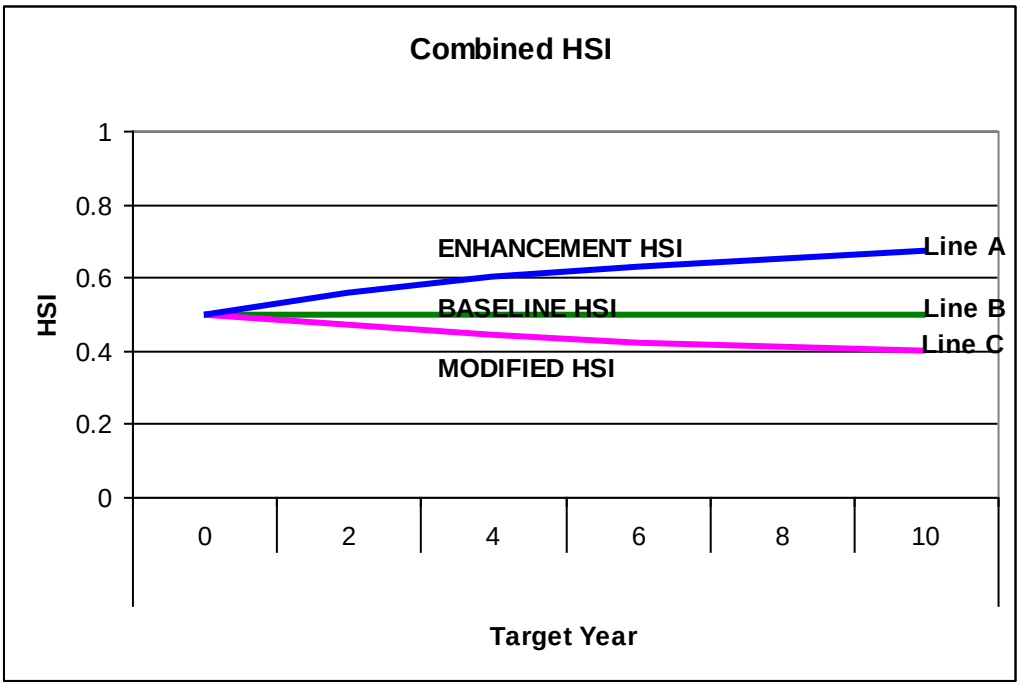


Figure 13 Combined modified baseline and enhancement habitat suitability index

Continuing this example, in Table 3 the 1,000 acre BPA acquisition baseline HSI is 0.50 generating 500 HUs while the enhancement credit HSI is 0.15 generating 150 HUs[44] . BPA receives a combined total of 650 habitat units for acquiring and enhancing 1,000 acres of wildlife habitat i.e., FCRPS HU crediting.

Table 5 HU crediting comparison of land acquired with BPA funds versus land owned by WDFW

Project Type	Credit Type	HSI	Acres	HUs
BPA Acquisition	Baseline	0.50	1,000	500
	Enhancement	0.15	(same acres as above)	150
BPA Totals			**1,000**	**650**
WDFW Lands[a]	Baseline	0.10	1,000	100
	Enhancement	0.15	(same acres as above)	150
WDFW Totals			**1,000**	**250**
[a] WDFW Crediting Formula				

In contrast, if the same 1,000 acre project area was purchased by WDFW without BPA funds, the baseline HSI is 0.10 (0.50 HSI - 0.40 HSI = 0.1 HSI) (Figure 11) - generating 100 habitat units. The enhancement HSI is 0.15 (0.65 HSI – 0.50 HSI = 0.15 HSI) (Figure 12) equaling 150 HUs. BPA receives both modified baseline HU credit and enhancement credit (Figure 13) and is credited with 250 total habitat units on lands owned by WDFW (WDFW crediting Formula).

Swanson Lakes WA Spreadsheet Example

Actual baseline, projected (10-year), and follow-up habitat suitability indices and associated habitat units for the Swanson Lakes Wildlife Area are illustrated in Table 4. HSI and HU computations are shown for both lands owned by WDFW and properties purchased by BPA. Spreadsheet computations in Table 4 are explained briefly in the following paragraphs.

Baseline (measured) HSIs and HUs are listed for both WDFW and BPA ownership (TY[45] 0 HSI and TY O HUs). Further HU computations stopped for lands purchased with BPA mitigation funds until a follow-up HEP analysis was completed in TY 16. Habitat units derived from TY 16 follow-up HEP analysis supplanted baseline HUs. Net HU gains can be determined by subtracting baseline HUs from TY 16 HUs.

On parcels owned by WDFW, the columns titled “W/O[46] Project HSI” and “W/O Project HUs” reflect the projected decrease in habitat quality and habitat units without the infusion of BPA funds for O&M and enhancement activities (notice that the “W/O Project

[44] Habitat units are determined by multiplying the HSI by the number of acres.
[45] TY is an acronym for “target year.”
[46] W/O is “without project”. The term “project” refers to BPA mitigation funding in this instance.

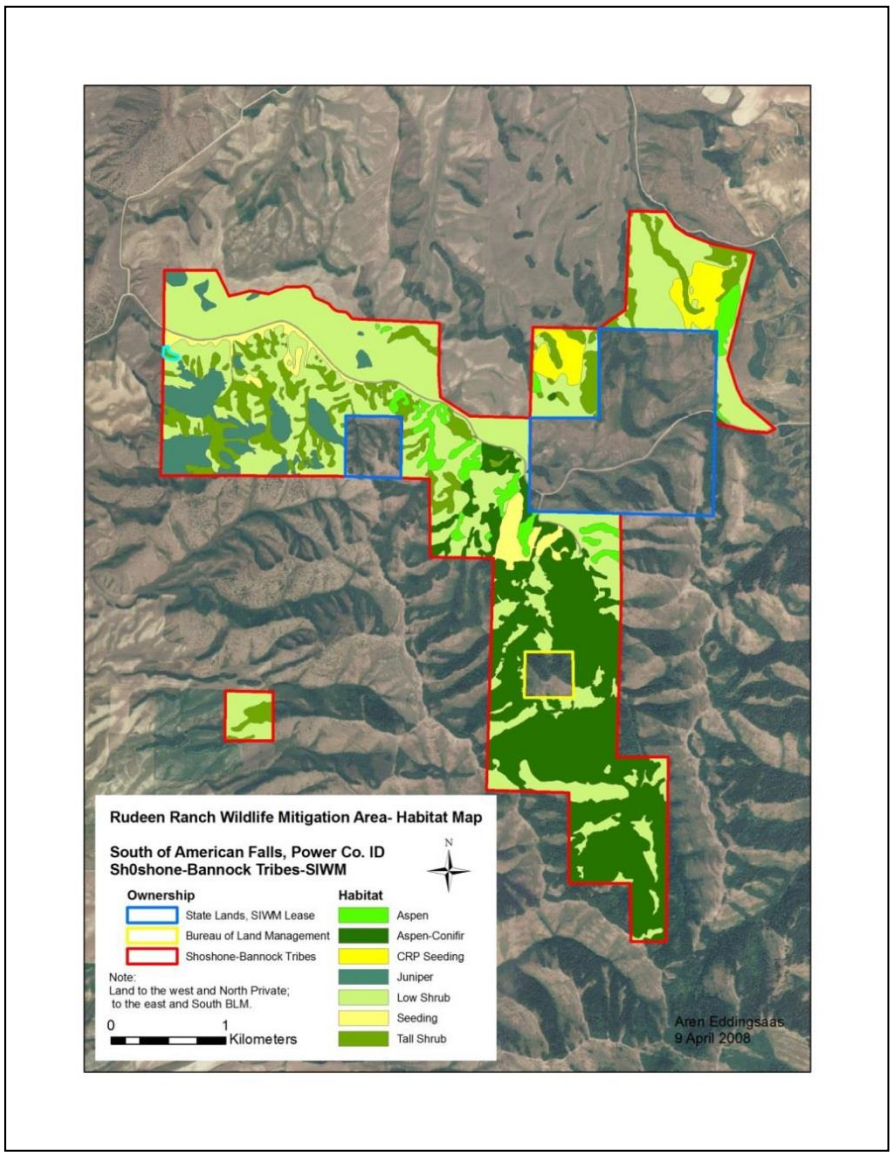
HSI" dropped below the baseline HSI at this project site). The projected "TY 10 HSI" column is the predicted HSI resulting from BPA funding O&M and enhancement activities over a 10-year period. The "Net HSI Gain" is the difference obtained by subtracting the "W/O project HSI" from the "TY 10 HSI." Credited HUs were derived by multiplying cover type acres by "Net HSI Gain."

Table 6 Habitat unit crediting spreadsheet example for Swanson Lakes Wildlife Area

PROJECT	PARCEL	ACRES	PURCHASE ENTITY/OWNER	COVER TYPE(S)	ACRES	HEP MODEL	TY 0 HSI (Baseline)	TY 0 HUs (Baseline)	W/O PROJECT HSI	W/O PROJECT HUs	TY 10 HSI (Projected)	NET HSI GAIN	CREDITED HUS
SWANSON LAKES			WDFW	Shrubsteppe	3,749	Sharp-tailed Grouse	0.20	749.80	0.10	374.90	0.30	0.20	749.80
						Mule Deer	0.40	1,499.60	0.30	1,124.70	0.40	0.10	374.90
						Sage Grouse	0.20	749.80	0.10	374.90	0.30	0.20	749.80
	Hatton/Tracy/Finch	4,905		Grassland	359	Sharp-tailed Grouse	0.20	71.80	0.10	35.90	0.40	0.30	107.70
	Nelson	320				Mule Deer	0.00	0.00	0.00	0.00	0.10	0.10	35.90
						Sage Grouse	0.10	35.90	0.00	0.00	0.20	0.20	71.80
				Agriculture	1,117	Sharp-tailed Grouse	0.00	0.00	0.00	0.00	0.40	0.40	446.80
						Mule Deer	0.00	0.00	0.00	0.00	0.10	0.10	111.70
						Sage Grouse	0.00	0.00	0.00	0.00	0.30	0.30	335.10
	WDFW Sub-total	5,225			5,225			3,106.90		1,910.40			2,983.50
	PARCEL	ACRES	PURCHASE ENTITY/OWNER	COVER TYPE(S)	ACRES	HEP MODEL	TY 0 HSI (Baseline)	TY 0 HUs (Baseline)	W/O PROJECT HSI	W/O PROJECT HUs	TY 16 HSI (Actual)	NET HSI GAIN/LOSS	TY 16 CREDITED HUS
			BPA	Shrubsteppe	14,047	Sharp-tailed Grouse	0.20	2,809.40	N/A	N/A	0.29	0.09	4,073.63
	Roloff/Welch	13,280				Mule Deer	0.40	5,618.80	N/A	N/A	0.46	0.06	6,461.62
	L&C Dynasty	40				Sage Grouse	0.20	2,809.40	N/A	N/A	0.45	0.25	6,321.15
	Baker	160		Grassland	793	Sharp-tailed Grouse	0.60	475.80	N/A	N/A	0.32	-0.28	253.76
	Koch	80				Mule Deer	0.00	0.00	N/A	N/A	0.38	0.38	301.34
	DNR Lease	1,280				Sage Grouse	0.40	317.20	N/A	N/A	0.20	-0.20	158.60
	BPA Sub-total	14,840			14,840			12,030.60					17,570.10
PROJECT TOTALS		20,065			20,065			15,137.50		1,910.40			20,553.60

Appendix I – Cover Type Description

In general, cover types are defined by the plant communities present on the site at a given time e.g., an area dominated by conifer trees is identified as the “conifer forest” cover type. Cover types generally do not remain static and change due to anthropogenic factors such as logging, stochastic events like flooding, and/or through plant succession. For example, a recent forest clear-cut will undergo several cover type changes. That is, when the trees are removed and deciduous shrubs become the dominant floristic feature, the cover type changes from conifer forest to deciduous shrub. Over time as conifer seedlings replace the deciduous shrub plant community as the dominant floristic feature, the cover type moves from deciduous shrub to “conifer forest regeneration”. This process continues until the conifer seedlings reach the “pole stage” at which time the cover type is re-designated “conifer forest”. An example cover type map is shown below.



In general, “cover types” were differentiated from “habitat types” and defined as follows: “cover types” describe present floristic and occasionally edaphic conditions e.g., “rockland cover type” while habitat type describes site potential or climax conditions. Hence, a logged conifer forest “habitat type” site could be devoid of trees, but the conifer forest “cover type” must have trees present.

Appendix J – Cover Type Pairing and Species Stacking Explanation

Cover type “pairing” was a concept developed in the early years of the Columbia River Wildlife Mitigation Program as a method to guide how Bonneville Power Administration (BPA) received credit for acquiring “out of kind/dissimilar” cover types[47]. BPA and the Northwest Power Conservation Council (NPCC) supported Columbia River wildlife mitigation project managers who wanted the ability to acquire high quality functional habitat and important high value “out of kind” cover types. In exchange, wildlife managers agreed to give BPA credit for all lands acquired with BPA wildlife mitigation funds, thus establishing the need to develop the cover type “pairing” concept[48]. Cover type “pairing” addressed the question, “how are out of kind/dissimilar cover types, HEP models, and habitat units credited against a given loss assessment”?

Pairing “in kind” loss assessment and project cover types is simply aligning “like” cover types and, in most cases, evaluating like cover types with the same number of HEP models (species stacking) and the same species listed in the credited loss assessment. For example, the project area grassland cover type would correspond to the loss assessment grassland cover type. If four HEP models were used to evaluate the grassland cover type in the loss assessment, then four HEP models would be used to evaluate the project area grassland cover type.

Similarly, “pairing” “out of kind” project cover types with loss assessment cover types involves “pairing” project cover types with loss assessment cover types comprised of “similar” habitat elements or structural conditions such as shrubs, trees, and snags. For example, the RHT “paired” the upland shrub cover type at Isqúulktpe with the riparian shrub cover type listed in the McNary Dam loss assessment matrix (Rasmussen and Wright 1989). The “similar” habitat element/structural condition shared by both cover types is the shrub component; specifically, deciduous shrubs.

[47] “Out of kind/dissimilar cover types” are cover types that are not identified as “losses” in a given loss assessment document.

[48] Standard HEP protocols (USFWS 1980) suggest that compensation acquisition and easement cover types should be identical (in-kind) to the cover types identified in the applicable loss assessment document unless another alternative is agreed upon by the involved parties. The mitigation program that BPA funds has by project selection choices of wildlife managers become an out-of-kind mitigation program, which the Council and BPA agree with, so the mitigation habitats are not identical to those identified in the loss assessments.

A secondary consideration is the HEP species models associated with the “paired” loss assessment cover type. If habitat elements/structure are similar between a project cover type and more than one loss assessment cover type, the RHT “paired” the project cover type with the loss assessment cover type that included the most HEP models having the best biological fit for project cover type conditions. Note that “pairing” dissimilar cover types does not automatically equate to total HEP model species substitution.

[i] The number of AAHUs may appear relatively small when compared to the total number of HUs calculated for a given TY analysis period. However, when the average number of HUs for each year within a given target year period is calculated the difference appears far less significant. For example, the average number of HUs per year in the TY 50 analysis period is 1,200 HUs (30,000 HUs ÷ 25 years = 1,200 HUs per year).