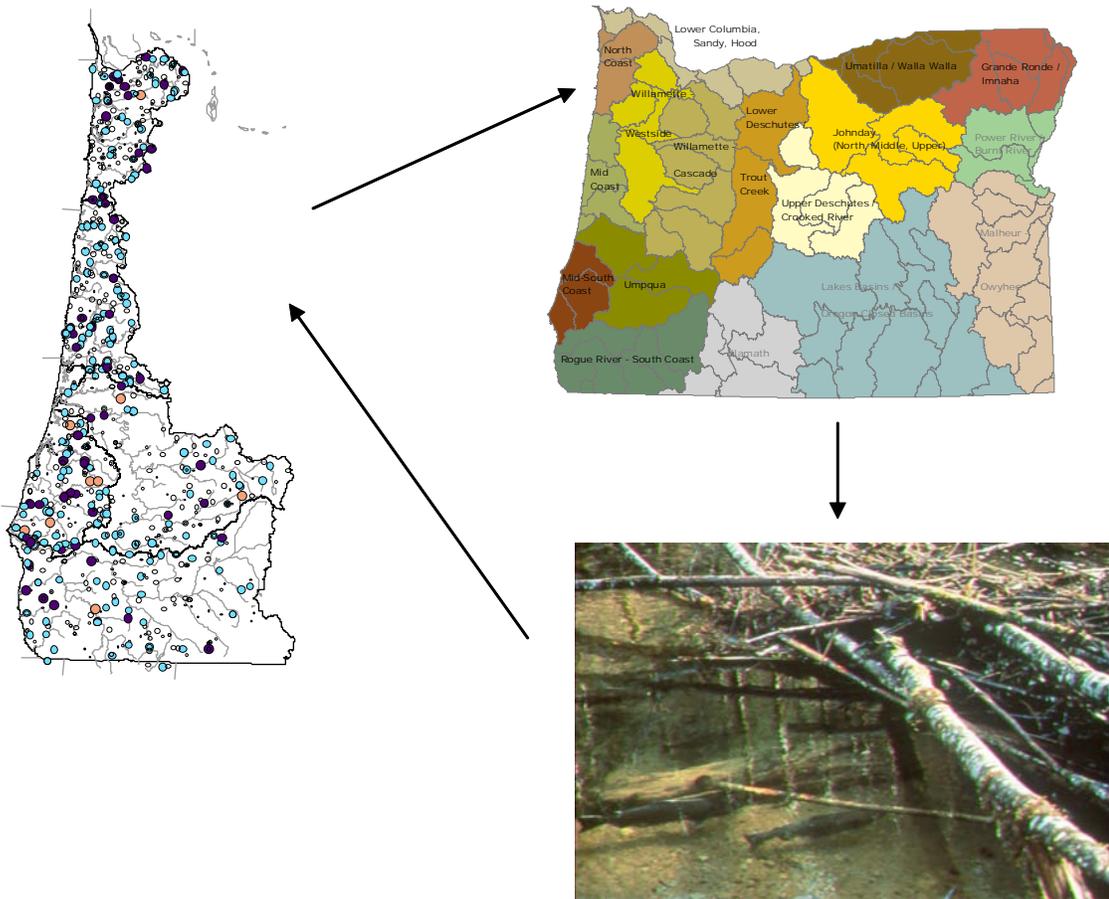


# Monitoring Strategy

## The Oregon Plan for Salmon and Watersheds



# Oregon Plan for Salmon and Watersheds Monitoring Strategy Overview

## *Desired Outcomes*

## *Framework Questions*

## *Implementation Strategies*

### **OUTCOME ONE**

**Assessment of watershed conditions and salmon populations**

What is the condition and capacity of aquatic habitat and watershed systems?

1. Assess status and trends of watershed conditions and salmon populations regionally.
2. Monitor habitat, water quality, biotic health, and salmon, in select watersheds.
3. Analyze habitat, water quality and population trends at the landscape scale.

### **OUTCOME TWO**

**Evaluation of Oregon Plan restoration actions, conservation measures, and management practices**

What is the benefit of Oregon Plan restoration projects, management practices, and conservation programs relative to adverse impacts and to natural ecosystem variability?

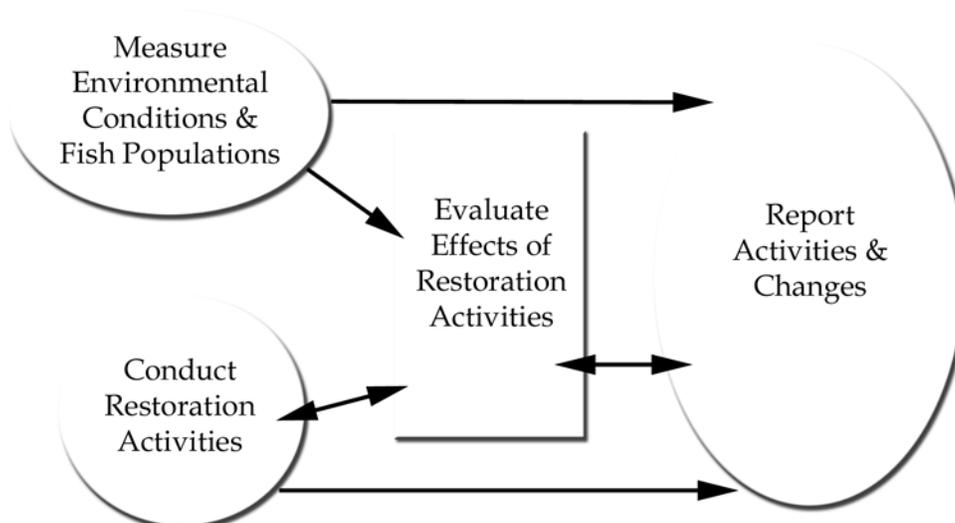
4. Document conservation and restoration projects, activities, and programs.
5. Evaluate effectiveness of restoration and management efforts locally.
6. Evaluate the combined effectiveness of restoration and conservation efforts in select watersheds.

### **OUTCOME THREE**

**Application of monitoring results for use by policymakers, agencies, and the public**

Does the Monitoring Program provide information and analysis for adaptive review of restoration actions, management practices, and Oregon Plan policies?

7. Standardize monitoring collection, management, and analysis efforts.
8. Coordinate and support public-private monitoring and partnerships.
9. Integrate information and produce data products and reports.



# Oregon Plan Monitoring Strategy

“The most pressing Oregon Plan Monitoring need is a long-term commitment for integration, not simply aggregation of studies. This integration and synthesis is necessary to understanding the linkages between various monitoring elements.”  
- Oregon Plan Monitoring Report, Independent Multidisciplinary Science Team, 1999

This Monitoring Strategy presents the conceptual framework the Oregon Watershed Enhancement Board (OWEB) and other agencies will use to evaluate the effectiveness of the Oregon Plan for Salmon and Watersheds (Oregon Plan). The objective of this Monitoring Strategy’s is to guide development and implementation of specific actions that will result in efficient, credible monitoring on the status of watershed conditions and salmon populations. Over time, monitoring will track responses to restoration activities within the context of overall trends in watershed condition and species status. The Monitoring Strategy outlined in this report will allow the people of Oregon to gauge the successes and shortcomings of statewide efforts to meet the challenges of salmon recovery and watershed enhancement.

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# *A Monitoring Strategy for the Oregon Plan for Salmon and Watersheds*

## **Overview**

Throughout its development, the Oregon Plan emphasized the importance of monitoring the status of environmental factors that affect watersheds and habitat quality as well as monitoring salmon population status and trends. Support for monitoring and reporting represents the State's commitment to evaluate the benefit of measures implemented to improve watershed conditions and salmon populations and to make changes in policies or programs when necessary. With Executive Order 99-01, the Governor expanded the original monitoring program developed for the 1997 Coastal Salmon Restoration Initiative (CSRI) to include all watersheds and salmon species and to the habitats of native fishes throughout the state. In 2001, the Oregon Legislature "institutionalized" the Oregon Plan by placing the state authorities in statute, including those directing OWEB to develop and implement a statewide monitoring program in coordination with Oregon Plan agencies and partners. This monitoring strategy seeks to meet these far-reaching commitments to effectively assess long term trends in watershed health and salmon recovery.

The Monitoring Strategy delineates the expectations and geographic scope of monitoring and describes the process for planning monitoring activities to meet program expectations. Rather than monitor "everything, everywhere", an integrated monitoring strategy needs to address fundamental information needs and match the level of inquiry to the

extent of population and habitat response at appropriate spatial and temporal scales. This can be achieved by employing a hierarchical structure of multiple spatial and temporal scales for data acquisition and analysis. Oregon's monitoring efforts are supported through collaborative work with NOAA Fisheries Northwest Fisheries Science Center, the Washington State Salmon Recovery Office, and the Columbia Basin Fish and Wildlife Authority. Working with these groups, Oregon is contributing to a consensus that supports monitoring programs throughout the region based on a consistent conceptual framework, compatible methods, and efficient implementation.



## *Strategic Framework for Monitoring*

The Monitoring Strategy provides a framework to evaluate existing monitoring efforts and to expand efforts to assess the effectiveness of Oregon Plan and OWEB activities. The Framework outlines three Desired Outcomes, identifies Framework Questions, and describes nine Implementation Strategies to achieve these objectives.

- **Desired Outcomes** establish the overall scope and expectations for the monitoring program. The outcomes are based on the need for credible information to inform policy and program decisions for the Oregon Plan and to evaluate the effectiveness of program implementation. Outcomes apply to each spatial scale monitored and to the reporting and analysis of results. Integration and realization of the outcomes will proceed at different rates in different regions of the State.
- **Framework Questions** clarify the intent and identify the main information needs for achieving an Outcome. Questions help focus the purpose of each Strategy and help connect specific monitoring activities to information needed for management and policy decisions. Framework Questions are further developed into a series of Key Questions for each of the Outcomes.
- **Implementation Strategies** are the general approaches necessary to accomplish the Outcomes. Strategies establish strategic monitoring subject areas and provide guidance for developing work plans. Ultimately, monitoring Strategies must address issues of the distribution of sampling effort, the protocols and methods used, and the way information is managed.
- **Framework Questions** clarify the intent and identify the main information needs for achieving an Outcome. Questions help focus the purpose of each Strategy and help connect specific monitoring activities to information needed for management and policy decisions. Framework Questions are further developed into a series of Key Questions for each of the Outcomes.



## DESIRED OUTCOME ONE

Framework Question: What is the Condition and Capacity of aquatic habitat and watershed systems?

**An adequate answer to the Framework Question will require addressing the following component questions.**

1. What is the condition of salmon populations at the ESU, Sub-Basin and watershed scale? What are the populations that must be monitored? What is the status and trend in population abundance, distribution and productivity? How are populations utilizing available habitat? Are the populations exhibiting sufficient diversity and survival rates?
2. What is the status and what are the trends in freshwater aquatic habitats, water quality, and stream flow that affect native salmon?
3. What are the critical factors that limit watershed function and salmon productivity? Can monitoring detect significant trends with adequate certainty?
4. What constitutes detectable and meaningful changes in habitat condition and populations?

In order to achieve this Desired Outcome, we need to identify appropriate indicators of population and watershed conditions, the appropriate scales of inquiry, and the appropriate level of precision needed.

Examples of Data Types & Information Needed

- Watersheds and Landscapes: land use, land cover, site potential, ecoregion characteristics
- Salmon: abundance, geographic distribution, life history, diversity, and productivity
- Biotic Condition: invertebrate communities, riparian vegetation, pollutants
- Habitat Condition: channel morphology, habitat assessments, hydrology, fish passage.
- Water Quality and Quantity: stream temperature, water chemistry, stream flows

# ASSESSMENT OF WATERSHED CONDITIONS & SALMON POPULATIONS

Investments in watershed health are more effective when based on an understanding of the status of salmon populations and habitat conditions throughout the state. The purpose of monitoring is to ensure that we know the current status and recent trends in condition of Oregon's watersheds and salmon populations. Documenting and understanding the causes for these trends is a prerequisite to meeting other Oregon Plan goals. Developing baseline data provides the necessary foundation to evaluate the effectiveness of restoration efforts and establish recovery goals

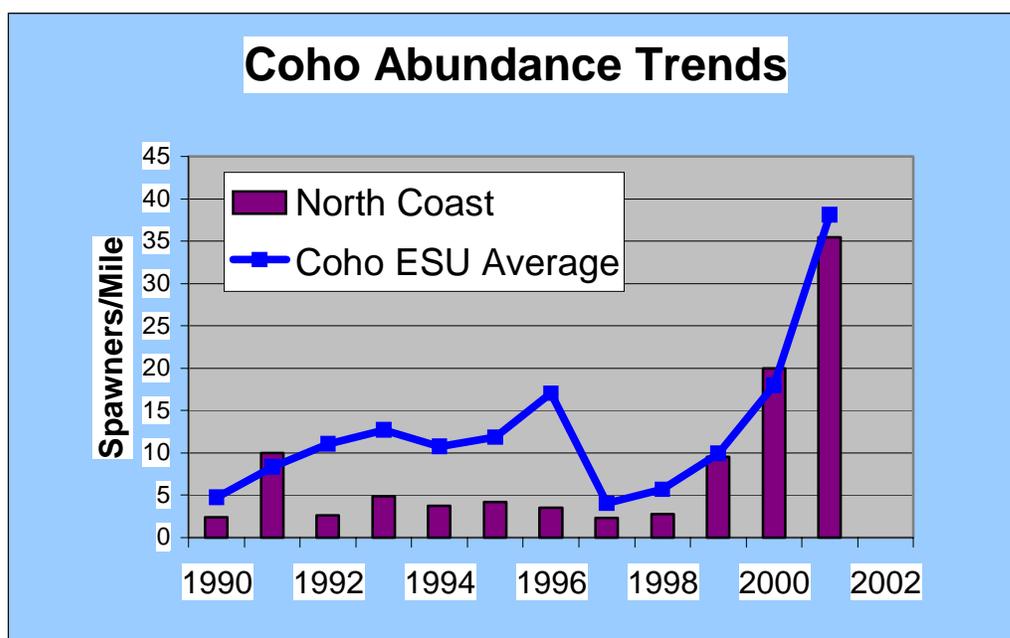
Assessments of watershed conditions and salmon populations will be structured to be both comprehensive and efficient. Comprehensive assessments ensure the results are understood in the context of complex interactions between populations and habitat. These interactions vary by species and location, and are also influenced by external factors such as ocean conditions and climate. Efficient assessments strive to avoid duplicative efforts and seek to maximize existing monitoring work around the state.

## Outcome One Implementation Strategies

**Strategy 1:** Assess general status and trend for physical habitat, salmon populations, and biotic conditions in Oregon sub-basins and ESU regions at appropriate scales.

**Strategy 2:** Monitor habitat capacity, salmon survival and productivity, and biotic processes in selected watersheds within each sub-basin or ESU region.

**Strategy 3:** Analyze habitat trends and salmon populations in the context of local or regional effects, landscape influences, and ocean productivity.



## **Outcome One: Strategy 1**

### **Assess general status and trend for physical habitat, salmon populations, and biotic conditions in Oregon sub-basins and ESU regions at appropriate scales.**

#### **What is it?**

Assessing status and trends, based on a well designed monitoring effort can provide reliable data for assessing the state of the health of Oregon's watersheds and salmon. The information it provides can then be used to regularly report indicators of watershed health and salmon population status. Status and trend monitoring of salmon populations, water quality, stream and riparian habitat, and condition of watersheds, estuaries, and near-ocean environments over time requires an environmental monitoring program that has statistical rigor and comparability both year-to-year and place-to-place. Data must be gathered using a rigorous, unbiased sampling design that includes statistical analysis to detect trends with a high degree of scientific confidence. The sampling scheme must provide this information on the status and trends in key indicators of water quality, habitat condition, and salmonid populations at appropriate management and ecological scales.

#### **Why is it important?**

Monitoring can provide basic data on the number, spatial distribution, and productivity of salmonid populations and environmental conditions that are critically needed to conduct recovery planning and to describe restoration goals. To evaluate progress in achieving Oregon Plan goals and to develop meaningful population recovery goals it is important to collect and use data that can detect trends with known statistical confidence limits.

Comprehensive environmental monitoring, comprised of landscape, habitat, water chemistry, and population assessments, is essential for evaluating the effectiveness of restoration actions at multiple spatial scales.

Implementation of this strategy will provide important information about regional-level environmental conditions and salmon population characteristics that allow us to understand trends in individual watersheds and the appropriate context for interpreting restoration project effectiveness.

#### **Where are we and where are we going?**

Since 1997, Oregon Plan monitoring in coastal watersheds has provided comprehensive annual assessments of coho salmon populations, stream and riparian habitat, water quality, and biotic condition. Based on the Oregon Plan statistical sampling design, one hundred coho salmon spawning surveys, 50 juvenile surveys, 50 habitat surveys and biotic assessments are completed annually in five coastal monitoring areas. The data allows scientists to determine independent trends in each of these areas for salmon populations and environmental conditions.

We have demonstrated the tools we need to expand the monitoring to ESU's and regions statewide. Comprehensive information on the number of spawning adults, spatial patterns of adult and juvenile abundance, and the productivity of populations is not uniformly available at this time.

Building upon the successful implementation of the coastal monitoring program, OWEB and the Oregon Plan Monitoring Team are coordinating with federal agencies and the states of Washington and California in an effort to implement compatible status and trend monitoring throughout the Pacific Northwest.

## **Outcome 1: Strategy 2**

### **Monitor habitat capacity, salmon survival and productivity, and biotic processes in select watersheds within each sub-basin or ESU region.**

Focused assessments are needed to monitor the functional relationships between habitat and populations that are mediated by regional and local management factors and landscape conditions.

#### **What is it?**

Specific studies that test hypotheses on the relationship between salmon populations and environmental conditions will link environmental trend data to salmon population data at the watershed scale. Understanding the functional relationships between habitat and populations requires more intensive monitoring at finer spatial scales than general status and trend monitoring. Linking salmonid population indicators with watershed indicators is the first step in the process to determine the effectiveness of restoration activities (Outcome 2). Implementation of this strategy will provide new information on the status and trends of key watershed indicators and must be complimentary to monitoring of population and environmental trends.

#### **Why is it important?**

Implementation of this sampling strategy builds upon the general assessments of watershed conditions conducted by watershed councils and federal agencies. The general assessments can be utilized to help establish meaningful watershed recovery goals. More detailed assessments and monitoring in select watersheds can provide the information needed to track progress toward those goals. Tracking of environmental conditions using key watershed indicators yields a better understanding of variation in indicator performance over a range of conditions. This information will support more robust analysis of management impacts.

Knowing, with confidence, the status of key watershed indicators satisfies elements of the Endangered Species Act that require evidence of sufficient habitat capacity to support and sustain populations before a species can be removed from threatened or endangered status. This knowledge is difficult to attain and the associated level of confidence needed to meet ESA requirements is uncertain. However, this strategy will allow reasonable determinations to be made by providing data from a representative sample of watersheds from around the state.

#### **Where are we and where are we going?**

A general assessment of watershed conditions and the ability of habitat to sustain coho salmon and steelhead populations was conducted during the development of the Oregon Plan. Since that time, there have been initial summaries and analyses of status and trends data for both habitat and salmon populations but no analysis of functional relationships using this data at the watershed scale.

Watershed condition monitoring can be based on current ODFW salmon life-cycle monitoring in seven coastal Oregon watersheds. At these sites, ODFW is comprehensively monitoring juvenile and adult salmon as they enter, rear, and leave the watersheds creating the potential to evaluate freshwater survival rates relative to habitat condition and independent of ocean influences. In some areas, watershed councils are also conducting intensive monitoring of water quality, habitat conditions, and other factors using standardized protocols. Collectively, these various monitoring efforts may allow eventual integration of data sets.

A sample of small watersheds (USGS 5th or 6th field Hydrologic Unit Code) within each Sub-Basin or salmon ESU will be selected. In coastal Oregon, assessment of estuary and near ocean environments shall be incorporated into the monitoring design. Monitoring will focus on the same indicators as Strategy One, but will occur at more sites and data will be collected more frequently. This more intensive degree of monitoring will be combined with ongoing assessments of conditions within each watershed. Intensive monitoring at this spatial scale creates the opportunity for systematic evaluation of restoration projects and management practices.

## **Outcome 1: Strategy 3**

### **Analyze habitat trends and salmon populations in the context of local or regional effects, landscape influences, and ocean productivity.**

*Monitoring will provide the ability to account for the influence of local environmental conditions, natural disturbance, and productivity cycles while evaluating management effects.*

#### **What is it?**

The monitoring and assessment actions that support strategies one and two will be incomplete unless they contribute to an understanding of natural resource management that incorporates a broader range of environmental information across spatial scales. This strategy seeks to implement an applied interdisciplinary approach that will incorporate elements of landscape and community ecology, oceanography, climatology, and social science with existing Oregon Plan expertise to develop integrated analyses of the relationships between environmental variables and salmon populations. This analysis will support modeling that tests system responses to different management scenarios. The products of this strategy will include maps and investigative reports that compare salmon productivity at multiple spatial and temporal scales.

#### **Why is it important?**

Understanding the relationships between environmental changes and salmon populations is necessary to develop confidence in restoration strategies and to adjust strategies accordingly. Testing hypotheses and analyzing correlations are critical to further our understanding of salmon population trends within the context of natural and anthropogenic changes in environmental conditions, particularly at various spatial scales. Data of known statistical rigor can improve public understanding of salmon-environment relationships when presented in comprehensible

reports. Information resulting from analyses can provide local conservation groups with meaningful guidance for priority and action planning, can help direct OWEB investments, and can contribute to the development of realistic habitat restoration and recovery goals tailored to regional conditions. Through analysis, data becomes practical information for use in policy and program decision-making processes.



### **Where are we and where are we going?**

Currently there are no Oregon Plan efforts specifically targeted for this strategy. However, there are several decision-support systems in existence that OWEB can use as models for this work and that also constitute potential cooperators. The Coastal Landscape Analysis and Modeling Study (CLAMS) project (Oregon State University's College of Forestry and the Pacific Northwest Forest and Range Experiment Station) has applied remote sensing to reconstruct historical vegetation patterns and to model projected changes in coastal watersheds. The Willamette Valley Alternative Futures Project (EPA, University of Oregon, and Oregon State University) has applied a variety of methods to assess the impact of different development scenarios on natural resource values. Another program, the Freshwater Habitat (Salmon/Native) Fish Project at the Corvallis EPA Laboratory, is initiating a research effort that will incorporate Oregon Plan coastal monitoring information with remote sensing and vegetation assessments to improve understanding of land use impacts on watershed conditions.

Various Oregon agencies have staff with responsibilities to evaluate environmental data, but this tends to be on a project-by-project basis. The DEQ analyzes water quality data, ODF&W analyzes fisheries data, ODA and DSL analyze compliance data, etc. Even for the Oregon Coast, the area with the most extensive data available, no inclusive analysis of Oregon Plan monitoring data has yet been conducted. And, no single agency or program currently has the responsibility to evaluate the interactions between projects and programs or to integrate data sets. A clear assignment of responsibility and cooperative evaluation of data gathered is critical for any effective monitoring effort.

In January, 2003 the OWEB Board addressed this issue by allocating funds for an independent assessment and integration of the results from coastal monitoring efforts. Each agency, working through the Oregon Plan Monitoring Team, has agreed to share data, provide interpretation and analysis, and contribute to a Monitoring Synthesis report to be completed in October, 2003.



## DESIRED OUTCOME TWO

Framework Question: What is the benefit of Oregon Plan restoration projects, management practices, and conservation programs to watershed health and salmon populations?

**An adequate answer to the Framework Question will require addressing the following component questions.**

1. What changes are occurring in watersheds that improve stream habitat quality? What are the number, type, and location of restoration actions?
2. What are the management practices and programs that enhance or restore watershed functions and salmon populations? Were and how have these practices and programs been implemented?
3. What habitat changes and biotic responses result from these projects, practices, and programs? What is the relationship between compliance with land management policies, guidelines, and rules and the status of watersheds, freshwater habitat, water quality, and native salmon?
4. What are the impacts of land use and land management practices on watershed conditions? What is the extent and impact of unintentional or illegal negative impacts on watershed conditions and salmon? What are the trends in large scale and near shore

### Examples of Data Types & Information Needed:

- Instream, riparian, road, and upland project type, number and location.
- Habitat and biotic indicators of project effectiveness.
- Compliance rates and effectiveness measures of policy guidelines and rules (i.e. Forest Practices Act)
- Hatchery releases, harvest rates
- Component and cumulative analysis of restoration actions and management program benefits
- Broad Scale Indicators :
  - land use/land cover
  - riparian condition
  - wetland change
  - ocean productivity cycles

# **PROVIDE AN EVALUATION OF OREGON PLAN RESTORATION ACTIONS, CONSERVATION MEASURES, AND MANAGEMENT PRACTICES**

Oregonians are making significant investments in watershed restoration and other actions that support salmon recovery. OWEB has a responsibility to evaluate the effectiveness of the public's investments intended to improve the health of watersheds. This desired outcome seeks to provide Oregonians with a clearer understanding of the effectiveness of restoration activities, management actions, and the cumulative efforts being taken to conserve specific resource values.

A comprehensive accounting of all types of restoration activities is needed to evaluate their component and cumulative effectiveness. A multi-level effort to assess the effect of restoration actions and conservation policies is necessary to evaluate the impact of the Oregon Plan. Evaluation of project level effects of restoration activities can be based on a stratified sample of all known projects. The cumulative effect of restoration efforts can be assessed in a number of "Intensively Monitored Watersheds", areas where we could comprehensively monitor habitat and populations to see if management actions and restoration projects produce the desired change in conditions and status. The number and distribution of Validation Watersheds will need to be developed to get a statewide, ecoregion and/or basin perspective.

## **Outcome Two Implementation Strategies**

OWEB and the Oregon Plan Monitoring Program will work to achieve Outcome Two by implementing three guiding strategies.

**Strategy 4:** Document implementation of restoration projects, conservation activities and agency programs

**Strategy 5:** Evaluate the local effectiveness of restoration efforts and management practices by monitoring representative samples of specific project, activity, and program types.

**Strategy 6:** Evaluate the combined effectiveness of restoration efforts and conservation measures by monitoring habitat and population response in a structured sample of watersheds.

## **Outcome 2: Strategy 4**

### **Document implementation of restoration projects, conservation activities and agency programs.**

*Monitoring will help provide accountability for restoration efforts through documentation of project and program implementation, appropriateness, and completeness.*

#### **What is it?**

This strategy calls for a comprehensive accounting of all activities relevant to watershed enhancement. Information about the type, location, and purpose of restoration activities needs to be collected, organized, and made available in a way that allows for querying of data and the creation of standardized reports and map products. Current inventories can be built upon to include all Oregon Plan restoration activities. This strategy involves more than maintaining a database of projects and activities funded by OWEB grants. Through cooperation with landowners and industry organizations, federal agencies that conduct or fund restoration, and volunteer groups, a more comprehensive documentation of restoration efforts will provide greater accountability for restoration efforts throughout the state.

#### **Why is it important?**

It is impossible to relate restoration investments to change in watershed function or salmon population change without knowing what restoration activities have occurred or where and when they were conducted. Improved coordination is necessary among all Oregon Plan partners to provide accurate and comprehensive reporting. This work is not only essential to achieving Strategy 4; it also satisfies public demands for increased agency coordination and enhanced accountability. The ability of OWEB to accurately report on the status and scope of projects beyond those it funds will significantly improve public accountability for the Oregon Plan.

Maintaining a database of projects is essential to monitoring efficiency. Knowledge of the full extent of project types and locations within a region creates opportunity for statistical sampling of projects for effectiveness monitoring. If sufficient information is available in the database, relatively few projects need be intensively evaluated, and the results of effectiveness monitoring can be used to characterize the impact of the projects collectively.

#### **Where are we and where are we going?**

Since 1995, OWEB has maintained a database of restoration activities and has produced annual reports that track the types of investments made in watershed restoration. The database includes those projects funded directly by OWEB and those reported voluntarily. It has not included information about some federal conservation activities or restoration programs nor does it capture many agricultural conservation activities. OWEB has recently been working with federal agencies to either include information about their restoration efforts or to create links to their databases. More sophisticated interagency coordination will be invaluable to achieving the goal of comprehensive and reliable project documentation.

## **Outcome 2: Strategy 5**

### **Evaluate the local effectiveness of restoration efforts and management practices by monitoring representative samples of specific project, activity, and program types.**

*Monitoring at the project, activity, and program level will clarify the cause and effect relationships between a variety of management actions and the response in habitat condition and/or salmon populations.*

#### **What is it?**

Restoration projects are a form of applied field experiment. Evaluation of these experiments is a critical building block for understanding overall program effectiveness. As experiments, restoration projects are based on a presumed understanding of the relationships between environmental conditions and salmon survival or productivity. Many restoration actions are developed to address the proximal causes of salmon decline. Evaluation of these field experiments is necessary both to test the presumptions involved in the design of projects and to identify design improvements.

In addition to evaluating restoration projects, this strategy seeks to understand the efficacy of management practices and compliance with protective policies and rules. Management and compliance practices include efforts like implementation of the Forest Practices Act, Agricultural Water Quality Plans, stream bank fill-and-removal regulations, and other protective measures. Strategy 5 aims to increase knowledge about how well the rules and practice guidelines meet their intent and how landowners and land managers interpret and follow protective regulations.

#### **Why is it important?**

It is imperative to assess whether actions taken to improve watershed conditions are having the desired effects. If they are not, further implementation and investment is unwarranted or must be redirected. The ability to understand whether a proposed restoration strategy is appropriate for addressing a given watershed condition is integral to creating a working information base for watershed councils, soil and water conservation districts, other conservation groups, and funding organizations.

#### **Where are we and where are we going?**

No comprehensive program to evaluate the variety of restoration activities currently exists, although some monitoring occurs among agencies and others around the state. For example, OWEB requires grant recipients to document the implementation of restoration projects; has helped fund the evaluation of large wood placement projects designed by ODFW and of fish passage improvements implemented by ODOT; and has completed an initial effort to evaluate riparian restoration in conjunction with the Conservation Reserve Enhancement Program. Some watershed councils and local conservation districts also monitor environmental changes as a result of restoration projects. And the Oregon Department of Forestry systematically monitors Forest Practices Act program implementation, compliance, and effectiveness. Their evaluation efforts serve as a model for other programmatic assessment methods.

This strategy, once implemented, will bring Oregon agencies together to conduct the first comprehensive evaluation of the full range of watershed restoration activities.

## **Outcome 2: Strategy 6**

### **Evaluate the combined effectiveness of restoration efforts and management practices by monitoring habitat and population response in a structured sample of watersheds.**

*Monitoring at the watershed scale will provide information useful to understand the relative importance of restoration efforts in the context of all factors that affect habitat and populations and thus support both cost-benefit and risk analysis.*

#### **What is it?**

Effectiveness monitoring conducted at the watershed scale will provide the most complete evaluation of restoration efforts. Evaluation at this scale entails systematic monitoring to assess the cumulative effect of all restoration activities in the context of other management and natural influences on watershed conditions and salmon populations. Beyond accounting for individual project benefits, monitoring is needed to distinguish changes resulting from management actions that are representative of larger geographic areas. This strategy calls for the establishment of a network of “Intensively Monitored Watersheds”, small watersheds where a full accounting of factors that influence habitat and salmon populations can be combined with comprehensive monitoring of cause and effect relationships and trends. This level of monitoring is closely linked to research studies of ecosystem function at the watershed scale.

#### **Why is it important?**

Simply put, monitoring at the watershed scale is the most appropriate way to determine whether or not the Oregon Plan is working. Monitoring at the project scale is a critical, but incomplete, piece of the overall strategy because project scale monitoring cannot track system responses. Monitoring at the watershed scale tracks the interaction between restoration efforts, factors that limit salmon productivity, and the response of salmon populations.

Ensuring public funds dedicated to watershed restoration are effectively used requires that there be a means to evaluate the combined effectiveness of restoration strategies. OWEB needs feedback on what restoration actions have the most immediate benefit to watershed conditions and salmon versus what actions have effects over longer time periods. The linkage between individual restoration actions and indicators of watershed health (water temperature, riparian condition, salmon abundance, etc.) response may be direct, indirect or complex. Evaluating the relationship between multiple restoration actions and land use changes that degrade habitat and the response on aquatic systems is very challenging but worthwhile. It can provide information deemed necessary to establish priorities and on the effectiveness of particular programs and policies.

#### **Where are we and where are we going?**

Experience gained from recent collaborative work and regionally focused efforts provide some momentum but overall progress in this area has been limited. Identifying the most appropriate methods for monitoring at this scale has been a challenge. The state has cooperated with the federal government in their attempt to monitor the effectiveness of the Northwest Forest Plan at similar geographic scales.

For the Oregon Plan, the “Intensively Monitored Watersheds” concept has the potential to contribute to both state and federal monitoring needs. This monitoring effort could combine protocols for evaluating salmon productivity, such as ODFW’s Life-Cycle Monitoring Sites, with federal techniques for conducting integrated watershed characterizations. OWEB is working with partners from federal land management agencies, NOAA Fisheries, and the Power Planning Council to support monitoring at this level. Oregon is also cooperating with Washington State’s monitoring effort to implement a cooperative and coordinated approach to Intensively Monitored Watersheds. This work, will be designed to integrate monitoring across spatial and temporal scales so that information will be useful beyond the specific project for which it was collected.

## Oregon Plan Reporting Basins



## DESIRED OUTCOME THREE

Framework Question: Does the Monitoring Program provide information and analysis for adaptive review of restoration actions, management practices, and Oregon Plan policies?

An adequate answer to the Framework Question will require addressing the following component questions.

1. Is there sufficient support and guidance for local efforts so that their monitoring evaluates restoration effectiveness and contributes to broader scale assessments? What is the effectiveness of investments intended to restore watershed conditions and native salmon?
2. Does the Oregon Plan coordinate effectively with other state federal, and tribal assessment and monitoring activities? What are the different roles and responsibilities of each entity? How can monitoring meet multiple program objectives and mandates?
3. What is the level of public understanding and acceptance of and participation in the Oregon Plan? Is monitoring information used effectively in information and outreach components of the Oregon Plan? Is there a relationship between monitoring information and changes in behavior or attitudes.
4. Is monitoring information used adaptively to guide actions and to meet Oregon Plan reporting requirements? What are the Oregon Plan processes and mechanisms designed to link information to policy?
5. Does the monitoring help evaluate progress toward environmental benchmarks and salmon recovery goals? Is there a clear relationship between the monitoring and future State of the Environment Reports, Oregon Progress Board Benchmarks, and regional recovery goals?

In order to achieve this Desired Outcome, we need to identify appropriate indicators of population and watershed conditions, the appropriate scales of inquiry, and the appropriate level of precision needed.

Examples of Data Types & Information Needed:

- Comprehensive documentation of who is monitoring what and where, and what methods are used. (agencies, Tribes, watershed councils, SWCD's, landowners, other organizations)
- Assessment of natural resource data management throughout the Pacific Northwest.
- Whole stream or watershed surveys, synoptic assessments of salmon populations and water quality, and other OWEB funded and cooperative monitoring.
- Complimentary Program Data:
  - NW Forest Plan Aquatic and Riparian Monitoring
  - Clean Water Act - DEQ TMDL implementation
  - Ag Water Quality 1010 Plans
- Integrated assessments of system responses to Oregon Plan efforts.

# **PROVIDE USEFUL INFORMATION TO POLICYMAKERS, AGENCIES, AND THE PUBLIC THROUGH EFFICIENT AND COORDINATED MONITORING**

Oregon is making unprecedented efforts to involve agencies and the public in watershed restoration and species recovery.

New efforts to measure the changes in Oregon's environment are necessary to provide information to assist policy makers and enhance public understanding. This Outcome aims to extend support and coordination for monitoring beyond public agencies to include all potential partners (e.g., tribes, landowners, watershed councils, city and county government, local citizens). OWEB will not be the center of all monitoring, but rather one of several coordinated "hubs" of effort and information that need to work together.

The tools for this coordination include monitoring protocols and methods, digital libraries, training, quality control, and guidance for sampling designs and statistical analysis. Data and information will need to be systematically managed to assure its utility and application when adaptive changes are necessary. This Outcome includes work to gauge how well information is communicated and how effectively it is used.

## **Outcome Three Implementation Strategies**

OWEB and the Oregon Plan Monitoring Program will work to achieve Outcome Three by implementing three guiding strategies.

**Strategy 7:** Standardize monitoring designs, assessment protocols, and methods to manage and analyze data.

**Strategy 8:** Coordinate and support interagency monitoring programs and public-private monitoring partnerships.

**Strategy 9:** Integrate information from multiple sources to produce data products and reports that assess restoration efforts and evaluate progress towards recovery goals.

## **Outcome 3: Strategy 7**

### **Standardize monitoring designs, assessment protocols, and methods to manage and analyze data**

*Monitoring data will be collected and reported in ways that are meaningful at the watershed, basin, and statewide scales and create the ability to generalize from the results and to ensure compatibility among users.*

#### **What is it?**

Monitoring designs and assessment protocols describe the methods used to select the number and location of sample sites as well as the data collection methods for each type of monitoring task. This strategy aims to create the ability to compare information from watershed to watershed, region to region by standardizing field protocols and implementing shared monitoring designs for data compilation. While every detail of monitoring protocols need not be identical, it is particularly important that the methods used by different agencies are documented and managed to insure compatibility of results. Once the data is collected, standardized methods for storing and reporting data are essential for making comparisons to historic data and to ensure compatibility between data sets.

#### **Why is it important?**

At its core, the Oregon Plan relies upon the participation of informed individuals and partner organizations to make local decisions and take action towards the recovery of salmon populations and watershed functions. Guidance, such as monitoring protocols and templates for plans, provides some assurance that all monitoring activities - whether they are conducted by an agency, landowner, or council - are consistent and complimentary. Open access to essential data, such as the distribution of each salmonid species and location of migration barriers within a watershed, is critical for restoration planning at the local level as envisioned by the Oregon Plan.

Only by gathering useful data can analyses be conducted to test the success of restoration activities. The collection and testing of data can reveal whether there are differences between treated and untreated areas or between areas with different treatments. Meaningful results are highly dependent upon rigorous and standardized protocols and methods. New programs should be compatible with past efforts to ensure continuity of long term data sets. At the same time, compatibility among all ongoing efforts, regardless of who is collecting the data, is essential for overall program efficiency. All sampling should be evaluated to determine the accuracy and precision of each protocol as well as for the ability to differentiate trend detection from other sources of variability. Common monitoring designs are also important to ensure that the data gathered is representative for a meaningful geographic area.

#### **Where are we and where are we going?**

Significant progress has already been made as a number of protocols have been created and are available from OWEB. The Oregon Plan Monitoring Team and OWEB have already produced common protocols for water quality monitoring and watershed assessment while protocols for assessing riparian conditions will be completed in 2002. OWEB also has funded DEQ to provide equipment and training to increase local monitoring capacity and invested in the development of a common digital data format for streams (hydrography) and fish distribution.

A common monitoring approach, the EMAP based random sampling frame, has been adopted for the Columbia Plateau to match the coastal sampling conducted to date. OWEB staff will work directly with the Oregon Geographic Information Center to develop data standards and other mechanisms that promote sharing of natural resource information. Beyond design and protocol issues, a certain level of standardization must occur to coordinate data collection and information sharing. OWEB is supporting the creation of data reporting templates for local monitoring actions. Also, the Oregon Plan Information System Strategy, being developed by OWEB, includes specific recommendations for the creation of web-based data storage, access, and analysis tools. Planned for implementation beginning in summer 2003, the information strategy provides a mechanism for sharing information among councils, agencies, and other potential partners.

## **Outcome 3: Strategy 8**

### **Coordinate and support interagency monitoring programs and public-private monitoring partnerships**

*Oregon Plan monitoring will be a cooperative, inclusive, and efficient process that meets the needs of multiple partners.*

#### **What is it?**

This strategy directs effort to create formal and informal partnerships among groups and individuals throughout the region to improve monitoring programs.

The complexity and scope of monitoring needed to assess watershed restoration and species recovery is too great to be the responsibility of any single organization or agency. Successful Oregon Plan monitoring will rely upon developing cooperative agreements among state agencies, by forming alliances with Federal and Tribal programs, maintaining strong connections to research institutions, and by supporting public involvement in monitoring at the watershed scale. OWEB will continue to provide technical guidance and funding support to local groups and individuals as active and informed participants in Oregon Plan monitoring.

All Oregon Plan partners would benefit from the development of collective approaches to problem identification, prioritization, and action plans. Local partners, in particular, such as watershed councils and conservation districts, should have the opportunity to learn from the experience of other councils and colleagues from around the state.

#### **Why is it important?**

The founding principle of the Oregon Plan is the recognition that broad public and agency participation in coordinated and collaborative restoration efforts are essential to species recovery. Coordination among interagency and interdisciplinary planning teams was required to produce the goals and to implement the restoration actions that make up the Oregon Plan. OWEB's role has been to ensure that watershed councils, soil and water conservation districts, landowner groups, and private individuals are connected to the Plan.

The Monitoring Program is part of this process and improved mechanisms for coordination, sharing, and support requires continual development and refinement.



### **Where are we and where are we going?**

Comprehensive, coordinated, interagency monitoring has been instituted for the Oregon Coast. Statewide, OWEB provides funding, training, and support for watershed assessments and project effectiveness monitoring conducted by local watershed organizations. These local programs need to be maintained and enhanced, but also reviewed carefully to ensure that they are strategically targeted to provide the best program support possible.

OWEB and other Oregon agencies are working with NOAA Fisheries, the Northwest Power Planning Council, and the Bonneville Power Administration to coordinate monitoring efforts in the Columbia Basin. OWEB has worked directly with the State of Washington to develop a common monitoring approach so that consistent information on transboundary salmon populations can be collected and shared. This same effort is just starting with the State of California. These ongoing efforts to ensure coordinated scientific monitoring and efficient use of funding resources requires state-federal cooperation at the highest policy levels as well as local understanding and support.

Ongoing coordination of monitoring issues occurs at regular meetings of the Oregon Plan Monitoring Team. The Monitoring Team is chartered and supported by representatives from each of the state natural resource agencies and includes participants from federal agencies (USFS, BLM, NMFS, USFWS, EPA, NRCS), Tribes (Siletz), OSU Extension, and other scientists. As the monitoring effort expands to other parts of the state, participation from additional Tribal governments, local natural resource managers, and watershed councils will be sought for the Monitoring Team.

Maintaining links among existing programs, and expanding the Oregon Plan to new partners, also entails continued efforts to evaluate the efficiency of these monitoring efforts. OWEB will support ongoing evaluation of monitoring to ensure that implementation of strategic and coordinated efforts that support the mission of the Oregon Plan.



## **Outcome 3: Strategy 9**

### **Integrate information from multiple sources to produce data products and reports that assess restoration efforts and evaluate progress towards recovery goals.**

*Information obtained from Oregon Plan monitoring efforts will be comprehensive, understandable and available to the public and for scientific review and program evaluation.*

#### **What is it?**

Coordinated management of dependable natural resource data is needed to share and integrate information for the Oregon Plan. Data from various spatial scales and sources needs to be linked and, in turn, synthesized in order to provide practical information for Oregon Plan partners. Well-managed and integrated data will support the analysis and reporting of information in terms that are useful to policymakers as well as the public. The legislatively mandated biennial report for the OPSW will be part of the effort to accomplish this strategy. The first biennial report, released in January 2002, provides an initial snapshot of trends and current conditions, documents investments in restoration, and lays the groundwork for interpreting the effectiveness of measures. This strategy reinforces OWEB's commitment to the biennial report and to other reporting formats that provide information on the "why, what, and where" of watershed issues for use by the public, scientists, managers, and policy.

#### **Why is it important?**

Monitoring must be designed to provide information that managers need to make good decisions. Access to credible data and understandable analysis of monitoring results is needed for citizens of the state to make informed opinions about their investments in watershed health. At times, the amount of information can be overwhelming, systems are needed to help tailor information products to specific types of users.

Tracking research and monitoring activity is already required under the Endangered Species Act, 4(d) rule for monitoring and research. However, current reporting of monitoring data is inadequate for the purposes of the Oregon Plan for several reasons. It fails to provide timely information for planning restoration actions and to contribute meaningful summaries of status and trend data for use in effectiveness monitoring. These limitations are not entirely avoidable. Naturally, project reports focus on data from individual investigations such as the number of salmon produced by a stream reach for one project or the existence of physical barriers to fish passage in another project. A common platform for sharing and displaying data is needed to allow spatial analysis of one factor in the context of all others. Analyses resulting from an integrated database will aid in developing new proposals as well as improve efficiency by helping to avoid duplicative projects.

Ongoing work to develop recovery criteria and restoration goals may also be accelerated by improving the availability and consistency of information. Planning efforts ranging from NOAA Fisheries Technical Recovery Teams to local action plans developed by watershed councils are dependent on access to dependable information.

#### **Where are we and where are we going?**

The 2001 Legislative Assembly identified a substantial need to obtain standard spatial data and to report on the implementation of the Oregon Plan for Salmon and Watersheds. Senate Bills 945 and 946, signed into law in 2001, address this need and place the responsibility with OWEB. Information policy staff at OWEB are completing work that provides strategic guidance for this effort. OWEB is working with Oregon's Department of Administrative Services, state natural resource agencies, and federal partners to prioritize the needs for standardized information and to determine ways to deliver this information through the internet. There is significant work ahead to integrate the monitoring efforts with biennial reporting requirements, and to evolve this effort into a meaningful assessment of progress toward identified indicators and goals.

## Implementation

Monitoring is the systematic collection of information used to assess the current condition and trend of an environmental or performance indicator. For salmon populations, monitoring means knowing how many individuals are in a specific population and how that number changes over time. Factors that affect the status and trend in salmon populations such as habitat conditions, water quality, watershed health, predation, fisheries harvest, and ocean conditions are also monitored. Monitoring should reliably and efficiently measure those factors needed to describe relationships between populations, habitats, restoration actions, natural processes, and management.

Monitoring should be designed to adequately capture the complexity of biological, geographical, and cultural systems in Oregon. Regional differences in habitat capacity, patterns of land use and land management practices, and variability in climatic and ocean conditions challenge the ability to characterize natural resource health.

This Monitoring Strategy is designed to manage this complexity by providing a framework of Outcomes, Questions, and Strategies for Oregon Plan monitoring activities

While the Strategic Framework establishes the overall scope and direction for the monitoring program, an implementation plan for the Monitoring Strategy is needed to identify who will do the work, where the work will be done, and how the information from all the component activities will be compiled and used. The Oregon Plan Monitoring Team will build upon the knowledge gained from current monitoring projects and program evaluations. This experience will help guide implementation as the team provides recommendations to the OWEB Board and participating Oregon Plan agencies prioritizing monitoring activities and to identifying gaps in program coverage.

Additional guidance comes from the Independent Multidisciplinary Science Team (IMST) 1999 and 2001 letter reports on the monitoring program. The IMST is charged, by statute, with responsibility to assess and comment on the activities of the Oregon Plan. The IMST has recommended specifically that the Monitoring Program:

- Develop a strategy to address and prioritize key issues
- Identify the highest priority questions to be answered
- Define what constitutes a comprehensive monitoring report
- Link agency monitoring activities to specific monitoring questions
- Provide detailed information on study design, sampling protocols, data analysis, interpretation, and evaluation
- Ensure integration and synthesis of monitoring information and relate these results to the goals of the Oregon Plan

OWEB will accelerate the Monitoring Program's response to these recommendations by working with agencies represented on the Oregon Plan Monitoring Team to develop specific work plans and budgets for identified monitoring related products. All work plans must address important challenges such as implementation issues. One of the greatest difficulties will be identifying core monitoring needs and the means to fund them. OWEB is working with other agencies and the Governor's Office meet this challenge by addressing issues specific to each of the monitoring strategies that comprise this plan.

Monitoring program implementation and integration across spatial scales and over time will continually challenge the capacity of the Oregon Plan to realize its goals. Short-term improvements in habitat or numbers of returning salmon must be evaluated in the context of long term ecosystem recovery. The efficacy of actions intended to ameliorate causes of habitat degradation are difficult enough to evaluate. Modeling the effect of events that do not occur (e.g. decreased road failures, reduced pollutants), thanks to protective measures already taken, are even harder. Monitoring and analyses must be supported by new, innovative research. The Strategic Framework for the Oregon Plan monitoring program helps establish the need for such work. Ultimately, the Oregon Plan will be evaluated by its ability to maintain support for ongoing restoration efforts and to adaptively apply monitoring results to program needs.

OWEB is engaged in a three-step process to further refine the scope of the Oregon Plan Monitoring Program in the near future. First, OWEB will support the development of appropriate environmental indicators. Second, OWEB will conduct a comprehensive assessment of current monitoring activities, both under the Oregon Plan as well as monitoring supported by other programs or agencies, to identify overlapping activities and gaps in coverage. Third, OWEB will assess funding and budgetary needs for Oregon Plan monitoring. Throughout this process, OWEB will abide by these principles:

- Prior to initiating new programs, existing monitoring activities will be reviewed for applicability to the Monitoring Strategy and potential for modification.
- Measures of salmon population health, water quality, riparian function, and other environment indicators will be addressed comprehensively.
- Monitoring efforts will be planned for and maintained over appropriate time intervals.
- Compatibility with habitat and population indicators used in other region-wide monitoring and assessment efforts will be sought.
- Proposed and developing monitoring processes will be coordinated to ensure the information collected will be broadly utilized.
- The conceptual framework, questions, and indicators that guide the Oregon Plan monitoring strategy will be streamlined to be compatible with other approaches used to evaluate progress, including complimentary environmental benchmarks proposed by the Oregon Progress Board and the State of the Oregon Environment Report.
- Monitoring results will be reported at multiple levels of complexity, from publications in scientific journals to non-technical public presentations and in a biennial monitoring report to the IMST.
- Monitoring results will be developed in a manner that easily integrates into a biennial report of implementation of the Oregon Plan for Salmon and Watersheds.

The Monitoring Strategy lays out a framework for a science-based monitoring program. Major decisions will be required to define appropriate levels of investment and to develop realistic expectations for overall program performance.

## *OWEB and the Oregon Plan*

OWEB programs support Oregon's efforts to restore salmon runs, improve water quality, and strengthen ecosystems that are critical to healthy watersheds and sustainable communities. OWEB is responsible for three interrelated monitoring functions:

- strategic guidance for cooperative monitoring
- accountability for restoration investments
- reporting on the progress of the Oregon Plan.

Recent legislation, Senate Bill 945, directs OWEB to develop and implement a statewide Monitoring Program in coordination with other state natural resource agencies for activities conducted under the Oregon Plan. OWEB is also obligated to ensure investment in local restoration activities results in positive environmental, cultural, and economic benefits. Finally, OWEB is responsible for the creation of a Biennial Report that provides an assessment of the implementation and effectiveness of the Oregon Plan. OWEB's multiple roles require the integration of science based natural resource information, analysis of restoration activity efficacy, and accountability reported via the Biennial reporting process.



## Oregon Plan Monitoring Strategy Details

Outcomes	Questions	Strategies	Example Data
<p>Outcome One: Provide a scientific assessment of watershed conditions and salmon populations.</p> <p>Identify the appropriate indicators of population and watershed condition, the appropriate scales of inquiry, and the appropriate level of precision needed.</p>	<p>What is the condition of aquatic habitat and watershed systems?</p> <ol style="list-style-type: none"> <li>1. What is the condition of salmon populations at the ESU, Sub-Basin and watershed scale?</li> <li>2. What is the status and what are the trends in aquatic habitats, water quality, and stream flow?</li> <li>3. What are the critical factors that limit watershed function and salmon productivity?</li> <li>4. What constitutes detectable and meaningful changes in habitat condition and populations?</li> </ol>	<ol style="list-style-type: none"> <li>1. Assess general status and trends for physical habitat, salmon populations, , and biotic conditions in Oregon sub-basins and ESU regions at appropriate scales.</li> <li>2. Monitor habitat capacity, salmon survival and productivity, and biotic processes in selected watersheds within each sub-basin or ESU region.</li> <li>3. Analyze habitat trends and salmon populations in the context of local or regional effects, landscape influences, and ocean productivity.</li> </ol>	<p>Landscape Characterization: Riparian Condition: canopy composition, site potential. Habitat Condition: channel morphology, fish passage. Salmon: abundance, geographic distribution, life history, diversity, and productivity. Biotic Condition: invertebrate communities, , toxics. Water quality: temperature, DO, pH, sediment, bacteria. Stream flow: duration, peak flow events, minimum flows.</p>
<p>Outcome Two: Provide an evaluation of Oregon Plan restoration actions and conservation measures</p> <p>Evaluate the relative importance of restoration activities as a contribution to watershed health. Develop analytical models to evaluate changes produced by the Oregon Plan to target conditions and recovery goals.</p>	<p>What is the benefit of Oregon Plan restoration projects, management practices, and conservation programs relative to adverse impacts and natural ecosystem variability?</p> <ol style="list-style-type: none"> <li>5. What changes are occurring in watersheds that improve stream habitat quality?</li> <li>6. What are the management practices and programs that enhance or restore watershed functions and salmon populations?</li> <li>7. What habitat changes and biotic responses result from these projects, practices, and programs?</li> <li>8. What are the impacts of land use and land management practices on watersheds?</li> </ol>	<ol style="list-style-type: none"> <li>4. Document implementation of restoration projects, conservation activities, and agency programs.</li> <li>5. Evaluate the local effectiveness of restoration efforts by monitoring representative samples of specific project, activity, and program types.</li> <li>6. Evaluate the combined effectiveness of restoration efforts by monitoring habitat and population response in a structured sample of watersheds.</li> </ol>	<p>Broad Scale Indicators: land use/land cover, road density, wetland change, ocean productivity cycles. Instream, riparian, road, and upland project type, number and location. Habitat and biotic indicators of project effectiveness. Compliance rates and effectiveness measures of policy guidelines and rules (i.e. Forest Practices Act Monitoring). Component and cumulative analysis of restoration actions and management program benefits.</p>
<p>Outcome Three: Provide useful information to policymakers, agencies, and the public through efficient and coordinated monitoring</p> <p>Oregon Plan partners coordinate to implement efficient monitoring, employ scientific assessments, and report results in ways that promote adaptive responses and informed participation.</p>	<p>Does the Monitoring Program provide information and analysis for adaptive review of restoration actions, management practices, and Oregon Plan policies?</p> <ol style="list-style-type: none"> <li>9. Is there sufficient support and guidance for local efforts so that monitoring evaluates restoration effectiveness and contributes to broader scale assessments?</li> <li>10. Does the Oregon Plan coordinate effectively with state, federal, and tribal assessment and monitoring activities?</li> <li>11. What is the level of public understanding and acceptance of and participation in the Oregon Plan?</li> <li>12. Is monitoring information used adaptively to guide actions and to meet Oregon Plan reporting requirements?</li> <li>13. Does the monitoring help evaluate progress toward environmental benchmarks and salmon recovery goals?</li> </ol>	<ol style="list-style-type: none"> <li>7. Standardize monitoring designs, assessment protocols, and methods to manage and analyze data.</li> <li>8. Coordinate and support interagency monitoring programs and public-private monitoring partnerships.</li> <li>9. Integrate information from multiple sources to produce data products and reports that assess restoration efforts and evaluate progress toward recovery goals.</li> </ol>	<p>Comprehensive documentation of who is monitoring what and where, and what methods are used. (agencies, Tribes, watershed councils, SWCD's, landowners, other organizations) Assessment of natural resource data management throughout the Pacific Northwest. Whole stream or watershed surveys, synoptic assessments of salmon populations and water quality, and other OWEB funded and cooperative monitoring. Complimentary Program Data: NW Forest Plan Aquatic and Riparian Monitoring Clean Water Act - DEQ TMDL implementation. Ag Water Quality 1010 Plans.</p>



**THE OREGON PLAN**  
*for salmon & watersheds*

***OWEB Vision:***

***“To help create and maintain healthy watersheds  
and natural habitats that support thriving  
communities and strong economies.”***