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# TIMBER-FISH-WILDLIFE

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Cooperative Monitoring, Evaluation and Research  
Workplan Status Report

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Prepared by the  
Cooperative Monitoring, Evaluation and Research  
Committee

October, 1992

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**ISSUE:** Status and trends of physical stream conditions

**PROGRAM:** Stream surveys pilot program

**RATIONALE:** To monitor the "health" of Washington's streams through time and to evaluate the effectiveness of forest practice regulations in maintaining or improving these conditions, we must understand what these conditions are like today.

**SPECIFIC QUESTIONS:**

- (1) What variables should be routinely measured statewide to accurately assess the condition of fish habitat?
- (2) What variables should be routinely measured statewide to characterize present levels of, and detect changes in, the inputs of sediment, water, and wood?
- (3) How can this information be gathered efficiently and in a way that ensures comparable data quality and accuracy from person to person, year to year, and place to place?

**TFW PRODUCTS:**

- Monitoring procedures manual (Ralph 1990).
- Training in standardized methods.
- Efficient system for data gathering and input (Scantron forms).
- Centralized and standardized data analysis, interpretation, and distribution.
- Baseline data from disturbed sites.

**ACTION STEPS:**

1. Survey project review report (16 December).
2. Program re-alignment (January '92).
3. Training of survey crews (May-June).
4. Continue surveys (July-October).
5. Begin effectiveness monitoring (July).

**FUNDING:**

BIENNIUM	FY87-89	FY89-91	FY91-93	FY93-95
BUDGET	\$00 CMER ~\$100,00 NWIFC	\$200,000 CMER \$445,000 NWIFC TRIBES	\$106,000 CMER \$50,000 NWIFC TRIBES ITT	becomes effectiveness monitoring program

**PROJECT LIST:**

- (1) Extensive stream survey project (CSS; ends December 1991)

**ISSUE:** Status and trends of physical stream conditions, continued

**PROGRAM:** Classification

**RATIONALE:** Not all streams and not all parts of a given stream respond the same to management. Use of classification principles to group channel units, valley types, watersheds, or physiographic provinces may help identify natural patterns of stream channel responses across Washington.

**SPECIFIC QUESTIONS:**

- (1) Do valley segments help account for the variability of our measured parameters?
- (2) Will they help us predict the way channels will respond to management?
- (3) What tools can we develop to aid in extrapolating data from studied to unstudied streams?

**TFW PRODUCTS:**

- Valley segment classification methods manual—completed (Cupp 1990).
- Methods for hydrologic classification of basins—completed (Orsborn 1990).

**ACTION STEPS:**

- 1. Classification workshops—completed (1988 and 1989).
- 2. Testing and refinement of the valley segment classification system—completed (Beechie and Sibley 1990).
- 3. Preliminary evaluation of ecoregion as a useful classification or data interpretation tool (CSS 1991).
- 4. Analyze available data to explore utility of valley segments and ecoregions as classification tools (winter '91).

**FUNDING:**

BIENNIUM	FY87-89	FY89-91	FY91-93	FY93-95
BUDGET	---	\$95,000 CMER ~\$30,000 cooperators	incorporated into stream survey projects.	incorporated into stream survey projects.

**PROJECT LIST:**

- Additional (specific) classification projects postponed until available data has been analyzed.
- Analysis due (spring '92).

**ISSUE:** Status and trends of physical stream conditions, continued

**PROGRAM:** Watershed Characterization

**RATIONALE:** Current channel conditions are strongly influenced by watershed characteristics such as geology, climate, hydrology, topography, vegetation, disturbance history and past management practices. Identification of which features have greatest influence on stream potential is needed to accurately interpret status and trends.

**SPECIFIC QUESTIONS:**

- (1) What are the prominent links between basin setting and measured channel conditions?
- (2) How does past land use and disturbance history influence present or future stream conditions?
- (3) Which basin characteristics are the most important influences on fish habitat within valley segments.

**TFW PRODUCTS:**

- Report and maps from assessment.

**ACTION STEPS:**

- 1. Identification of which watershed features should be routinely examined as interpretation tools.
- 1. Analysis of existing data (winter '91-'92).
- 2. Incorporation of key results into results of Watershed Analysis methods.

**FUNDING:**

BIENNIUM	FY87-89	FY89-91	FY91-93	FY93-95
BUDGET	---	\$64,000	---	---

**PROJECT LIST:**

- (1) Watershed Characteristics and Conditions Assessment--completed (Jones & Stokes Assoc., Inc.

**ISSUE:** Effectiveness of TFW-era forest practices.

**PROGRAM:** Effectiveness monitoring.

**RATIONALE:** Forest practices developed and implemented under the TFW program are aimed at protecting public resources while maintaining a viable forest products industry. Trends in resource conditions must be monitored and interpreted to evaluate the effectiveness of TFW regulations in meeting the resource goals. The results of watershed analysis will enable effectiveness monitoring to be done in a meaningful way by providing a watershed perspective of basin sensitivities and the expected response of key watershed features to basin- or site-specific BMPs. It is against these hypothesized system and resource responses that we can measure performance of TFW regulations.

**SPECIFIC QUESTIONS:**

- (1) What variables should be monitored in a stream or a watershed to evaluate effectiveness of TFW forest practices? Are these different than routine resource assessment variables?
- (2) What is an appropriate sampling scheme for a comprehensive effectiveness monitoring program?
- (3) How often should streams or watersheds be revisited to establish resource trends?
- (4) How do natural catastrophic events alter trends and our interpretation of effectiveness?

**TFW PRODUCTS:**

- Statewide watershed monitoring system to follow watershed analysis.
- Periodic "state of the streams" report.
- Standardized, reliable results.
- Basin monitoring library.

**ACTION STEPS:**

- (1) Identify methods for effectiveness monitoring program (spring-summer 1992).
- (2) Continuous improvement of methods for effectiveness monitoring programs (ongoing '93-'95).
- (3) Conduct level 2 training sessions (spring 1993, 1994, 1995).
- (4) Begin effectiveness monitoring in conjunction with CE analysis (summer 1992).
- (5) Continue effectiveness monitoring in conjunction with CE Analysis (continuous '93-'95).
- (6) Report on status and trends of monitored streams (periodically throughout 1993-'95).

**FUNDING:**

BIENNIUM	FY87-89	FY89-91	FY91-93	FY93-95
BUDGET	---	---	\$100,000 \$80,000 NWIFC	\$194,000 \$100,000 cooperators

**PROJECT LIST:**

- (1) Development and continuous improvement of field methods modules for level 2 parameters.
- (2) Training sessions for level 2 methods.
- (3) Quality assurance and field problem-solving for cooperators.
- (4) Development and operation of standardized gravel processing center (not CMER funded).
- (5) Establishment of watershed analysis and effectiveness monitoring data processing and library.
- (6) Status and trends communication system.
- (7) Operational "trend analysis" crew for on-going effectiveness monitoring.

**ISSUE:** Effectiveness of TFW-era forest practices.

**PROGRAM:** Regional Classification and Undisturbed Reference Sites..

**RATIONALE:** Not all streams and not all parts of a given stream respond the same to management. Use of classification principles to group channel units, valley types, watersheds, or physiographic provinces may help identify natural patterns of stream channel responses across Washington. This program will establish a network of regional reference sites which will produce baseline values for regional resource condition indicators. These will be used to explain natural variability between regions and will produce for watershed analysis a regional set of resource condition criteria instead of one value for the entire state.

**SPECIFIC QUESTIONS:**

- (1) Where within the state are there streams or reaches of streams that qualify as candidates for undisturbed reference sites?
- (2) What is the best way to subdivide the state into useful regions for development of regional resource condition criteria?
- (3) What sampling methods and intensities should be used to adequately establish reference resource conditions.
- (4) What are the reference conditions?

**TFW PRODUCTS:**

- Continuous monitoring of statewide network of regional reference sites.
- Efficient and timely communication system to convey the results of this monitoring to cooperators and facilitate incorporation into watershed analysis.

**ACTION STEPS:**

- (1) Identify candidate reference sites for use in statewide network (spring 92)
- (2) Survey the reference sites using standard Ambient Monitoring (level 2 watershed analysis) methods (summer-fall, 1993 & 1994).
- (3) Develop regional reference criteria for use in watershed analysis (winter 1993-spring 1995).
- (4) Develop schedule for repeated surveys of the sites over time (as required, 1993 and 1994).
- (5) Conduct repeat surveys, update and communicate information to cooperators (ongoing '93-'95).

**FUNDING:**

BIENNIUM	FY87-89	FY89-91	FY91-93	FY93-95
BUDGET	---	\$95,000 \$30,000 cooperators	\$100,000 \$20,000 NWIFC	\$163,000 \$50,000 cooperators

**PROJECT LIST:**

- (1) Establish and survey regional reference sites.
- (2) Develop regional resource condition criteria for use in watershed analysis.
- (3) Develop and implement long-term monitoring program for reference sites.

**ISSUE:** Cumulative Effects of Forest Practices, Excluding Wildlife.

**PROGRAM:** Watershed Analysis.

**RATIONALE:** Recognizing and managing for cumulative effects has been a long-standing legal challenge and management issue for TFW. Objective techniques of CE assessment are needed so management responses can be developed.

**SPECIFIC QUESTIONS:**

- (1) How do we identify the existence of, or potential for, cumulative effects in a basin?
- (2) How do we incorporate best scientific knowledge of hillslope hazards and resource risks into a forest management tool?

**TFW PRODUCTS:**

- Method for prioritizing basins for watershed analysis.
- Level I Watershed Analysis methods manual.
- Level II Watershed Analysis methods manual.
- Resource threshold parameters.
- Watershed Analysis team training and certification.
- Refinement, validation and control of CE analysis.

**ACTION STEPS:**

1. Level I methods completed (6 Dec. '91).
2. Begin Level II methods (20 Dec. '91).
3. Begin threshold review (early Jan. '92).
4. Draft methods and parameters ready ('92).
5. Final methods and parameters ready ('92).
6. Watershed Analysis team training ('92).
7. Watershed Analysis design team final report (31 Dec. '92).
8. Refinement and validation begins (Dec. '92).

**FUNDING:**

BIENNIUM	FY 87-89	FY 89-91	FY 91-93	FY 93-95
BUDGET	NONE	NONE	\$236,300 CMER \$70,000 cooperators \$150K still needed.	\$223,000

**PROJECT LIST:**

- (1) Level I Watershed Analysis completed (Pacific Watershed Institute, 1991)
- (2) Level II Watershed Analysis (Start Date = December 20 1991)
- (3) Resource threshold parameter review and recommendations completed(1992).
- (4) Develop and refine methods for manual ('93-'95).
- (5) Develop QA/QC methods to insure correct use of methods ('93-'95).
- (6) Test modules for validation.('93-'95).
- (7) Examine results of Watershed Analysis for Statewide/Regional Trends ('93-'95).

**ISSUE:** Effects of forest practices on fish.

**PROGRAM:** The effect of large woody debris, flow, sediment and temperature regimes on salmonids and other fishes.

**RATIONALE:** Large scale logging in Washington has altered the basic input patterns of woody debris, water, sediment and solar radiation to streams draining forested watersheds. Changes in the amount and character of these inputs has resulted in significant changes to physical stream habitat. A better understanding of how individual fish populations and communities respond to these changes is needed for developing guidelines that promote sustainable fisheries. Previous studies focusing on single habitat elements or individual species have failed to adequately evaluate the effects of multiple, and interrelated habitat changes. Therefore, an integrated approach to studying the cumulative effects of habitat change is being employed with several levels of experimental control.

**SPECIFIC QUESTIONS:**

- (1) Do salmonids modify the gravel environment during spawning and if so, do these changes persist through the incubation period?
- (2) What agents of mortality (streambed scour, smothering, or entombment) are most important during the intragravel development of salmonids?
- (3) How does the type and distribution of large woody debris affect summer and winter growth and survival of juvenile salmonids?
- (4) How does temperature influence the timing of significant life history events?
- (5) What fish and stream habitat information do managers need in order to make sound site and watershed specific forest practice decisions, and how is that information best conveyed?

**TFW PRODUCTS:**

- An evaluation of the applicability of gravel composition and streambed stability threshold and recommendations for management monitoring protocols.
- An evaluation of the influence of habitat structure influenced by forest practices and fish size on the winter survival of juvenile salmonids.
- An evaluation of flow disturbance on the structure and function of fish communities in streams draining forested watersheds.
- An evaluation of population specific variation in response of juvenile coho to temperature regimes.
- An evaluation of the role of woody debris cover in the summer growth and survival of juvenile salmonids.
- An evaluation of the seasonal habitat unit needs by species and age class.

(Continued)

**PROGRAM:** The effect of large woody debris, flow, sediment and temperature regimes on salmonids and other fishes.

**ACTION STEPS:**

1. Prototype of interactive computer program for foresters and habitat managers completed (summer '91).
2. First year results from experimental channel, on fish size, habitat structure, and winter survival (Jan '92).
3. Resident trout work begins (summer '92).
4. Complete an evaluation of the role of woody debris cover in the summer growth and survival of juvenile salmonids (Jan '93).
5. Complete an evaluation of the seasonal habitat unit needs by species and age class (Jan '93).
6. Second year results from experimental channel, on fish size, habitat structure, and winter survival (Jan '93).
7. Complete an evaluation of population specific variation in response of juvenile coho to temperature regimes (summer '93).
8. Complete an evaluation of the applicability of gravel composition and streambed stability threshold and recommendations for management monitoring protocols (summer '93).
9. Complete and evaluation of fish distribution, community structure and function. (Dec. '93).

**FUNDING:**

BIENNIUM	FY87-89	FY89-91	FY91-93	FY93-95
BUDGET	\$00 CMER	\$168,000 CMER	\$381,000 CMER	\$750,000 CMER

**PROJECT LIST:**

- (1) Evaluation of altered sediment regimes on the reproductive success of salmonids.
- (2) Evaluation of habitat structure on salmonid growth and survival.
- (3) Evaluation of forest management induced temperature changes on growth and survival of salmonids.
- (4) Population level trends based on long term data bases in forested watersheds.

**ISSUE:** Effects of large woody debris on fish populations, production and habitat.

**PROGRAM:** The deliberate addition of large woody debris to stream channels.

**RATIONALE:** Forest practices have resulted in the removal of large woody debris from stream channels. In addition, timber harvest has resulted in reduced input of woody debris from "natural" processes. These losses of woody debris adversely affect fish habitat and fish production. The addition of large wood to stream channels is a common mitigation / enhancement method. The effect of this addition not been consistently evaluated. Current methodologies are expensive and time consuming. This project is designed to evaluate the effectiveness of current LOD addition methodology and evaluate alternative methods.

**SPECIFIC QUESTIONS:**

- (1) What is the effect of LOD addition on fish habitat?
- (2) What is the effect of LOD addition on fish populations?
- (3) What is the effect of LOD addition on fish production?
- (4) What is the effect of LOD addition on stream morphology?
- (5) How effective is an "operational" method of LOD addition compared to traditional methods?

**TFW PRODUCTS:**

- An evaluation of change in stream morphology, fish populations and fish production following LOD addition.
- An evaluation of an "operational" method of LOD addition for enhancement, mitigation, and management.
- Information on fish populations and fish production before and after large woody debris addition.

**ACTION STEPS:**

1. Literature review, site selection ('88-'89).
2. Pre-Alteration stream sampling (spring '89).
2. Begin Field work (summer '90).
3. Pre-Alteration sampling complete (fall '90).
4. Stream Alteration Treatment begins (fall '90).
5. Post-Alteration stream sampling begins (fall '90).
6. Stream Alteration Treatment ends (fall '91).
7. Preliminary report (Stream Alteration) (Jan '94).
8. Post-Alteration stream sampling ends (Dec. '95).

**FUNDING:**

BIENNIUM	FY87-89	FY89-91	FY91-93	FY93-95
BUDGET	\$20,000 CMER	\$00 CMER \$120,000 COOP	\$00 CMER \$145,000 COOP	\$00 CMER \$120,000 COOP

**ISSUE:** Erosion from mass wasting.

**PROGRAM:** Evaluation of road engineering guidelines and techniques.

**RATIONALE:** Most of the landsliding and sedimentation problems resulting from forest practices associated with roads. Hillslopes that are steep and/or potentially unstable present severe challenges for the construction and maintenance of forest roads.

**SPECIFIC QUESTIONS:**

- (1) How do we evaluate the design and construction problems posed by difficult sites for forest roads?
- (2) Do current techniques provide adequate function, stability, drainage and so forth?
- (3) How do we evaluate existing roads so that problems can be found and treated in a timely manner?

**TFW PRODUCTS:**

- Post Construction Road Management Guidelines: Guidelines for recommended methods of hazard and risk assessment, and techniques for dealing with apparent problem sites, to be used in evaluating and performing work for road maintenance and abandonment.
- Pre-Construction Design and Construction Guidelines: Guidelines for forest roads on steep or landslide-susceptible slopes, including such items as site limitations, standards and specifications for excavation, compaction, reinforcement, and drainage.
- Revised Edition of Roads Handbook: As appropriate, a revised edition of the roads handbook; proposed changes to the forest practices regulations; or any other means of communicating information that will facilitate adaptation of improved techniques.

**ACTION STEP:**

1. Road Questionnaire completed (1991).
2. Deschutes River Case Study completed (1991).
3. Road assessment Case Study planned ('93-'95).

**FUNDING:**

BIENNIUM	FY87-89	FY89-91	FY91-93	FY93-95
BUDGET	0	\$13,200	0	\$75,000

**PROJECT LIST:**

- (1) Road Survey Questionnaire Complete 1991.
- (2) Deschutes River Case Study Complete 1991.
- (3) Road assessment Case Study planned ('93-'95).

**ISSUE:** Erosion from Mass Wasting

**PROGRAM:** Slope Stability Hazard Assessment

**RATIONALE:** Any system of assessing and dealing with potential landslide problems depends on the identification of susceptible areas early in the planning, operational, and regulatory schedule, so that the necessary technical evaluations and mitigation can be made in a timely manner. Currently, the broad-scale screening tool used for this purpose within DNR and T/F/W is the slope-hazard ratings of the state soil survey. Because of the perceived deficiencies in this system, better means are sought of providing classification of forest lands in terms of their potential for experiencing slope instability resulting from or affecting forest practices.

**SPECIFIC QUESTIONS:**

- (1) Is the current system flagging providing adequate identification of potentially stable areas, i.e. does it direct further attention to a large proportion of the appropriate sites, while not creating excess work by flagging too many inappropriate sites?
- (2) Is a sufficient amount of information conveyed about the nature of the flagged sites, so that we are able to determine what conditions would be expected, what further assessment procedures should be carried out, and/or what mitigation measures should be employed?
- (3) Could a better system be developed utilizing more rational means of analysis and classification, and having the flexibility to adapt to an evolving knowledge base and technologies? Could such a system be implemented in a reasonable time and cost?

**TFW PRODUCTS:**

- Improved GIS-based Hazard Zonation for flagging of potentially unstable sites. Flagging tools will be used by the DNR regulatory foresters and staff and land managers.
- Site-specific slope stability hazard assessment methods (regionalized). Site-specific hazard assessment methods may be used by road engineers, regulatory foresters, managers, and ID teams.

**ACTION STEP:**

1. Hazard Zonation Study begins (summer '89)
2. "Big Earth" Project begins (Oct. '91)
3. Hazard Zonation Study completed (early '92)
4. "Big Earth" Project continues ('93-'93)

**FUNDING:**

BIENNIUM	FY87-89	FY89-91	FY91-93	FY93-95
BUDGET	0	\$78,000 CMER	\$25,000 CMER	\$235,000 CMER

**PROJECT LIST:**

- (1) Hazard Zonation (SH-4): On-going; expected completion date: 1992
- (2) Big Earth Project (SH-10): Begin October 1991
- (3) Site Slope stability assessment methods (SH-13):
  - First phase complete 7/91
  - Second phase delayed due to budget cut

\*SHAMW is requesting cooperator funds during 91-93 biennium to continue program and CMER funds in 93-95 to complete TFW tools.

**ISSUE:** Erosion from Mass Wasting

**PROGRAM:** Effects of Forest Practices on the Stability of Deep-Seated Mass Movements.

**RATIONALE:** Deep-seated mass wasting is an important erosion process in some locations of Washington. The large volume of sediment mobilized by a single deep failure can dominate the sediment budget of a watershed. Technical understanding of deep-seated failures is usually based on the analysis of large failures after their occurrence. Predictive methods for recognizing and assessing potential forest practice effects are needed.

**SPECIFIC QUESTIONS:**

- (1) Can systematic methods be devised to predict the locations where forest management practices could affect the stability of deep-seated failures based on topographic, geologic and hydrologic information?
- (2) What are the effects of different silvicultural and logging practices on the stability of areas susceptible to deep-seated mass movement?

**TFW PRODUCTS:**

- Workbook/manual for the field practitioner to use in interdisciplinary team work on timber harvest applications ('93-'95).
- Database of collected data and literature pertinent to the slope stability of deep-seated mass movement features completed '91-'93)

**ACTION STEP:**

1. Literature Review (spring '90)
2. Program Scoping (spring '91)
3. "Big Earth" Project begins (Oct. '91)
4. Field test prototype predictive method ('93-'95)

**FUNDING:**

BIENNIUM	FY87-89	FY89-91	FY91-93	FY93-95
BUDGET	0	\$10,000	\$110,000	\$100,000

**PROJECT LIST:**

- (1) Deep-seated Mass Failures Literature Review Complete Dec. 1991.
- (2) Geomorphological watershed analysis ("Big Earth") continues ('93-'95).

**ISSUE:** Channel damage from Landslides

**PROGRAM:** Channel Hazard from Catastrophic Landslide Events

**RATIONALE:** Landslides caused by debris flow or damming of small channels by floatable debris triggering debris torrents can significantly alter the channels they flow through. More knowledge is needed of the habitat characteristics and recovery rate of impacted channels. In addition, the role of logging debris and the effectiveness of the debris cleaning guidelines needs to be evaluated.

**SPECIFIC QUESTIONS:**

- (1) What is the relative importance of in-channel and out-of-channel initiation of debris flows and debris torrents (dam-break floods)?
- (2) Can the potential initiation sites and runout of landslides be predicted?
- (3) Do forest management practices influence their occurrence?

**TFW PRODUCTS:**

- Hazard Assessment Methodology for Mass Failures Initiated In-Channel. Identification of potential hazard with forest management around type 4&5 waters relative to slope stability concerns. Relative importance regionally within the state and link to hydrologic issues.
- Debris Torrent Risk Assessment Method. Assessment of likely delivery of debris torrent material and downstream effects.

**ACTION STEP:**

1. Dam-break Flood projects begins (spring '90).
2. Interim report (June '91).
3. Dam-break Flood project model complete (fall '92)
4. Further refinement of predictive capability of Dam-break Flood project model (summer '93).

**FUNDING:**

BIENNIUM	FY87-89	FY89-91	FY91-93	FY93-95
BUDGET	0	\$47,000 CMER	\$37,000 CMER	\$30,000 CMER

**PROJECT LIST:**

- Dam-break flood runout model (U.W.) SH-9 (initiated 1991).
- Floods channel effects (U.W.) SH-17 (Interim report completed '91).

**ISSUE:** Rain-on Snow Hydrologic Effects.

**PROGRAM:** Forest Management Effects on Hillslope and Stream Hydrology.

**RATIONALE:** Rain-on-snow runoff is a major contributor to flood flow throughout Washington and has caused substantial damage to roads and streams. There is an interaction between forest management activities and snow accumulation and melt processes. A much stronger data base is needed to determine the effects of changes in available water during rain-on-snow events with changes in downstream flow and its effect on flooding and fish habitat.

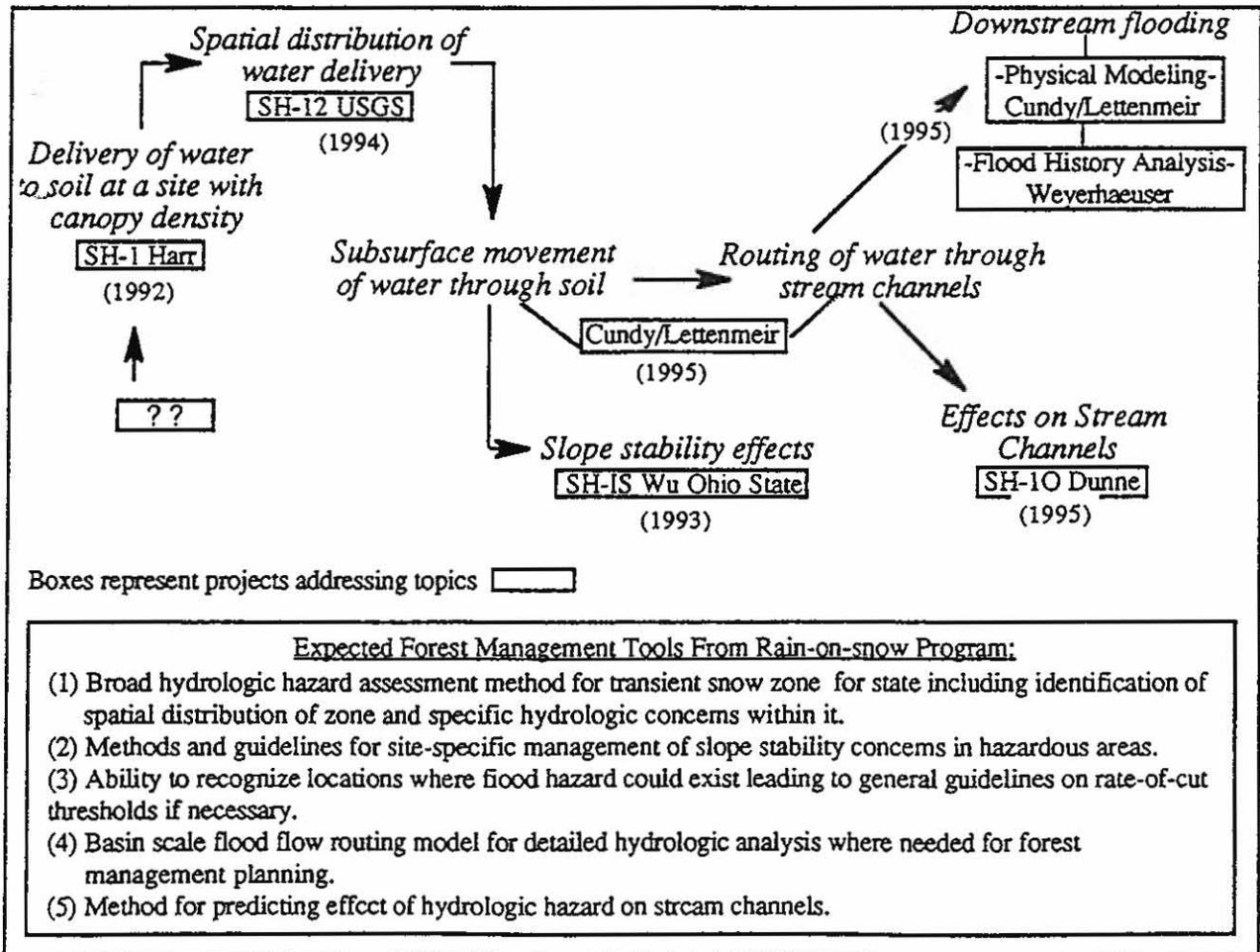
**SPECIFIC QUESTIONS:**

- (1) What effects do different forest-cover conditions have on snow accumulation and melt rate?
- (2) If water delivery to hill slopes changes, would it affect the timing and quantity of runoff and in turn, would it affect channel stability and morphology?
- (3) What are the cumulative hydrologic effects of forest management practices on a watershed scale?

**TFW PRODUCTS:**

- (1) Watershed hydrologic model for predictive stream flow with land use.
- (2) Hillslope scale hydrologic model for predicting the effects of hillslope hydrology on slope stability.
- (3) Map of transient snow zone in Washington.

**ACTION STEP:**



**(Continued)****PROGRAM:** Forest Management Effects on Hillslope and Stream Hydrology.**FUNDING:**

<b>BIENNIUM</b>	<b>FY87-89</b>	<b>FY89-91</b>	<b>FY91-93</b>	<b>FY93-95</b>
<b>BUDGET</b>	<b>\$47,300 CMER</b>	<b>\$46,000 CMER</b>	<b>\$174,000 CMER</b>	<b>\$92,500 CMER</b>

**PROJECT LIST:**

- (1) Snow Accumulation and Melt field study (SH-1) Complete 1991.
- (2) Rain-on-snow mapping pilot project (SH-3) Complete 1990.
- (3) State-wide rain-on-snow data records (SH-12) ('94-'95)
- (4) Effects of Rain-on-snow on slope stability ('93-'95)
- (5) Effects of Rain-on Snow on downstream flooding ('95)
- (6) Effects of floods on channel stability --part of "Big Earth"--(SH-10)('95)

**ISSUE:** Channel response to forest practices

**PROGRAM:** Stream channel effects from changes in watershed processes

**RATIONALE:** Sediment, flow and large organic debris determine the shape of stream channels and directly influence the quality of habitat for fish and other biota. Forest practices can influence each of these processes. A method is needed for interpreting and predicting the response of channels to changes in geomorphic regime for purposes of risk assessment.

**SPECIFIC QUESTIONS:**

- (1) Can stream channel conditions be quantitatively predicted or interpreted relative to sediment, hydrologic or LOD regime based on key channel variables?
- (2) Does the physical and biologic condition of type 4&5 waters have significant influence on downstream habitat?
- (3) What are the special channel effects in zones or regions, ie Eastern Washington, glaciated terrane.

**TFW PRODUCTS:**

•Risk Assessment Methods for all channels. Field technique for interpreting and predicting location and nature of channel response to changes in sediment, flow or LOD loading. Methods for fish-bearing streams (Type 1-3) and non-fish-bearing (types 4&5) will be provided.

**ACTION STEPS:**

1. Type 4 & 5 water literature review (fall '88)
2. Type 4&5 waters sediment study (spring '90)
3. Program scoping (Jan '91)
4. "Big Earth" Project (Oct. '91)
5. Type 4&5 waters project - Easton (spring '93)
6. Geomorphological watershed analysis ('93-'95)
7. Erosion and glacial deposits ('93-'95)
8. Sediment effects in streams of Eastern Washington. ('93-'95)

**FUNDING:**

BIENNIUM	FY87-89	FY89-91	FY91-93	FY93-95
BUDGET	\$20,000 CMER	\$189,500 CMER	\$244,000 CMER	\$341,000 CMER

**PROJECT LIST:**

- (1) Type 4&5 waters literature review (SH-2)--Complete 1988.
- (2) Type 4&5 waters sediment study (SH-7)--In progress
- (3) Cumulative Effects Risk Screening using aerial photograph (SH-8)--In progress
- (4) Stream Process Model--Component of "Big Earth" project (SH-10)--In progress
- (5) Type 4&5 waters characterization (In progress).
- (6) Geomorphological watershed analysis ('93-'95)
- (7) Erosion and glacial deposits ('93-'95)
- (8) Sediment effects in streams of Eastern Washington. ('93-'95)

**ISSUE:** Sediment BMPs.

**PROGRAM:** Evaluation of Sediment BMPs.

**RATIONALE:** Forest management practices which influence sediment in streams and effect water quality. It is essential that we evaluate BMP effectiveness. This will assist managers in planning to accomplish both timber and water quality objectives.

**SPECIFIC QUESTIONS:**

- (1) How effective are current BMPs in protecting water quality and which need modification?
- (2) What methods for evaluation of BMPs can be developed?
- (3) How can these methods be implemented?
- (4) What practices are of key importance?

**TFW PRODUCTS:**

- Analysis of Sediment BMP effectiveness ('92-'95).
- Recommend changes to BMPs (spring '95).
- Methodologies for field study of BMP effectiveness related to sediment water quality issues ('91-'93).

**ACTION STEPS:**

1. Literature review of assessment methodology completed ('91).
2. Identification of practices of key importance completed ('91).
3. Methodology development for evaluation (winter '92).
4. Conduct field surveys to assess BMPs ('92-'95).
5. Final report of Phase 1 field survey results (spring '95)

**FUNDING:**

BIENNIUM	FY 87-89	FY 89-91	FY 91-93	FY 93-95
BUDGET	NONE	\$44,000 CMER	\$85,000 CMER \$240,000 DOE/EPA	\$138,000 CMER \$115,000 DOE/EPA

**PROJECT LIST:**

- (1) Development of methodologies for evaluating sediment BMPs (completed '91).
- (2) Assessment of BMP effectiveness ('93-'95)& ('95-'97).

**ISSUE:** Forest Chemicals and Water Quality.

**PROGRAM:** Pesticides.

**RATIONALE:** It is critical to determine whether the current regulation are providing adequate protect of water quality. By determining chemical concentrations in water following application we can evaluate effectiveness of regulations relative the water quality criteria.

**SPECIFIC QUESTIONS:**

- (1) Do the current regulations on pesticide application provide adequate protect for water quality?
- (2) What changes may be needed to provide protection, what current regulations may not be necessary?
- (3) How might the current guidelines be modified to better provide the appropriate protection?
- (4) What levels of pesticides in streams are harmful?

**TFW PRODUCTS:**

- Recommended water quality criteria for forest pesticides (completed'92).
- Evaluation of BMP effectiveness/BMP recommendations (on-going'91-'95).
- Recommended monitoring protocol for cooperatoor sampling(completed'92).

**ACTION STEPS:**

1. Review of published information on toxicity and recommended criteria (complete'91-'92).
2. Monitor applications completed (complete'91).
3. Assess stream buffering using aerial photography (on-going'92-95).
4. assess usefulness of alternative monitoring methods (complete'91-'92)
5. Use USFS drift model to evaluate application techniques ('92-'95)
6. Cooperator sampling to assess alternative management practices ('92-'95).

**FUNDING:**

BIENNIUM	FY 87-89	FY 89-91	FY 91-93	FY 93-95
BUDGET		\$37,500 CMER \$85,000 DOE	\$22,000 CMER \$86,000 DOE/EPA \$25,000 COOP	\$19,000 CMER ?

**PROJECT LIST:**

- (1) Development of water quality criteria for forest pesticides (completed spring '92).
- (2) Evaluation of BMP effectiveness through stream sampling at spray units -Phase I ('91-'92).
- (3) Cooperative water sampling of pesticide sprays - Phase II (spring '92 - spring '93).
- (4) Aerial photography assessment of stream buffering (spring '92 - spring '95).
- (5) Computer modeling study of pesticide application techniques. (spring '92 - spring '93).

**ISSUE:** Forest Chemicals and Water Quality.

**PROGRAM:** Fertilizer.

**RATIONALE:** It is critical to determine whether water quality and the aquatic biota are adequate protect under alternate plans. Only by determining potential for achieving toxic levels of fertilizer to the biota can we evaluate these plans..

**SPECIFIC QUESTIONS:**

- (1) Can adequate monitoring of N concentrations be achieved?
- (2) Can guidelines for application be developed?
- (3) How are aquatic biota influenced by sub-toxic levels of fertilizer?

**TFW PRODUCTS:**

- Evaluation of water quality protection from alternate plans (completed 1991).
- Guidelines for application of fertilizer (completed 1991).
- An assessment sub-toxic biotic influences ('93-'95).

**ACTION STEPS:**

1. Monitoring of N concentrations ('89-'91).
2. Produce guidelines for application ('89-'91).
3. Assessment of sub-toxic biotic influences ('93-'95).

**FUNDING:**

BIENNIUM	FY 87-89	FY 89-91	FY 91-93	FY 93-95
BUDGET	\$00 CMER \$ from (WEYCO DNR)	\$00 CMER \$ from (WEYCO DNR)	\$00 CMER	*\$00 CMER

**PROJECT LIST:**

- (1) Monitoring of "N" concentrations following application (completed '90).
- (2) Monitoring of fertilizer distribution patterns (completed '88).
- (3) Assessment of sub-toxic biotic influences ('93 - '95).

\*No funds have been located for the '93-'95 biennium to date.

**ISSUE:** Bioassessment of Forest Practices.

**PROGRAM:** Ecoregion Bioassessment Project.

**RATIONALE:** It is critical to determine baseline biological conditions relative to the influence of forest practices on biota. By using data from unimpacted sites as references we can more appropriately evaluate the effectiveness of current rules that govern forest practices. Different baseline biological conditions may exist in differing ecoregions of the state.

**SPECIFIC QUESTIONS:**

- (1) What methods are appropriate for monitoring of baseline biological conditions?
- (2) Can characterization of macroinvertebrate communities at unimpacted sites be used to identify the influence of forest practices on biota?
- (3) What are the baseline biological differences for differing ecoregions?

**TFW PRODUCTS:**

- Report on biotic communities at unimpacted sites ('92).
- Biota sampling protocol ('92).
- Report on biotic communities at impacted sites with comparison to reference sites ('93-'95).

**ACTION STEPS:**

1. Characterization of communities at unimpacted sites ('90-'92).
2. Development of sampling protocol ('90-'92).
3. Use procedure to evaluate impacted sites ('93-'95).
- \*4. Expand to other ecoregions ('93-'95).

**FUNDING:**

BIENNIUM	FY 87-89	FY 89-91	FY 91-93	FY 93-95
BUDGET	NONE	\$83,000 CMER \$38,000 DOE	\$65,000 CMER	\$140,000 CMER

**PROJECT LIST:**

- (1) Phase I: Reference conditions and monitoring protocol ('91-'92).
- (2) Phase II: Impacted sites assessment ('93-'95).
- \*(3) Ecoregions ('93-'95).

\* The Ecoregions project currently does not have funding.

**ISSUE:** Forest Practices and Water Temperature.

**PROGRAM:** Temperature Project.

**RATIONALE:** It is critical to develop a method to identify sensitive stream sites to temperature. To develop a method it will be necessary to examine water temperature from a basin perspective. The method should provide a tool to assess effectiveness of the current BMPs regarding water quality and temperature.

**SPECIFIC QUESTIONS:**

- (1) Can an adequate method be developed to identify temperature sensitive stream sites?
- (2) How can a basin be characterized relative to water temperature sensitivity?
- (3) How effective are the current BMPs in protection for temperature sensitive streams?

**TFW PRODUCTS:**

- Temperature sensitivity screen ('88-'92).
- Temperature prediction model ('88-'92).
- Evaluation of current riparian rules ('90-'92).
- Downstream impacts of exposed channels report ('92).
- \*Evaluation of type 4 & 5 waters ('93-'95).

**ACTION STEPS:**

- Temperature sensitivity screen ('88-'91).
- Temperature prediction model ('88-'91).
- Evaluation of current riparian rules ('90-'91).
- Downstream impacts of exposed channels ('90-'91).
- Testing and enhancing temperature sensitivity screen and model ('91-'93)
- \*Evaluation of type 4 & 5 waters ('93-'95).

**FUNDING:**

BIENNIUM	FY 87-89	FY 89-91	FY 91-93	FY 93-95
BUDGET	\$00 CMER \$100,00 DOE \$ COOP	\$68,000 CMER \$129,000 DOE/EPA \$7,500 WFPA \$15,000 WEYCO	\$4,000 CMER \$17,000 DOE/EPA	\$25,000 CMER

**PROJECT LIST:**

- (1) Model evaluation and TFW method development (completed '91).
- (2) Downstream temperature impacts of exposed (completed '91).
- (3) Evaluation of current riparian rules ('90-'92).
- (4) Temperature issues related to type 4 & 5 waters ('93-'95).
- (5) Testing/Revision of Temperature Screen & Model ('91-'95).

**ISSUE:** Cumulative Effects on Water Quality.

**PROGRAM:** Watershed Analysis WQ Methods.

**RATIONALE:** There are certain water quality aspects of cumulative effects of forest practices that are not adressed in the current watershed analysis methods manual. These include effects on non-fish aquatic habitats (e.q. macro invertebrates, amphibians, type 4/5 waters) and water chemistry. Mehtods modules need to be developed that will fit within the framework of Watershed Analysis.

**SPECIFIC QUESTIONS:**

- (1) What specific methods (e.g. bioassessment techniques) should be used to evaluate the occurance and potential for cumulative effects on non-fish aquatic cummunities and habitats.?
- (2) What specific methods should be used to evaluate the occurance and potential for cumulative effects on water chemistry?

**TFW PRODUCTS:**

- Watershed Analysis Methods Module(s) for non-fish aquatic habitats ('93-'95).
- Literature/ Research review of aquatic habitat parameters & thresholds for macroinvertebrates and amphibians ('93-'95).
- \*Watershed Analysis methods modules addressing water chemistry. ('93-'95).

**ACTION STEPS:**

- Develop watershed Analysis Bioassessment methods modules, (coordinated with Bioassessment Program workplan), ('93-'95).
- Conduct literature review of habitat parameters & thresholds for macroinvertebrates and amphibians ('93-'95).
- \*Develop Watershed Analysis methods for Water Chemistry ('93-'95).

**FUNDING:**

BIENNIUM	FY 87-89	FY 89-91	FY 91-93	FY 93-95
BUDGET	NA	NA	NA	\$45,000 CMER

**PROJECT LIST:**

- (1) Watershed Analysis Bioassessment methods.
- (2) Literature review of habitat parameters & thresholds for macroinvertebrates and amphibians ('93-'95).
- (3) Evaluation of current riparian rules ('90-'92).
- (4) \*Watershed Analysis methods for Water Chemistry ('93-'95).

\* No funds have been located to support this project during '93-'95 biennium

**ISSUE:** Conversion of forest lands into other forest types and uses displace and impact wildlife (Wildlife Action Plan [WAP], TFW Policy Com. 1990.).

**PROGRAM:** Biodiversity: Maintain representative habitats required to preserve natural biodiversity throughout Washington.

**RATIONALE:** Initial emphasis (WAP, 1990.) is for conversion of oak woodlands to other forest types. Of equal or greater concern is the conversion of forest land to other uses.

**SPECIFIC QUESTIONS:**

- (1) What species are impacted and how does the oak woodlands community change due to conversion of this habitat type?
- (2) What structural attributes need to be maintained in oak woodlands in order to ensure associated fauna will persist over time?
- (3) What is the rate of forest land conversion and how is this affecting wildlife? What wildlife species/communities are being negatively impacted?
- (4) Is forest conversion leading to severe habitat fragmentation and isolation of wildlife populations?

**TFW PRODUCTS:**

- Project List currently under scoping by Steering Committee.

**ACTION STEPS:**

1. Determine the current rate of forest land conversion - from one timber type to another and from timber production to another use.
2. Determine the wildlife species/communities being impacted through forest land conversions.
3. Depict the habitat relationships for those identified wildlife species sensitive to conversion.
4. Determine the degree of isolation forest conversions are presenting to preservation of wildlife and the biodiversity of Washington.

**FUNDING:**

BIENNIUM	FY 87-89	FY 89-91	FY 91-93	FY 93-95
BUDGET	NONE	NONE	NONE	NONE

**PROJECT LIST:**

- Project List currently under scoping by Steering Committee.

- ISSUE:** Wildlife protection needs to be species specific and goal oriented. (Wildlife Action Plan [WAP], TFW Policy Com.1990)
- PROGRAM:** Biodiversity: Identify sensitive wildlife species and their associated habitat types or habitat components affected by forest practices.
- RATIONALE:** "Wildlife protection means maintaining species in a wild state in suitable habitats within their natural geographic distribution so that isolated subpopulations are not created. Protection requires evaluating population levels, species by species, within their geographic distribution across the state: setting goals for those populations, including their habitats, and managing for those goals." (WAP, 1990)

**SPECIFIC QUESTIONS:**

- (1) What wildlife species are sensitive to the effects of forest practices?
  - A. Cumulative Effects: fragmentation/isolation (others)?
  - B. Direct Effects?
    - a. unique/special habitats (riparian, upland etc..)
    - b. structure? (snags, canopy diversity etc.)
- (2) How do wildlife communities respond to forest practices? Does response vary depending on landscape context?
  - A. Community composition?
  - B. Community organization?
  - C. Foraging/breeding guild structure?

**TFW PRODUCTS:**

- Identification/validation of species habitat relationships: Determine habitat variables in terms of structural characteristics that influence wildlife use of managed forests. (NCASI, 1989. TFW-017-089-004; TFW-WSC Landscape & RMZ projects\*, due for completion Fall 1995).
- Characterize habitat variables for RMZs and UMAs. (WDW, 1991. TFW-003-90-003 &- 005).
- Evaluate BMPs-guidelines and recommendations for changes to improve the wildlife effectiveness of RMZs and UMAs. (WDW, 1991. TFW-003-90-003 & -005; TFW-WSC RMZ and Landscape projects\*, Fall, 1995).
- Assess BMPs; describe differences in wildlife species richness between RMZs and riparian areas with differing structural features or riparian areas adjacent to "rotation" age upland habitat. (RMZ project\*, Fall, 1995).
- Assess BMPs; determine changes in riparian and upland habitat wildlife communities correlated with adjacent harvest areas and landscape context. (RMZ and Landscape projects\*, Fall, 1995).
- Assess BMPs; report on how pond-breeding salamanders and bats are influenced by cumulative effects including; fragmentation, isolation, within stand diversity, landscape linkage, etc.. (Landscape project\*, Fall, 1995).

**ACTION STEPS:**

1. UMA/RMZ habitat characterization (completed winter '91).
2. Review wildlife use of managed forests (completed summer '89).
3. Evaluate the effectiveness of RMZs (began fall '90, completion Fall '95).
4. Research wildlife use in managed landscape (began winter '91, completion Fall '95)
5. Investigate specific taxa, management guilds, or species providing detailed habitat relationship descriptions.
  - Pond-breeding salamanders, SW Cascades (Fall '95).
  - Bats, SW Cascades & Selkirks (Fall '95)

**PROGRAM:** Biodiversity: Identify sensitive wildlife species and their associated habitat types or habitat components affected by forest practices.

**FUNDING:**

BIENNIUM	FY 87-89	FY 89-91	FY 91-93	FY 93-95
•LEG. IN-kind:	\$67,500	\$150,837	\$967,992	\$1,254,000
•Res. Team			\$255,320	
•WDW/WCC	\$19,000	\$106,000		
•INDUSTRY				
•USF&W			\$36,000	

**PROJECT LIST:**

- (1) Wildlife use of the Managed Forest: A Review. NCASI 1989. (TFW-017-89-004).
- (2) UMA?RMZ Characterization: Field Procedures Handbook. WDW 1988. TFW-003-90-005.
- (3) UMA/RMZ Characterization: Cumulative Report. WDW 1991. TFW-WLI-91-001.
- (4) Wildlife Effectiveness of RMZs\* (contracted w/WSU, EWU and UW. due for completion; Fall 1995).
- (5) Wildlife in Managed Forests-Landscape Perspective\* (contracted w/WSU, EWU, UW, and PNW labs. due for completion; Fall, 1995).

\* These projects are being conducted in the Southwest Cascades and Northeast - Selkirks. Species/taxa being investigated include: breeding birds, reptiles, amphibians, small mammals, and bats. Other species/taxa/assemblages (ungulates, carnivores, raptors, wintering birds, cavity nesters, etc.) and ecoregions (East-side Cascades, Olympic, North Cascades, Okanogan, Blue Mountains) will be investigated as budget permits. The focused studies in the landscape project are investigating bats (both areas), and pond-breeding salamanders (Southwest Cascades).

**ISSUE:** "Provide the greatest diversity of habitats (particularly riparian, wetlands and old growth) and assure the greatest diversity of species within these habitats for survival and reproduction of enough individuals to maintain the native wildlife of Washington forests."(TFW Agreement, 1987 & Wildlife Action Plan [WAP], TFW Policy Com. 1990)

**PROGRAM:** Biodiversity: Evaluate species-habitat relationships and identify specific habitat characteristics influencing overall habitat effectiveness for wildlife species.

**RATIONALE:** Develop habitat objectives for wildlife and analyze, measure, and evaluate how well the wildlife resource is doing in the forest lands of Washington. (WAP, TFW Policy Com. 1990).

**SPECIFIC QUESTIONS:**

- (1) What are the wildlife-habitat relationships in Washington's forests? Are these relationships altered in managed forests?
- (2) How do wildlife respond to landscape level habitat conditions as created by various timber management strategies? (3) What wildlife species have an affinity with particular habitat types (e.g., wetlands, riparian, old growth), and what are the habitat components that influence their affinity?
- (4) For a given timber/wildlife objective, what factors must be considered in landscape management planning?
- (5) Are wildlife populations in Washington persisting under current forest management strategies?

**TFW PRODUCTS:**

- Literature review of species habitat relationships and monitoring/evaluation strategies and techniques. (NCASI, 1989. TFW-017-089-004; UW, WSU, EWU, 1992. Literature Review-RMZ Study)
- Assess BMPs; measures of wildlife population and community responses relative to various degrees of changing habitat through forest management. (TFW-WSC Landscape & RMZ Effectiveness projects\*, due for completion 1995)
- Identification of structural attributes, seral stages, patch size classes and landscape contexts that influence community composition and species abundance. (TFW-WSC Landscape project\*, 1995)
- Provide a database of stand- and landscape- scale wildlife-habitat relationships. (Southwest Cascades and Northeast Selkirks selected for initial focus; TFW-WSC Landscape project-, 1995)
- Detailed database of wildlife use and specific associations with riparian habitats. (RMZ Effectiveness project\*, 1995).
- Assess BMPs; develop guidelines improving the characteristics of RMZs for wildlife. (RMZ Effectiveness project\*, 1995)
- Assess BMPs; identification/verification of wildlife species associated with various seral stages as influenced by landscape patterns and structural changes produced in managed forests. Inference of specific management induced effects contributing to population and community changes. (TFW-WSC Landscape project\*, 1995 - integration w/results from PNR-GTR-285 [Wildlife and Vegetation of Unmanaged Douglas-Fir Forests] 1991.)
- Provide methods for analyzing wildlife responses to landscape-scale habitat conditions in managed watersheds. The most detailed information will be provided for pond-breeding salamanders and bats. (TFW-WSC Landscape project\*, 1995)

**PROGRAM:** Biodiversity: Evaluate species-habitat relationships and identify specific habitat characteristics influencing overall habitat effectiveness for wildlife species.

**ACTION STEPS:**

1. Review and evaluate wildlife use of managed forest and appropriate habitat modeling techniques. (completed summer 1989)
2. Literature review for wildlife-habitat relationships in riparian areas. (completed fall 1992)
3. Research a variety of landscape patterns predicated on differing harvest strategies and determine influences of these strategies on wildlife. (TFW-WSC Landscape and RMZ Effectiveness projects, Fall, 1995)
4. Conduct intensive studies on wildlife species associated with forests. Determine probabilities of population persistence, given various timber management strategies. (TFW -WSC Landscape project, Fall, 1995).

**FUNDING:**

BIENNIUM	FY 87-89	FY 89-91	FY 91-93	FY 93-95
•LEG. IN-kind:	\$32,500	0	\$967,992	\$1,254,000
•Res. Team			\$255,320	
•WDW/WCC				
•INDUSTRY				
•USF&W			\$36,000	

**PROJECT LIST:**

- (1) Wildlife use of the Managed Forest: A Review. NCASI 1989. (TFW-017-89-004).
- (2) Wildlife Effectiveness of RMZs\* (contracted w/WSU, EWU and UW. due for completion; Fall 1995).
- (3) Wildlife in Managed Forests-Landscape Perspective\* (contracted w/WSU, EWU, UW, and PNW labs. due for completion; Fall, 1995).
  - a. initial focused intensive studies within the scope of this project; salamanders and bats.

\* These projects are being conducted in the Southwest Cascades and Northeast - Selkirks. Species/taxa being investigated include: breeding birds, reptiles, amphibians, small mammals, and bats. Other species/taxa/assemblages (ungulates, carnivores, raptors, wintering birds, cavity nesters, etc.) and ecoregions (East-side Cascades, Olympic, North Cascades, Okanogan, Blue Mountains) will be investigated as budget permits. The focused studies in the landscape project are investigating bats (both areas), and pond-breeding salamanders (Southwest Cascades).

- ISSUE:** Cumulative effects of maintaining entire landscapes in low diversity stands may result in impoverished wildlife resources, (Wildlife Action Plan [WAP], TFW Policy Com. 1990.)
- PROGRAM:** Biodiversity: Evaluate species-habitat relationships and identify specific habitat characteristics influencing overall habitat effectiveness for wildlife species.
- RATIONALE:** Pursue a landscape approach for managing forests. Develop mechanisms for integrating identified prioritized habitat protection needs as part of timber management plans outside specified protection zones.(WAP, 1990)

**SPECIFIC QUESTIONS:**

- (1) How does distribution and juxtaposition of forest age classes (structural classes) influence wildlife? What is the balance needed to maintain natural biodiversity?
- (2) How does patch size and the distribution of patch sizes across a landscape influence wildlife?
- (3) What structural components of patches influence wildlife species and communities both within individual patches and in a broader context throughout a forested landscape?
- (4) What structural attributes are maintained in UMAs and RMZs? How are these influencing wildlife?
- (5) What parameters influence wildlife use and population dynamics in managed forested landscapes?
- (6) How do we evaluate and monitor wildlife in managed forests; can we predict species and/or community responses to proposed management strategies/prescriptions?

**TFW PRODUCTS:**

- Guidelines for quantification of habitat in RMZs and UMAs. Characterize a representative sample of RMZs and UMAs throughout managed forests in Washington (WDW, 1991. TFW-003-90-003 & 005).
- Literature review of habitat parameters influencing wildlife communities and populations in managed forests. Identification of appropriate analysis techniques (NACSI, 1989. TFW-017-089-004; RMZ Effectiveness, Literature Review, 1992).
- Assess BMPs; determine changes riparian associated wildlife populations and communities undergo pursuant to adjacent forest practices (RMZ Effectiveness project\*, 1995).
- Integration of stand level surveys and analyses into landscape-level evaluations to predict the affects of proposed timber harvesting alternatives on wildlife communities and populations (TFW-WSC Landscape project\*, 1995).
- Provide a database of stand- and landscape- scale wildlife-habitat relationships and an analytical procedure for managers to use for forest wildlife management (TFW-WSC Landscape project\*, 1995).
- Focused studies for species/taxa/management guilds determined sensitive to forest management (TFW-WSC Landscape project\*, 1995 - current contract focus on bats and salamanders).
- Assess BMPs; report on the wildlife responses to cumulative effects of forest practices in a forested watershed (TFW-WSC Landscape project\*, 1995).
- Define important stand physical and botanical habitat characteristics that forest managers should strive to create or retain during timber harvest (RMZ Effectiveness and TFW-Landscape projects\*, 1995).
- Develop BMPs; determine the implications for wildlife of staggering harvest units, varying the sizes of harvest units and/or leaving corridors/linkages between like patches within forested landscapes (TFW-WSC Landscape project\*, 1995).

**PROGRAM:** Biodiversity: Evaluate species-habitat relationships and identify specific habitat characteristics influencing overall habitat effectiveness for wildlife species.

**ACTION STEPS:**

1. Develop a techniques manual and characterize physical and botanical features of RMZs and UMAs (completed fall 1991).
2. Review and evaluate wildlife use of managed forest and appropriate habitat modeling techniques (completed summer 1989).
3. Research a variation of landscape patterns predicated on differing harvest strategies. Determine the influences on wildlife this gradation of management strategies projects (TFW-WSC Landscape project, Fall, 1995).
4. Review current protection measures in relation to maintenance of biodiversity (RMZ Effectiveness and TFW-WSC Landscape project, Fall, 1995).

**FUNDING:**

BIENNIUM	FY 87-89	FY 89-91	FY 91-93	FY 93-95
•LEG. IN-kind:	\$67,500	\$150,337	\$967,992	\$1,254,000
•Res. Team			\$255,320	
•WDW/WCC	\$19,000	\$106,000		
•INDUSTRY				
•USF&W			\$36,000	

**PROJECT LIST:**

- (1) Wildlife use of Managed Forests: A Review. NCASI 1989. TFW-017-89-004.
- (2) UMA/RMZ Field Procedures Handbook and Characterization. WDW 1991. TFW-003-90-003 & 005; TFW-WLI-91-001.
- (3) Wildlife Effectiveness of RMZs\* (contracted w/WSU, EWU and UW. due for completion Fall, 1995).
- (4) Wildlife in Managed Forests-Landscape Perspective\* (contacted w/WSU, EWU, UW, and PNW labs. due for completion Fall, 1995).

\* These projects are being conducted in the Southwest Cascades and Northeast - Selkirks. Species/taxa being investigated include: breeding birds, reptiles, amphibians, small mammals, and bats. Other species/taxa/assemblages (ungulates, carnivores, raptors, wintering birds, cavity nesters, etc.) and ecoregions (East-side Cascades, Olympic, North Cascades, Okanogan, Blue Mountains) will be investigated as budget permits. The focused studies in the landscape project are investigating bats (both areas), and pond-breeding salamanders (Southwest Cascades).