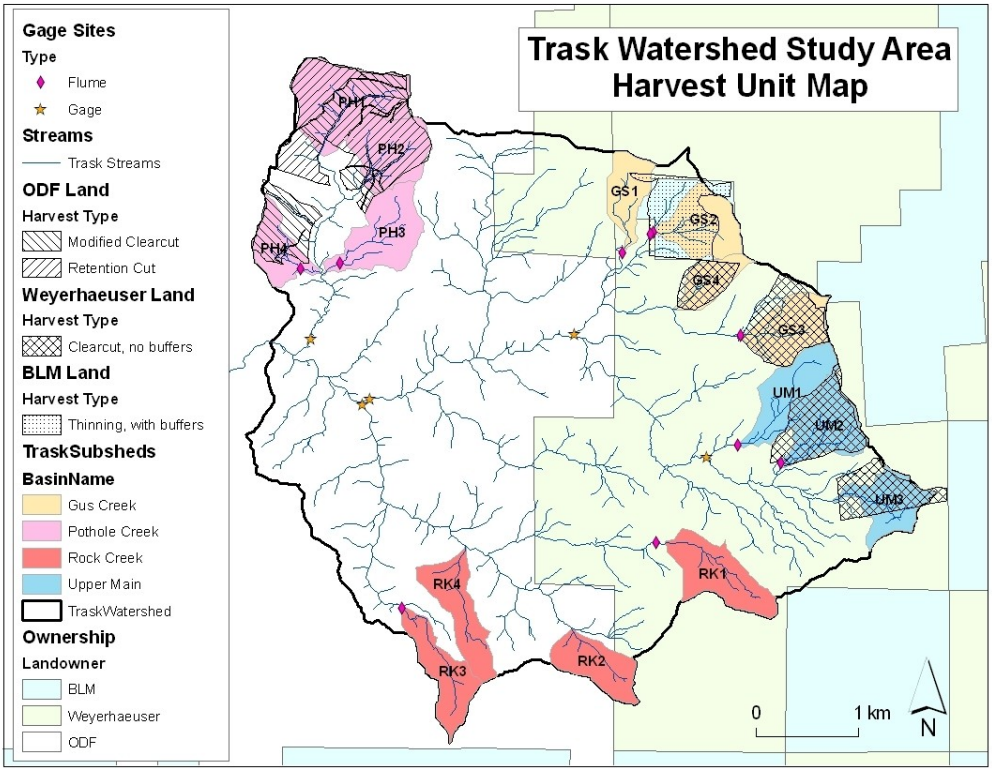
TRASK RIVER WATERSHED RESEARCH REPORT
2006-2009

The Trask Watershed Study is a multi-disciplinary, long-term research project designed to evaluate the impacts of forest harvest on public and private lands to aquatic ecosystems within the harvest areas as well as downstream. Multiple headwater basins in the Trask will be clearcut harvested in 2012; forested riparian buffers along small non-fish bearing streams will be retained on public land but not on private land. The results from this experimental study will provide resource managers with expanded understanding of both direct and indirect effects of forest management on aquatic ecosystems.

The investigations in the Trask River Watershed Study will comprehensively examine the mechanisms and processes that drive aquatic ecosystems, including physical, chemical and biological. Field-collected data will be combined with process models to elucidate aquatic responses to forest management in headwaters and the manner and degree to which harvest in headwaters can influence downstream aquatic communities.

This report provides initial highlights of research since inception of the study in 2006.

Map below shows Trask Watershed study area with headwater study basins delineated. Areas planned for harvest in 2012 are shown as well as forest ownership.



Subject area: Fish

Researchers: Jason Dunham, USGS, Principal Investigator; Doug Bateman, OSU, Senior Faculty Research Assistant; David Hockman-Wert, USGS, Biologist; David Leer, OSU, Faculty Research Assistant, Steven Clark, OSU, Contractor.

Overview of Trask fish field research:

2006 Objectives:

- Determine occurrence and distribution of fishes within the Trask Watershed Study area.
- Install stream markers for use as points of reference throughout fish bearing portions of the stream network throughout the Trask Watershed Study area.
- Develop a research design to study use of instream cover by larger (>100 mm) coastal cutthroat trout (Heidi Vogel-Andersen, MS, Fisheries and Wildlife, Oregon State University).
- Develop and vet a conceptual framework for studying fishes and forestry impacts in the Trask Watershed Study.

2007 Objectives

- Initiate intensive monitoring of fishes in headwater sites during summer low-flows immediately downstream of proposed forest harvest treatments (Pothole, Gus, and upper mainstem East Fork South Fork Trask, and in untreated stream (Rock Creek).
- Implement study of instream cover
- Develop a research design to study trophic interactions between salmon, trout, and sculpins (Mark Raggon, MS, Fisheries and Wildlife, Oregon State University.

2008 Objectives

- Continue intensive monitoring of fishes in headwater sites during summer low-flows
- Initiate late spring – early summer monitoring of emigration of larger (>100 mm) coastal cutthroat trout from headwater sites
- Complete first MS thesis by Heidi Vogel-Andersen examining use of instream cover by larger (<100 mm) coastal cutthroat trout
- Develop a research plan to implement a modeling and experimental study of factors influencing population dynamics of coastal cutthroat trout (Brooke Penaluna, Ph.D., Fisheries and Wildlife, Oregon State University)

Summary of key fish research findings: (*preliminary*)

2006 key findings

- Fish distribution described by widespread occurrence of coastal cutthroat trout, sculpins, and coho salmon in two sites: Pothole Creek and Rock Creek. Limited numbers of steelhead trout present in the Trask Watershed study streams.
- A conceptual framework was drafted and converted into a presentation that has been delivered to several audiences for discussion and feedback.

2007 key findings

- Intensive monitoring was successfully implemented, including installation and maintenance of weirs to track immigration and emigration of individual fish on a daily basis from late July through mid-September.
- During the intensive monitoring, it was found that growth of fish was fastest for smaller (<100 mm) salmon and trout, and minimal (not measurable) for larger (>100 mm) coastal cutthroat trout. Survival of coastal cutthroat trout was greatest for fish approximately 100 mm in size and lower for both smaller and larger fish. Immigration and emigration during the monitoring period was very restricted.
- A research review for Mark Raggon's thesis proposal was successfully conducted. A copy of the proposal is available on request.

2008 key findings

- Intensive monitoring successfully implemented for a second year. Rates of immigration and emigration were very low, as with 2007. Analysis of growth rates and survival ongoing as of February 2009.
- Early season monitoring of emigration by larger (>100 mm) coastal cutthroat trout indicated limited movement from late May through mid-July.
- Annual recaptures of individual fish between 2007 and 2008 have provided good information on growth rates outside of the low-flow season and will provide the basis for evaluating the accuracy and efficacy of analysis of growth rates based on fish scales.
- Heidi Vogel-Andersen completed her MS thesis entitled "Transferability of Models to Predict Selection of Cover by Coastal Cutthroat Trout in Small Streams in Western Oregon, USA" which is available in full text and also being prepared for publication in a peer-reviewed journal.
- Field data for Mark Raggon's thesis was collected and are now being processed.
- A research review for Brooke Penaluna's Ph.D. research proposal was successfully conducted. A copy of the proposal is available on request. Field data to parameterize models to simulate coastal cutthroat trout population dynamics in relation to future impacts of natural processes and forestry are being collected, and experiments to evaluate population responses to changes in instream cover are being designed for implementation at the Oregon Hatchery Research Center.

2009 key findings

- Completed a third year of intensive fish population monitoring at four sites immediately downstream of treatment and control watersheds within Trask: Pothole Creek, Rock Creek, Gus Creek, and upper Mainstem Trask. Evaluation of

these data will include summaries of fish growth during intensive monitoring (late July-Sept), population size, size structure, fish movement, recruitment, survival, instream habitat characteristics, and annual rates of growth for fish recaptured over 2007-08 and 2008-09.

- Preliminary results are showing: 1) The phenology of emergence of young-of-year coastal cutthroat trout varies among years and can be substantially delayed in some sites; 2) there is a consistent pattern of higher maximum growth rates in coastal cutthroat trout from Gus Creek; 3) seasonal survival shows a weak influence of size, with larger fish showing lower probabilities of survival, consistent with work on Hinkle Creek; 4) whereas there is considerable variability in responses we have measured, it is the pattern of variability itself that is more interesting than trends in mean or median values.
    - Further analysis and interpretation will be conducted in 2010 and the first manuscript on annual monitoring will be prepared for publication in a scientific journal.
- Mark Raggon, MS thesis research: Mark has nearly all of the data he needs to complete his thesis and is currently analyzing data. He is focusing on seasonal (spring-summer-fall) dynamics of predation by sculpins, coho, and coastal cutthroat trout (50-100mm, >100 mm). Diets of these species are currently being summarized through statistical comparisons of counts of different prey items by species and season, diet overlap (Morisita's index), niche width (Bolnick et al.), and food limitation using standard bioenergetic approaches (e.g., the Wisconsin bioenergetics model). Results of this work will provide the first quantitative descriptions of food limitation and resource overlap in sculpins versus salmonids in headwater streams in the Oregon Coast Range. Understanding interactions among these different predators should provide critical information for evaluating forestry impacts (e.g., consumer regulation versus bottom-up ecosystem processes that determine food supply, individual growth, and survival). Mark will complete his thesis in 2010.
- Brooke Penaluna Ph.D. dissertation research: Brooke successfully completed two trials of a manipulative experiment at the Oregon Hatchery Research Center this summer (June-October 2009). The experiment consisted of 8 experimental units located within the semi-natural stream channels at the OHRC. Treatments consisted of high and low cover based on results of field studies of hiding cover in WRC streams (Andersen 2008). The first trial was heavily impacted by predation from kingfishers. These birds invaded the experiment in spite of limited access to the channels, providing a direct demonstration that predators can have large impacts on fish populations during summer low flow. The second trial was free from impacts of terrestrial predators. Results of this work have yet to be fully summarized, but we anticipate a full analysis of individual and population-level responses to hiding cover. This is a complement to prior field observational work and will help to link patterns observed to actual processes and population consequences. Brooke is also working to complete data collection needed to fully parameterize an individual-based model (inSTREAM) to further explore individual and population consequences of changes in discharge, temperature, sediment, and fish assemblages (e.g., competition) with specific reference to

streams in Trask. This will provide us with a prospective view of potential forestry or other impacts on coastal cutthroat trout in Trask. For example, if timber harvest increases water temperatures, based on modeling within inSTREAM we will have some a-priori predictions about what specific processes should be influenced and why. This is complementary to the more simplistic "before-after" analysis of change, or pattern-based approaches.

- Ben Ramirez, MS thesis research: Ben is just beginning his program of study and will be focused on growth and bioenergetics of coastal cutthroat trout across all three WRC studies (Hinkle, Alsea, Trask). Data from these studies provides a rich spatial and temporal template for understanding these responses. Through this work we will be able to better understand processes influencing growth, a major variable measured across all studies. Ben is currently in the early stages of drafting a research proposal.

Fish Data on shared directory:
Last update Nov 2009

Fish Metadata :
2006 network protocols and 2007-2009 weir protocols are on shared directory
Data and metadata for Heidi Vogel-Andersen study are included in thesis

Products:
MS Thesis: Andersen, H.V. 2008. Transferability of Models to Predict Selection of Cover by Coastal Cutthroat Trout in Small Streams in Western Oregon, USA. MS thesis, Fisheries Science, Oregon State University, Corvallis, OR.
http://hdl.handle.net/1957/9969

Presentations at Scientific Meetings:
Penaluna, B., and J. Dunham. 2009. Individual- and population-level dynamics of coastal cutthroat trout: examining roles of physical and biotic processes using individual-based models and manipulated experiments. Oral presentation at the 2009 Oregon Chapter American Fisheries Society Meeting, Bend, OR.

Raggon, M., and J. Dunham. 2009. The ecological relevance of seasonal and spatial variability in diet and consumption by cottid and salmonid fishes in headwater streams in western Oregon. Poster presentation at the 2009 Oregon Chapter American Fisheries Society Meeting, Bend, OR.

Leer, D., S. Clark, and D. Bateman. 2009. Low Cost Weir Design for Monitoring Fish Movement in Small Headwater Streams: Examples from the Trask River Watershed Study. Poster presentation at the 2009 Oregon Chapter American Fisheries Society Meeting, Bend, OR.

Penaluna, B. 2009. A cutthroat story with some serendipity. Oral presentation at the 2009 Western Division American Fisheries Society Graduate Colloquium, Fort Collins, CO.

Fish Projects

1. Project title: Quantifying use and selection of hiding cover by salmon and trout across paired watershed studies in western Oregon (Heidi Vogel-Andersen, MS thesis)
Name of funding source: Oregon State University College of Forestry, Forestry Sciences Laboratory (FRL) Fish and Wildlife Habitat in Managed Forests Research Program
Amount allocated: $59,672
Year(s): 2007-2008

2. Project title: The importance of sculpins in headwater streams: implications for understanding forestry influences on salmon and trout (Mark Raggon, MS thesis)
Name of funding source: Oregon State University College of Forestry, FRL Fish and Wildlife Habitat in Managed Forests Research Program
Amount allocated: $62,675
Year(s): 2008-2010

3. ***Project title:*** Integration of individual-based simulation models and empirical field studies to understand forestry impacts on salmonids at multiple scales in the Oregon Coast Range (Brooke Penaluna, Ph.D. dissertation)
***Name of funding source*:**U.S. Geological Survey, Forest and Rangeland Ecosystem Science Center, Forest Science Partnership
Amount allocated: $179,540
Year(s): 2008-2011

Subject area: Amphibians

Researchers: Michael Adams, USGS, Principal Investigator; Nathan Chelgren USGS

Overview of Trask amphibian field research:
2007 Objectives

- Begin a pilot study to determine workable goals and physical methods for monitoring stream amphibians in headwater and cumulative reaches with minimal impact.
- Determine whether individual marking is feasible.
- Conduct pilot work in the headwaters at one sub-basin per basin to capture variation that might be encountered across the Trask watershed.
- Determine efficacy and identify key sources of variation in capture methods.
- Resolve decisions on the dimension and location of headwater reaches as well as plot size and number of repeat visits.

2008 Objectives

- Expand amphibian electroshocking efforts to 300-m reaches in all 14 headwater sub-basins plus the original four cumulative reaches.

- Investigate marking and electroshocking impacts on growth and survival of *Ascaphus* and *Dicamptodon* using enclosure experiments.
- Measure multiple demographic responses of *Ascaphus* and *Dicamptodon* in order to separate, to the extent possible, impacts on terrestrial stages from impacts strictly on aquatic stages.

Summary of key amphibian research findings:

2007 key findings

- Electroshocking in headwater reaches is very effective for capturing stream amphibians. Efficacy exceeded our expectations in the headwaters and should result in our precisely estimating abundance and demographic rates with a reasonable number (2-3) of capture occasions per sampled plot.
- Electroshocking in the cumulative reaches on the other hand is on the order of one tenth as effective as in the headwater reaches. This will somewhat limit our inferential ability in the cumulative reaches. Shocking intensity is limited by the tolerance of the fish which are much more susceptible to the method and liable to incur injury than the amphibians.
- Methods were developed to individually mark larval *Ascaphus* and *Dicamptodon*.
- In the headwaters, variation in capture probability was larger between plots within reaches than it was between reaches indicating that attention to plot-specific capture probability covariates is warranted.

2008 key findings

- We completed a total of 934 electroshock surveys of 5-m plots in 14 headwater sub-basins. Four electrocking surveys were completed in each of the four cumulative reaches, coincident with the fish sampling.
- Captures of marked individuals totaled 1336 *Dicamptodon* and 1746 *Ascaphus*, of which 258 and 264 were recaptures. Numbers of individuals recaptured were adequate to measure growth rates and summer movements.
- Capture probabilities were high as in 2007 and should result in precise estimates of abundance by size/year class in the headwater reaches.
- Of the small number of animals marked in 2007, we captured 17 that retained marks in 2008 leading to preliminary information on over-winter movements. These are novel data for *Ascaphus*, and very important from the standpoint of understanding impacts for both species. This is a good indication that 2009 work will result in adequate sample sizes for reasonable estimates of over-winter movement rates. Large movements were observed, exceeding 120 m downstream. Maximum upstream movement was zero and five meters for *Ascaphus* and *Dicamptodon*, respectively.
- *Dicamptodon* larvae were captured in all 14 headwater sub-basins, while *Ascaphus* and *Rhyacotriton* were absent from three and one sub-basin, respectively.
- Marking and electroshocking effects experiments were very promising especially for *Ascaphus*. There appeared to be no concern in terms of mortality for either species. *Dicamptodon* marking revealed some concern for PIT retention. As a result, individuals of large enough size to PIT tag in 2009 will be double-marked

using elastomer. The marking and shocking experiment will be repeated in 2009 to increase sample size for *Dicamptodon* and to include individual handler effects for both species.

2009 key findings

- This was our second year of sampling and we completed 587 5-m plot searches in headwater reaches which yielded 3398 *Ascaphus*, 2747 *Dicamptodon*, 461 *Rhyacotriton* captures, and 125 over-winter recaptures (18 *Ascaphus* + 107 *Dicamptodon*).
- Key response variables differ among reaches and over time. Our emphasis at this stage of the study is to characterize this heterogeneity so that we can compare it to post treatment patterns to determine treatment effects.
    - There are highly significant differences in initial body size of *Ascaphus* between reaches.
    - Within developmental stages, body size of *Ascaphus* declines steeply over the summer despite individual growth. This decline differs significantly between reaches.
    - There was a 40% increase in numbers of adult *Ascaphus* captured over 2008 despite fewer searches completed. Despite the overall increase in *Ascaphus* captures, the majority of plots were remarkably similar in the abundance of *Ascaphus* between years. The increase was due to changes at a minority of plots.
    - Movements were reduced in 2009 from 2008 for *Ascaphus* but not for *Dicamptodon*.
- We have determined that our methods are working well and no adjustments are needed.

Products: Presentations

Adams MJ, Leuthold N, Chelgren N. The impact of forest practices on amphibians: preliminary results from Hinkle Creek and future investigations at the Trask Paired Watershed Study. Meeting of the Watershed Research Cooperative, October 2008.

Amphibian data on shared directory:

2007 -2009 amphibian data are on the shared directory.

Amphibian metadata :

2007 -2009 field protocols are on the shared directory.

<u>Amphibian Projects</u>

Subject area: Aquatic and Terrestrial Riparian Invertebrates

Researchers: Judith Li, OSU Dept. of Fisheries & Wildlife, Principle Investigator; Janel Sobota and Richard Van Driesche, OSU Research Assistants, Dept. of Fisheries & Wildlife

Fisheries and Wildlife Undergraduate students supported on these funds, but not towards degree credits:

1 Summer field worker in 2007 and 1 work study students
3 field workers in 2008 and 2 work study students
2 Interns (Tuskegee Institute)

Overview of Trask field research:

- **Objective is to assess species composition, density, biomass across basins and compare headwater sites with downstream sites**

- **Examine annual fluctuations in stream invertebrates pre-harvest.**
  - 2006: June: Benthic invertebrates collected at 18 sites (10 headwaters; 8 downstream)
  - 2007: early May and late June: Benthic and drifting invertebrates at 15 sites; August: Benthic invertebrates at downstream sites where fish were sampled
  - 2008: late June: Benthic and drifting invertebrates at 15 sites; Aug: Benthic and drift at 4 downstream sites
  - 2009: April, late June: Benthic and drifting invertebrates at 15 sites; Sept: Benthic at 4 downstream sites. Biomass in addition to density at sites will be calculated starting with 2009

- **Assess prey availability for fish.**
  -August 2008 in coordination with fish diet study, benthic invertebrates (Fish diet to be collected and analyzed by J. Dunham & students)

- **Assess prey availability for birds during riparian bird surveys** (4 sites):
  -Emergence of aquatic adults (8 weeks, mid- July-August 2008, 2009) Multiple emergence traps collected at each site 2 times a week
  -Riparian terrestrial insects (8 weeks, mid-July – August 2008, 2009) Malaise traps at streamside and 200 m upslope
  -Riparian bird fecal pellets collected during daily mist netting (2008).

- **Experimentally examine changes in aquatic life history patterns as a response to higher temperatures.**
  - Experiments at Oregon Hatchery Research Station studying caddisfly, mayfly and stonefly species during aquatic maturation and adult emergence. July-November 2007

Summary of key research findings:

2006 key findings

- Headwater benthic assemblages distinctive from downstream.
  In several tributaries downstream densities tended to be higher than upstream.
  Benthic invertebrate richness ranged from 38 to 47 taxa.

2007 key findings

- Lab experiments at Oregon Hatchery Research Center suggest that a change of 3 degrees Centigrade during growing season for autumnal emerging invertebrates could result in changes in growth and time of emergence, though the specific changes are taxa-specific. These changes may be detectable following increased temperatures associated with harvest or climate change.
- Community analyses of invertebrates in Trask streams using NMS-Ordination shows no distinctive grouping by sites among any of the four basins or by year. Spring vs summer 2007 show some seasonal differences in assemblages. Headwater benthic assemblages are distinctive from downstream. Benthic differences between headwater and downstream sites persisted in Spring 2007 samples.
- A comparison with other Watershed Research Cooperative basins shows spring benthic invertebrates at the Trask tended to be higher in taxa richness than in the Alsea watershed, and comparable to uncut reaches at Hinkle Creek. Benthic densities were not different from those at Alsea and higher than at Hinkle.

2008 key findings

- Examination of bird fecal pellets show that the few riparian birds captured in summer 2008 ate very little aquatically-derived prey (n = 54)
- More Diptera emerged than other aquatic orders over the summer. Ephemeroptera, Trichoptera, and Plecoptera emerged from all streams through July and August.
- Preliminary analyses of flying insects from Malaise traps indicates more abundance of flying-insects steamside than in the upland. The majority of insects are Diptera, streamside and upland. Higher biomass insects with terrestrial origin than than aquatic, both streamside and upland.

2009 key findings

- Biomass of stream invertebrates was similar in downstream and headwater sites in April and June. Downstream sites show slight decrease in biomass in September, with the exception of Pothole.
- Completed analysis of OHRC experiment suggests that response to increased temperatures varies among fall emerging taxa. Earlier emergence occurred for *Psychoglypha*, particularly for males. For other species, as in the response of the mayfly *Paraleptophlebia,* current conditions may be optimal, and heated temperatures resulted in smaller sizes and/or less synchronous emergence between sexes. A manuscript is in preparation for submission to Journal of the North American Benthological Society within 2 months.

Invertebrate data on shared directory:

Benthic density and drift 2006, 2007; Emergence and malaise density 2008; Benthic biomass 2009

Invertebrate Metadata:

Benthic and drift methods posted and updated in February, 2009

Invertebrate Projects

Products: presentations
J. Li, S. Johnson & J. Sobota. Invertebrate Emergence response to Temperature: April 2008, OHRC Board Meeting

J. Li, S. L. Johnson, J. Sobota, and W. Gerth: An experimental test of increased temperature on aquatic insect emergence timing and adult size. North American Benthological Society, National Meeting, Salt Lake City, UT, May 28, 2008

J. Li. Comparing Invertebrate Networks in the WRC Paired Watersheds. WRC workshop, October 2008

Subject area: Algae, FBOM standing stocks, stream chemistry and primary productivity

Researchers: Sherri L. Johnson, US Forest Service, Pacific Northwest Research Station, Principle Investigator; Linda R. Ashkenas, OSU Dept of Fisheries and Wildlife Senior Faculty Research Assistant

Overview of Trask field research:
Objectives
Evaluate and understand drivers of instream productivity and benthic resources across the Trask study sites to compare among headwaters and across seasons and years as well as upstream to downstream.
Chemistry

- Synoptic stream water grab samples were collected from 17 headwater and 12 downstream sites in late summer 2006 and analyzed for all dissolved nutrients, cations, and anions, including pH and alkalinity. Subsequent sampling in spring and early summer of 2007, 2008, 2009 has focused on the four downstream sites and 12 headwater sites. Analyses are limited to primary nutrients (C,N,P) and selected cations and anions.

Algae

- Stream epilithic algae are sampled from rocks in early spring (prior to leaf-out, flows and access permitting) and early summer, in conjunction with benthic macroinvertebrate sampling at downstream and headwater sites. Additional samples are collected in the four downstream fish study reaches in late summer.
- Analyses include biomass (standing stocks), photosynthetic pigments (primarily chlorophyll A) and community composition of algae.
- Community composition samples are preserved and archived, and the other samples are analyzed in the laboratory within one month of collection.
- Sampling began in summer 2006 and took place at 10 headwater and 7 downstream sites. Subsequent sampling has focused on the core clusters of 4 downstream sites and 11 headwater sites.

FBOM:

- Surface and subsurface (to 5 cm depth) deposited benthic sediments are sampled in the core four downstream and 12 headwater sites. The replicated samples are analyzed for fine organic and inorganic mass per unit area.
- Sampling began in spring 2007 and continues each summer during late June sampling to coincide with other benthic sampling.
- Because of substrate disturbances, sampling is only done once per year at beginning of low flow period
- Stream widths and depths are measured at the time of sampling.

Whole stream metabolism:

- In summer 2008, ecosystem metabolism estimates were made for all 4 downstream sites and 10 of the headwater sites. These measurements were repeated in 2009 at 11 headwater sites from mid-June to mid-July. Four downstream site measurements occurred during early September 2009 due to sampling constraints at higher flows and to coincide with the fish end-of-summer sampling. Additional measurements in 2 headwater sites were conducted in April 2009.
- The calculations of metabolism involve monitoring of water temperature, specific conductance, and dissolved oxygen over a 3-4day period. During this period, a short term (2-4 hour) tracer release of conservative solutes and gas were performed. The tracers, in addition to providing information required to calculate rates of primary production and respiration, provide estimates of discharge, surface velocity, reaeration rates, retention time and ultimately transient storage (both surface and hyporheic). Detailed width and depth measurements were also taken during these sampling periods.

Summary of key research findings:

Chemistry

- Preliminary findings show strong influences of geology, subsurface flow paths and streamside riparian vegetation for dissolved nutrients and cation/anion concentrations. Headwater basins within the Trask show nitrogen or phosphorus limitation, depending on location. Seasonal variation in concentrations is also observed.
- 2009 Samples have been filtered and frozen. Additional chemical analyses will be performed as funding permits.

Algae

- Initial results show a strong effect of seasonal riparian canopy shading, with the samples collected during early spring showing higher chlorophyll A than those collected during summer, however, this trend is strongest in 2007 and weaker in 2008 and 2009.
- Standing stocks (i.e., dry mass) do not necessarily reflect this trend, however.

- There are significant differences among the basin clusters, but headwater vs. downstream differences are less striking.

FBOM

- Total amount of both organic and inorganic material in the subsurface is twice the amount on surface of streambed.
- Surface sediments generally have a higher proportion of organic material than subsurface.
    - Headwater sites generally have greater standing stock of fine sediments than their downstream sites. However, the four clusters show very different patterns of deposition.
    - Preliminary results suggest annual variability in amount and proportion of organic and inorganic fractions, with least amounts present in 2009.

Metabolism

- All streams are at or above oxygen saturation, i.e., anoxic or low oxygen conditions were not found, even in low gradient streams at summer base flows.
- Hydraulic residence times are short, indicating relatively simple flowpath channels during early summer. However, additional analysis of tracer data will give us some estimates of hyporheic storage to confirm this initial result.
- All streams are strongly heterotrophic, i.e., respiration is greater than primary production. This is the norm in heavily shaded, forested streams with large inputs of terrestrial plant material.

Data on shared directory:

Chemistry June 2008
(traskWRC\DataAndMetadata\Physical\Chemistry)
Algae September 2009
(traskWRC\DataAndMetadata\Biotic\PrimaryProducers\StandingStocks)
FPOM June 2009
(traskWRC\DataAndMetadata\Biotic\BenthicOrganics\FBOM)
Metabolism Aug 2008
(traskWRC\DataAndMetadata\Biotic\PrimaryProducers\PrimaryProduction)

Metadata complete

Products: presentations

S. Johnson. Forty years of lessons learned about the impacts of forest practices on stream temperature. Watershed Research Cooperative Workshop, Corvallis, Oregon. 2008.

S. Johnson, J Dunham, Trask Watershed Research Study, EcoTrust Portland, April 2009

S. Johnson. Trask Watershed Research Study: Forest stream interactions, Portland State Univ., May 2009

S. Johnson, R. Bilby, J. Li, J. Dunham, M. Adams. Trask River Watershed Study: New food web studies of forest-stream interactions in a managed landscape. North American Benthological Society, Grand Rapids, Michigan. May 2009.

Subject area: Hydrology

Researchers: Arne Skaugset, OSU Forest Engineering and Resource Management, Principle Investigator; Amy Simmons, OSU Faculty Research Assistant; Maryanne Reiter, Weyerhaeuser Company

Overview of Trask field research:
Water Year 2006

- Stream gaging stations and data loggers installed at mainstem Trask and Rock Creek. Collection of data for rating curves began.

Water Year 2007

- Installed Turbidity Threshold Sampling (TTS) stations at five main stem or downstream locations in the Trask Watershed. Began data collection of stage, turbidity, water temperature, specific conductance, suspended sediment samples and water discharge measurements.

Water Year 2008

- Continued data collection at the five downstream TTS stations. Installed and instrument six headwater locations (Gus 3, Pothole 3 and 4, Rock 1, and Upper Main 1 and 2) with flumes, sheds, and sensors.

Water Year 2009

- To present, continued data collection at five TTS stations and begin data collection at six headwater flume locations. Maintenance performed on sites as necessary.

Summary of key research findings:
Data collection is in the pre-calibration phase. Results are not available yet.

Data on shared directory:
Discharge, Stage, Turbidity, Suspended sediment, Stream temperature Sept 2009
\traskWRC\DataAndMetadata\Physical\Sediment(TTS)\Trask_Hydrology.mdb

Metadata:
Metadata will be posted to the shared directory by end of 2009

Subject area: Low flow hydrology

Researchers: Maryanne Reiter, Weyerhaeuser Company and Liz Dent, Oregon Dept of Forestry

Overview of Trask research:
2009 Objectives:

- Our overarching objective for the Trask Watershed hydrology study is to characterize the low summer flow patterns in the Trask, especially in relation to stream temperatures and biological characteristics. Our low flow hypotheses for the Trask Watershed include: A) Summer stream temperature patterns are a function of low patterns; B) Streams with lower ground water contributions have more variable summer stream temperature patterns; C) Stream temperature response to harvest will in part be dependent on low flow patterns.
- Small headwater streams represent a new challenge for studying hydrology. Many of the traditional measurement techniques are not appropriate for these small streams. Therefore, the 2009 summer was a pilot effort to test methods and evaluate preliminary low flow patterns and trends.

Summary of key research findings: (*preliminary*)
2009 key findings

- The stage response of 13 small catchments varies across the Trask study area. Some of the catchments (PH3, Gus 2 and 3 and UM 3) show little diurnal fluctuation in low flow stage height, while others, like PH4 show more change.
- Stage height sensors in PH1 and 2 were in the streams during storms and used to examine stage response. For the early fall storms in these streams, diurnal fluctuations re-established following the rain until there was sufficient rainfall to mute the effect. By mid-Oct no diurnal fluctuations were observed. These headwater sites showed lagged responses to early storms compared to USGS Trask stream gage. This lag decreased after 4-5 storms.

Data and metadata on shared directory:
The data have not yet been shared on the directory.

Subject area: Stream Temperature and Climate Stations

Researcher: Maryanne Reiter, Weyerhaeuser Company; Peter James, Weyerhaeuser Company

Objectives:
To provide timely and quality climate data for Trask researchers.

Overview of Trask field research:

- Weyerhaeuser installed two climate stations in 2005. The weather stations both have an Onset® tipping bucket rain gage, air temperature, relative humidity and solar radiation sensors. They also have an anemometer for wind direction and

speed. The Southern climate station is at approximately 700 m elevation and the North station is at 580 m.

- Water temperature was monitored during summer of 2006 at 33 sites within the Trask watershed and at 31 sites in 2007 and 2008. In additions, air temperature was monitored at 6 sites in the study area in 2006 through 2008.
- A telemetry system at the South Weather station was installed in 2009 and a barometric pressure sensor added.

Summary of key research findings:

2006-2008 key findings

- For the South Station, July had the highest mean monthly air temperatures for all years while minimum temperatures occurred in January, although 2008 was milder than the other years.
- Average water year rainfall ranged from 83.20 inches for WY 2008 to 90.48 inches for WY 2006. The total monthly rainfall for the South Climate Station tracks well with the nearby Rye Mountain RAWS station (elev. 610 m) to the south of the study watershed. December has the highest average precipitation with 17.41 in while July has the lowest average (0.68 in) for water years 2006 through 2008.
- Stream temperatures for mainstem Trask stations and sub-watersheds were warmest in 2006, coolest in 2007. Stream temperatures for 2008 ranged between the 2006 and 2007 values. The mainstem Trask sites averaged 18.0°C for 2006, 15.8° for 2007 and 16.6°C for 2008. The average maximum for all the sub-watersheds was 13.3°C for 2006, 11.9 °C for 2007 and 12.8 °C for 2008.

2009 key findings

- The telemetry that was installed in the Trask South climate station provided valuable real-time information for researchers. This was important for both data access and field safety concerns.
- Ambient temperature for WY 2009 exhibited the highest mean monthly temperature and instantaneous minimum since monitoring began in 2006. In previous year the monthly minimum occurred in January, however in WY 2009 the monthly minimum (-12.3 °C) happened in December when cold air from the north blasted the northwest. The mean monthly maximum temperature of 17.7 °C occurred in the month of July as the previous 3 years. Overall, absolute maximum temperatures were similar to the last 3 years while absolute minimums tended to be colder.
- Total precipitation for the 2009 WY was 75” for the South Weather station, which was approximately 7” below the previous 2 years. This is comparable to the pattern seen at the nearby RAWS station which received 72.88 in of rain in WY 2009 and roughly 84 in of rain the previous 2 years.
- Stream maximum temperatures were similar to those of 2006. Subshed air temperatures likewise exhibited a similar pattern to 2006. Diurnal fluctuation temperatures can reveal different patterns than the maximum daily. For example while Gus 3 had low maximum temperatures for that subshed group, it had the highest diurnal fluctuations for the summer of 2009.

Data on shared directory
\traskWRC\DataAndMetadata\Physical\temperature through 2008:
\traskWRC\DataAndMetadata\Physical\weatherstation through April 2009

Metadata:
Posted

Shared projects

Project title: Stable Isotope Sampling

Subject area: Food web including terrestrial plants, benthic sediments, algae, invertebrates, amphibians, fish

Researchers: all researchers of biotic groups involved

Overview of Trask field research:

- Samples for stable isotope analysis (primarily ^{13}C and ^{15}N) were collected from a subset of sites in June 2006 and from all sites in early April, late June, and September 2009.
- All components of the stream and riparian food web are being sampled, including in-stream detritus (e.g. fine benthic material, wood), mosses, algae, macroinvertebrates, amphibians, fish and riparian birds. In addition, we are also sampling terrestrial sources of dominant detritus, including alder leaves, fir needles, swordfern,
- In 2009, a concerted effort was made by all crews to sample isotopes simultaneously within the 3 narrow time windows. All samples were frozen prior to preparation for analysis. For stream invertebrates, this necessitated development of new field collection and preservation techniques, as well as laboratory protocols.
- Data collected as part of this process are designed to be shared among all groups.

Summary of key research findings:

- Processing of samples has begun and most of April samples have been evaluated.
- Preliminary results suggest that food web linkages differ between headwater and downstream sites.
- Some groups, (ie. sculpins, fine benthics) are quite consistent in carbon signatures and variable in nitrogen signatures across all of the sites. Other groups, such as salmonid fishes and stream epilithon (algae) are much more variable across C and N signals.

Data and metadata
The data are not yet on shared drive, but are stored on network

Project title: Instream habitats, hemispherical photos and riparian surveys 2008

Subject area: Channel Morphology, riparian shading and characterization

Researchers: Sherri Johnson, Linda Ashkenas
Field assistance by Richard van Driesche, Brett Morrissette, Kylie Meyer, Yahn-Jauh Su

Funding source: Oregon Watershed Enhancement Board (OWEB) equipment grant

Description:

- Pre-treatment measurements of stream channel components and riparian characteristics, including relative species abundance, overstory and understory vegetation, riparian tree size and species, and degree of channel shading conducted at 4 downstream locations and 14 headwater sites according to pre-established protocols.
- Parameters measured included (but not limited to) stream widths and depths, channel slope, channel incision, amount of downed wood, stream substrate diameter (quantitative), channel and riparian shade (with densiometer and hemi-view photography), riparian understory and overstory community (dominant species only), riparian tree species and diameter.

Data and Metadata
Complete dataset was posted November 2008. Protocols as well as datasheets used by the 2008 field survey team are also posted. Data from earlier similar measurements made by benthic team (2006-2008) for densiometer, substrate type, stream widths and depths, were included.
traskWRC\DataAndMetadata\Physical\ChannelMorphology\
traskWRC\DataAndMetadata\Biotic\Vegetation\Densiometer
traskWRC\DataAndMetadata\Biotic\Vegetation\HemiViewPhotos\
traskWRC\DataAndMetadata\Biotic\Vegetation\RiparianSurveys

Products:
Haxton, Z. 2009. "Overstory structure, understory composition and tree regeneration in riparian forests of the Trask Watershed." Unpublished report to the Trask Watershed Research Cooperative.

Subject area: Songbird assemblages, juvenile songbird movement and habitat selection

Researchers: Stephanie Jenkins, MS candidate in Forest Ecosystems and Society, Oregon State University; *Graduate Advisor(s):* Joan Hagar, USGS-BRD and Matt Betts, Forest Ecosystems and Society, OSU

Funding source: USGS Forest and Rangeland Ecosystem Science Center, $144,000 2008-2010

Overview of field research:

- Bird assemblages compared between upland and riparian habitats using mist-net captures between four paired sites.
- Movement of juvenile focal species tracked using radio telemetry during the post-fledging period. Twice daily a GPS location of individuals were recorded.
- Vegetation Surveys identified coarse wood volume on hillslope and riparian plots, percent cover for shrub species, and canopy closure

Summary of key research findings:

- Upland and Riparian Bird Assemblage Comparison
  -131 songbirds captured total: 94 in riparian, 34 in upland
  -Total number of species captured was greater in riparian sites
  -Most species were captured at both riparian and upland locations; however number of individuals of most species was greater in riparian sites

- Juvenile Movement and Habitat Selection
  -Pacific-slope Flycatcher (n=2) general movements were parallel with stream for 10 consecutive days.
  -Swainson's Thrush (n=14) general movements showed minimal directionality with stream but preference for riparian areas.
  Preliminary analysis suggests that the relative odds of a Swainson's Thrush occurring at a site more than doubled with a 25% increase in midstory percent cover

Data on shared directory:
April, 2009

Metadata

Products:
S. Jenkins, J. Hagar, Songbird movement and habitat selection in the Trask Watershed, Oregon Coast Range Poster, The Wildlife Society 2009
T:\Groups\traskWRC\Presentations\Bird_Sjenkins_TWS_09.pptx

Subject area: Quantifying and Connecting Riparian Stand Structure and Microclimate Attributes to Stream Ecosystem Drivers

Researchers: Temesgen Hailemariam, OSU, Joan Hagar USGS, Bianca Eskelson, Zane Haxton, OSU

Funding source: USGS Forest and Rangeland Ecosystem Science Center, $140,000 2009-2010

Overview of Trask research:
2009 Objectives:

- Characterize changes in forest structure between headwater sites and across the stream-to-ridgetop topographic gradient in the Trask Watershed.
- Connect overstory structure with understory vegetation abundance/diversity and microclimate.
- Test innovative new approaches to quantifying forest structure for possible use in riparian monitoring.

Summary of key research findings: (*preliminary*)
2009 key findings

- Sites sampled: GS1, GS3, PH2, PH3, PH4, UM3, RK2, RK3.
- Red alder distribution appeared to be limited to within 10m above stream.
- There was a reasonable relationship between diameter at breast height and age for dominant and codominant conifer trees; most were from 45-60 years old.
- There was not a relationship between diameter at breast height and age for dominant and codominant red alder trees; most were from 40-55 years old.

Products:
Haxton, Z. 2009. "Overstory structure, understory composition and tree regeneration in riparian forests of the Trask Watershed." Unpublished report to the Trask Watershed Research Cooperative.