Middle Fork Coquille River

Riparian Shade Assessment

Technical Data for
Water Quality Management Plan

Prepared for
Coquille Watershed Association

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1. Introduction

The Middle Fork of the Coquille River was assessed for channel shading and riparian condition during the spring and summer of 2003. This report presents the procedures used in data collection, SHADOW model data inputs, methods used to fill in data gaps between field data points, and the results of running the SHADOW model for current shade and target shade from potential communities.

The Middle Fork Coquille is listed as water quality limited for stream temperature (DEQ 303d list). Shade and channel form have strong effects on the temperature of a stream through controlling how much the sun can strike the water. The SHADOW model uses trigonometry to project the amount of sunlight striking a stream using data on sun angle, which is calculated using an index day of August 1st, and the latitude of the site. Data loaded into the model is described in Section 2 below. The model output is the percentage of the stream that is currently unshaded. Running the model a second time using data on the potential natural vegetation (see Chapter 7) for the stream gives the target shade for the system. This allows an analysis of current versus target shade for each reach of the river system. This analysis helps indicate where a stream is susceptible to heating and where adding riparian vegetation can reduce that heating. It will be a very useful tool for the Coquille Watershed Association (CWA) and other partners to determine where riparian projects designed to address water temperature can be implemented.

The ownership of the Middle Fork is divided between: public lands administered by Bureau of Land Management (BLM), forest products companies (Plum Creek, Roseburg Forest Products), tribal lands, highway Right Of Way (ROW) owned by Oregon Department of Transportation, private ownership in agricultural activities, small timber owners and rural residential. Partners in the data collection include BLM, CWA, the Department of Environmental Quality (DEQ), Plum Creek Timber Company and Oregon Department of Transportation (ODOT).

The CWA Executive Board discussed an offer of funding from DEQ to complete the Middle Fork Assessment and voted to pursue this project. DEQ staff and/or project staff met with stakeholders and major landowners with holdings along the streams of the Middle Fork watershed. This process resulted in the list of streams to be included in the shade assessment. The entire mainstem of the Middle Fork Coquille River and its major tributaries were included in the assessment. Minor tributary streams (3rd order or larger) were included if they were of special interest for one of the major stakeholders. Tributary streams contributing 5% or less of the flow in the mainstem at their confluence provide localized refugia for fish, but not enough flow to change the water temperature in the mainstem below the confluence. Streams (3rd order or larger) on BLM land in Big Creek had been previously assessed; the majority of streams on private lands in Big Creek were added in this assessment. BLM also contracted with project staff to complete an assessment of all 3rd order and larger streams in the Sandy Creek watershed, which are included in this report. Table 2 presents the list of streams covered by this assessment.

Project staff performed a preliminary division of the Middle Fork streams into 619 reaches. Criteria for establishing reach breaks included: perennial confluences, change in channel aspect, change in riparian vegetation class, change in land ownership, or change in channel size. During the course of the more detailed assessment, 167 reaches were separated into left and right banks because the vegetation or other parameters were dissimilar enough to require this for the assessment.

BLM provided a work station and technical support to project staff for the duration of the assessment. BLM contributed additional material support to the project including access to the 2002 aerial photo set and a stereoscope for aerial photo interpretation, a basemap and GIS data layers.

The CWA provided material support including a computer for spreadsheet management and word processing, topographic maps, a Solar Pathfinder (shade measuring instrument), and grant management.

DEQ initiated the project, consulted with project staff on questions of methods, and provided base funding for the project utilizing "319" grant dollars.

Plum Creek Timber provided a map of their holdings, a forester who aided in field measurements on their land, and reviewed the draft report..

2. SHADOW Model Data Inputs

To run the SHADOW model requires 11 input columns for each of the 786 reaches (or left and right banks of a reach) in the Middle Fork Coquille watershed. Data was initially entered into an Excel spreadsheet and later pasted into a Lotus 123 spreadsheet containing the model. The data input columns are:

1. Reach Identification Code (tells where the reach is and if it has been split into two separate banks),

2. Selected Y/N (tells if a reach is included in the current 'SHADOW Model' run or excluded),

3. % Tree Overhang (the proportion of the channel covered by tree canopies in decimal %),

4. Active Channel Width (width of the bankfull channel in feet),

5. Length (reach length in feet),

6. Tree Height (height in feet of the trees contributing shade to the stream),

7. Tree to Channel Slope (angle of the bank between the bankfull channel and the closest trees providing shade),

8. Stream Orientation (the aspect of the reach in classes 0 [North-South], 45 and –45 [Diagonal], or 90 [East-West]),

9. Tree to Channel Distance (the average distance in feet of shade trees from the bankfull channel),

10. Shade Density (the canopy density in decimal % for trees adjacent to the stream), and

11. East/West/Both (instructs the model whether the calculation is for both banks [B] or only one bank [E or W]).

Additional information required by the model for the Middle Fork Coquille was the latitude (43 degrees) and the magnetic declination (19 degrees).

Stream reaches are numbered starting at the top and proceeding downstream (see Appendix 1 for the data spreadsheet). The Middle Fork watershed was broken into subwatersheds to aid in the analysis. The mainstem was broken into the following three sections:

- Camas Valley (MC 01-32),
- Middle mainstem (MM 01-49)
- Lower mainstem (ML 01-29)

All of the major tributaries in Camas Valley have their own code. The codes and reaches in each system are:

- Wildcat Ck (WILD 01-12)
- Reed Ck (REED 01-11)
- Noah Ck (NOAH 01-04)
- Kirkendall Ck (KIRK 01-04)
- Thompson Ck (THOMP 01-10)
- Jim Belieu Ck (JB 05-10)
- Holmes Ck (HOLM 03-19)

All of the major tributaries in the middle and lower mainstem have their own code. The codes and reaches in each system are:

- Twelvemile Ck (TWEL 02-25)
- Bridge Ck (BRIDG 01-10)
- Dice Ck (DICE 01-08)
- Boulder Ck (BOUL 01-06)
- Upper Rock Ck (UPROCK 01-30)

- Little Upper Rock Ck (LUPROCK 01-06)
- Sandy Ck (SAND 01-87)
- Myrtle Ck (MYRT 01-57)
- Lower Rock Ck (LOWROC 01-43)
- Belieu Ck (MIDBEL 02-06)
- Big Ck (BIG 02-158)

Additional reaches added after the initial reach identification codes were assigned the existing reach number with a letter suffix added (A-F). For the 167 reaches divided into separate banks, the reach takes two lines of the spreadsheet with an N, S, E, or W suffix appended to the reach identification code. The SHADOW model does not compute shade for the north bank of east-west trending streams (aspect class 90) because the north bank does not contribute shade to the active stream channel. The model returns a zero for the north bank in the output column to indicate this. The SHADOW model only recognizes E, W, or B in the East/West/Both input column. In this column, North banks are designated W and South banks are designated E.

To run the model, individual data columns are copied from the Excel spreadsheet and pasted into a Lotus 123 spreadsheet containing the model. The specific set of reaches for inclusion in that run are set prior to running the model (Yes/No column). This report presents the results from three model runs. The first run uses the data on current vegetation to get current shade and the second run uses data on *potential natural vegetation* to get *target shade*. Section 7 describes in more detail how target shade values were developed. The third model run was for model calibration and is discussed in Chapter 6.

Landowner and CWA riparian projects can seek to establish vegetation that the landowner desires and the site can support while working towards the *target shade* goals. This information can be used by private landowners, the CWA projects committee and other natural resource management entities to determine where increases of shade can be achieved in riparian areas and better tailor site management and planting prescriptions. This type of detail will allow the CWA to better measure riparian project successes where an increase in shade was identified as a project goal.

3. Data Collection

BLM collected and analyzed data on 80 reaches in Big Ck located on its lands using the 1997 aerial photo set and field data collection. The spreadsheet containing this information was turned over to project staff. Project staff performed no field checking of BLM data because BLM staff had already checked the photo interpretation for accuracy through field data collection.

Project staff collected information on the other 78 reaches in Big Ck and 461 reaches throughout the remainder of the Middle Fork using aerial photo interpretation, topographic maps, GIS data layers, and field plots. Aerial photo interpretation on all reaches was accomplished using the BLM 2002 aerial photo set.

Data collected from the aerial photos was:

1. canopy overhang over the stream (decimal percent),

2. shade density of the canopy adjacent to the stream (decimal percent),

3. riparian buffer width (feet),

4. existing riparian vegetation composition (using community codes),

5. whether a road was located within 100 feet of the stream (Y/N),

6. the distance between the mainstem and Highway 42 (where applicable), and

7. comments on the reach.

Topographic maps were used to determine:

1. reach aspect using an aspect template,

2. channel reach breaks.

ARCVIEW GIS was used to determine:

1. the drainage area for each reach (used to calculate the channel width), and
2. the reach lengths.

Project staff collected additional information on the reaches and verified data collected from aerial photos through taking 36 field plots. The field plots were located in: Sandy Creek (throughout), Camas Valley (throughout), the upper and middle sections of the mainstem (limited), and Lower Rock and Myrtle Creeks (limited). Due to a limited project budget no field plots were located on the lower mainstem (ML), or the tributaries not included in the previous list; the accuracy and quality of the final assessment would have been increased through additional field plots.

Data collected from field plots was:

1. canopy overhang over the stream (decimal percent),

2. shade density of the canopy adjacent to the stream (decimal percent),

3. bank angle/terrain slope (decimal percent),

4. tree to channel distance (feet),

5. tree heights (feet),

6. bankfull channel width (feet),

8. existing riparian vegetation composition (using community codes),

9. notes on the reaches, and

10. solar pathfinder readings (selected reaches).

The values for overhang, shade density and the existing vegetation composition collected in the field plots closely matched those determined from aerial photos except where the plot location was not typical of the reach as a whole. The paired point plots in the field and on the aerial photos are used to validate the model output and to provided detailed field observations on current vegetation and potential riparian vegetation.

4. Confidence in Data and Methods Used to Fill Data Gaps

The level of confidence for data indicates how accurate that number is compared to the actual measurement in the field. Field measurements are assumed to be the most accurate, and extrapolated/interpolated numbers are assumed to be the least accurate. The level of confidence for data used in the model was: first level (highest) was for field data, second level was for BLM data, third level was for aerial photo interpretation data, and fourth level (lowest) was for extrapolated/interpolated values. BLM data (tree heights, channel widths, etc.) was assigned second level because it contained both measured and estimated values. The methods for extrapolating/interpolating values are described below. This section will allow readers to understand which values were estimated, how those values were estimated, and to discount those estimated values if they have better information (i.e. direct measurements of a particular site).

In all cases, first level data was used where available. Then second, third and fourth level data were used in that order. The data exported to Lotus 123 for running the model is in the columns starting with the label ‘Input’ (see Appendix 1).

Methods for Extrapolating and Interpolating Values

The 36 reaches with field plots (first level) and 80 BLM reaches (second level) had complete information, which left 503 reaches with only aerial photo, GIS and topographic map data available. For these 503 reaches, some information was missing for four of the data columns (tree to channel distance, tree heights, tree to channel angle, channel width) required to run the model. The methods used to estimate the missing values (fourth level) for each of these columns are presented below.

Tree to Channel Distance: Average tree to channel distances were computed separately for Camas Valley, the middle and lower mainstem reaches, the lower reaches of the tributaries (<2% gradient), and the upper reaches of the tributaries (>2% gradient) using the data from the 36 field plots and additional field observations. The mean distance for Camas Valley was 4 feet, the mean distance for mainstem reaches was 10 feet, and the mean distance for low gradient and high gradient tributary reaches was 3.5 feet. All reaches that did not have a field-measured value or BLM data were estimated, and the estimated value was put in the Input column for Tree to Channel Distance.

Tree Heights: Average heights of the dominant shade producing trees for mixed hardwoods, and mixed hardwood and conifer stands were calculated from field plots for Camas Valley, the middle and lower mainstem reaches, the lower reaches of the tributaries (<2% gradient), and the upper reaches of the tributaries (>2% gradient) using the data from the 36 field plots and additional field observations. The mean tree height of the dominant shade producing trees for Camas Valley was 56 feet, the mean tree height for mainstem reaches was 66 feet, and the mean tree height for low gradient and high gradient tributary reaches was 61 feet. All reaches that did not have a field-measured value or BLM data were estimated, and the estimated value was put in the Input column for Tree Height.

Tree to Channel Slope: Average slopes (expressed as decimal %) from the bankfull channel to the shade-producing trees were computed using the data from the 36 field plots and additional field observations. Slopes were computed for: Camas Valley, the middle and lower mainstem reaches, the tributaries on Tyee geologic formation (Lower Rock and Upper Rock Cks.), the tributaries on Lookinglass geologic formation (Sandy, Myrtle and Twelvemile Cks.) on low (<2%) and high gradients (>2% gradient), and Big creek on the Roseburg formation. The mean tree-channel slopes were: Camas Valley 0.65, mainstem reaches 0.60, tributaries on Tyee formation 0.45, low gradient tributaries on Lookinglass reaches 0.75, high gradient Lookinglass reaches 0.40, and Big Ck. on Roseburg formation 0.65 for the low gradient tributary reaches and 0.52 for the high gradient reaches. All reaches that did not have a field-measured value or BLM data were estimated, and the estimated value was put in the Input column for Tree-Channel Slope.

Channel Width: Project staff used regressions of channel width on subwatershed drainage area to estimate the channel widths for the reaches lacking field data. The regression equations and graphs of the data points are in Appendix 2. Regressions were computed for Camas Valley, the lower and middle mainstem, the low gradient tributaries (<2%), the higher gradient reaches (>2.0%), and for Lower Rock Ck. The decision to divide the tributaries based on gradient and geology (Lower Rock Ck) was reached in consultation with BLM hydrology staff and supported by Rosgens's book titled "Applied River Morphology" (page 5-6, Figure 5-3). All reaches that did not have a field-measured value or BLM data were estimated, and the estimated value was put in the Input column for Active Channel Width.

5. SHADOW Model Output

In the two model runs reported here, the North banks were dropped by the model from the calculations on streams that run East-West; only the South bank data was used by the model as input. The model does this because vegetation on the North bank contributes negligible shade to the channel on streams that run East-West. The model output was converted to a reach weighted average by stream and/or subwatershed.

Table 1 presents the current and potential shaded area and the potential shade increase for all assessed stream channels in the Middle Fork Coquille River. These values are the results of two SHADOW model runs. The first predicts current shade using data on current vegetation and the second predicts the potential or target shade using data on potential natural vegetation conditions (see Chapter 7). The model inputs that change between the current and potential model runs are: canopy overhang, shade density, tree to channel distance, and tree heights. The potential shade increase is the potential shade minus the current shade.

Table 1. Current and Potential Shaded Area of All Streams Assessed in the Middle Fork Coquille River.

Subwatershed	Current Shaded Channel %	Potential or Target Shade %	Potential Shade Increase %
Middle Fk Camas mainstem	78	96	18
Wildcat Ck	92	99	7
Reed Ck	93	98	5
Kirkendall Ck	72	99	27
Thompson Ck	98	99	1
Noah Ck	92	99	7
Jim Belieu Ck	74	96	22
Holmes Ck	93	97	4
Camas Valley ALL	86	97	11
Twelvemile Ck mainstem	76	96	20
Bridge Ck	88	99	11
Dice Ck	89	98	9
Boulder Ck	65	99	34
Twelvemile Ck ALL	79	97	18
Middle Fk middle mainstem	59	79	20
Upper Rock Ck mainstem	86	96	10
Little Upper Rock Ck	88	99	11
Upper Rock Ck All	87	96	9
Sandy Ck mainstem	83	96	13
Sandy Ck tributaries	95	99	4
Sandy Ck ALL	91	98	7
Myrtle Ck	73	94	21
Lower Rock Ck	79	94	15
Belieu Ck	94	97	3
Big Ck mainstem and small tribs	90	97	7
Swamp Ck	94	98	4
Bear Ck	98	99	1
Axe Ck	97	98	1
Brownson Ck	97	99	2
Fall Ck	93	98	5
Big Ck ALL	93	98	5
Middle Fk lower mainstem	54	81	27
Middle Fork Coquille River ALL	80	97	17

6. Model Calibration and Data Accuracy Check

A series of 21 point plots covering 100' of stream channel (as opposed to reach average plots) was selected that represented the full range of channel widths and aspects in the watershed. These point plots were measured on aerial photos for canopy overhang % and shade density %. The plots were also measured in the field for bankfull channel width, tree heights, tree-channel slope, and tree-channel distance. Also in the field, the Solar Pathfinder instrument was used to measure the shade on the channel for the month of August. August was used because the SHADOW model computes the unshaded channel area for August 1.

The photo interpretation and field data were used to run the SHADOW model for the 21 point plots. The shaded stream values were compared for the SHADOW model outputs and the Solar Pathfinder. The average difference between modeled and measured shaded areas for the 21 points was 1.8%, with a range of 0-22.9% (see Appendix 3). Since the difference between the field-measured and modeled shade values did not show any systematic bias, no calibration adjustments were made to the model input. Additional measurements with the solar pathfinder at the field point plots would reduce the variation between the field-measured and modeled values by averaging out localized variation (i.e. one tree providing a lot of shade and affecting the measured value). Budget limitations precluded further field sampling time.

7. Potential Natural Vegetation

The potential natural vegetation is the riparian community that would exist on a site if it had been undisturbed for a long period (i.e., mixed large hardwoods and conifers in the mountains or a hardwood swamp in the Coquille Valley). This community is assumed to give the potential or target shade for that site. In most cases on private lands it would be feasible to grow the trees that make up the potential natural vegetation. Other younger, managed riparian communities can sometimes give the same amount of shade as the potential natural vegetation. On timber production lands (see "Steep and Moderate Canyons" below), a dense band of hardwoods and scattered conifers retained during harvest operations backed by a reproduction stand of 30'-50' tall Douglas fir would give as much shade as the site potential old growth trees. On agricultural lands (see "Camas Valley"), a dense planting of willow next to the bankfull channel backed by a mixed stand of tall hardwoods would give as much shade as these channels need. Restored riparian stands that are proportional in width to the stream channel are capable of providing shade equivalent to site potential shade throughout the watershed.

The watershed was divided into four regions with distinct potential natural vegetation communities. Most of the tree species are found in all of the communities, but the proportion of the primary shade they provide varies with their proportion of the community and their maximum size. Large trees growing close to the channel provide the primary shade in all of the communities. Large conifers growing far from the channel contribute to early morning and late afternoon shade. In confined channels (including transport reaches)7, large conifers are more important because they grow closer to the active channel in these topographic situations. In unconfined channels with terraces, large hardwoods are more important because they grow closer to the stream and provide the majority of canopy overhang and shade density. Large conifers farther from the channel are always ecologically important because they can provide large woody debris to the channel.

Steep and Moderate Canyons

The first community, Steep and Moderate Canyons, is found in steep to moderate gradient, narrow, V-shaped canyons. The streams have moderate to steep gradients (2-8%) and the channels are confined. The bankfull channel ranges from 3' to 38'. The channels are confined with moderate or no terrace development and no floodplain development adjacent to the channel. Alder (maximum 80') with a component of myrtle, bigleaf maple, and occasional Western redcedar and Pacific yew lines the streams. Douglas fir dominates the upland slopes and reaches a height of about 210'. The alder begins about 4' and the Douglas fir about 15'from the bankfull channel. Portions of the mainstem in lower Camas Valley (MC 28-32) and upper Middle Mainstem (MM 01-11) greater than 2% gradient are included in this type and account for the upper end of the range in channel widths. The portions of the Camas Valley tributaries that have greater than 2% gradient are also in this type.

Low Gradient Canyon

The second community, Low Gradient Canyon, is found in medium sized canyons with a low gradient (<2%). The channels are moderately confined or confined and have a bankfull width range of approximately 26' to 77'. Fewer than ten percent of the reaches in this type have bankfull channels over 50' wide and these occur on bedrock channels. There is limited terrace development adjacent to the channel. Large hardwoods (bigleaf maple 100', myrtle 90', Oregon ash 100', black cottonwood 100' and alder 80') line the lower slopes and the edge of the streams at an average distance of 5'. Douglas fir dominates the slopes and reaches a height of around 210' at an average of 10' from the bankfull channel. Other species of conifers (Western redcedar, white fir) are occasionally encountered in this community.

Camas Valley Agricultural

The third community, Camas Valley Agricultural, is found in the flat portions of Camas Valley. The streams have low gradients (1-2%) and the channels are not confined except where downcutting has occurred thus disconnecting the stream from the floodplain. The bankfull channel ranges from approximately 4' on the small streams to 38' on the lower mainstem. There is full floodplain development, and the stream is usually connected to the floodplain. Major riparian species include (in decreasing order of importance): Oregon ash, bigleaf maple, Oregon white oak, black cottonwood, incense cedar, alder, ponderosa pine, and Douglas fir. The hardwood species begin about 3' from the bankfull channel. Small hardwoods and shrubs (willow, creek dogwood and ninebark) line the edge of the streams at an average distance of 0'. The understory is sparse in the shade and consists of dense stands of Himalaya blackberry, reed canary grass or introduced pasture grass species where sunlight reaches the ground.

Mainstem Canyon

The fourth community, Mainstem Canyon, is found starting in the middle mainstem and continuing to the confluence with the South Fork Coquille River. Most of the mainstem has a low gradient (around 1%) and the channel ranges from 44' to 110' wide. There is terrace development in portions of the lower mainstem, but most of the length is classified as a transport channel. In the transport channel there are frequent scouring flows in the winter that, along with bedrock, limit tree development close to the channel. Hardwoods and their maximum heights include alder (up to 80'), bigleaf maple (up to 100'), myrtle (up to 90'), Oregon ash (up to 100'), and black cottonwood (up to 100'). Conifers are primarily Douglas fir (up to 210') along with scattered individuals of Western redcedar, white fir and Pacific yew. Small hardwoods and shrubs include willows, creek dogwood, ninebark, ocean spray and elderberry. The tree to bankfull channel distance is 5' for alder and 25' for Douglas fir. The understory is sparse under full shade, but dense stands of Himalaya blackberry or ruderal grasses develop down to the bankfull level in openings.

Highway 42 parallels and repeatedly crosses the river mainstem between the confluence with the South Fork and the entrance to Camas Valley. The highway is mostly on the North side of the river, but the winding channel and a number of bridges result in the highway impinging on the riparian buffer at the river crossings, between the highway right of way (ROW) and the active channel, and on outside bends where the ROW and sidecast rock from highway construction have pushed the channel over towards the opposite bank. The highway ROW lies within 30 feet of the active channel in some reaches (see spreadsheet "Distance to Hwy 42"). Particularly in the lower mainstem where the channel is classified as a 'transport channel' type, the highway ROW is often close to the active channel. In these cases the bank has frequently been hardened, which drastically limits riparian vegetation development and pushes the channel over towards the opposite bank. The channel shift results in a greater tree to channel distance and reduces shading of the channel. This has been incorporated into the potential community SHADOW run by increasing the tree to channel distance to 30 feet and using the conifer height of 210 feet for the shade producing trees at that distance from the channel. In general, where the ROW and active channel are 75-150 feet apart the impacts to the current and potential riparian buffers are light to moderate. In reaches where the ROW and active channel are less than 75 feet apart the impacts to the current and potential riparian buffers are moderate to severe.

Table 2 gives the characteristics of potential natural vegetation communities of the Middle Fork Coquille River. Overhang is the channel percentage covered by tree canopy. Shade density is the percentage of sidelight blocked by the canopy. In the last three columns, the first number is the average distance in feet between the trees and the bankfull channel and the second number is the average height in feet of the mature trees. The Potential Trees column is the data selected for the potential natural vegetation SHADOW run.

Table 2. Characteristics of Potential Natural Vegetation Communities of the Middle Fork Coquille River

Community	Active Channel Width (ft)	Overhang (%)	Shade Density (%)	Hardwoods (dist/ht)	Douglas fir (dist/ht)	Potential Trees (dist/ht)
Steep/ModCanyons	3 – 38	80	85	4/80	15/210	15/210
Low Gradient Canyon	26 – 77	50	90	5/100	10/210	10/210
Camas Valley	4 – 22	80	90	3/90	--	3/90
Mainstem Canyon	44 – 110	30	90	5/100	25/210	5/100
Transport Ch.	94-102	30	90	--	30/210	30/210

8. Target Shade and Solar Loading

The solar energy input or solar load has been calculated for the latitude of the Middle Fork Coquille watershed at 2440 BTU/square foot/day using a flat plane solar collector. This means that a square foot of stream that is totally unshaded would receive 2440 BTU/square foot/day of solar energy during a full, clear day in August. To get the current solar loading for any given stream reach, you multiply the total possible load (2440 BTU/square foot/day) by the area of the stream channel that is unshaded, thus giving the amount of sun the channel receives. Table 4 gives values for the current shade and target shade provided by the potential natural vegetation by watershed regions as well as for the entire Middle Fork Coquille River. The lower half of the table shows the current and target solar loading. The difference between current and potential future conditions is shown in the last column.

Table 3. Current Shade, Target Shade and Solar Loading of the Middle Fork Coquille River.

Watershed	Current Shade	Target Shade	Increase
Camas Valley	86	97	11
Large Tributaries	83.6	96.3	12.7
Middle/Lower Mainstem	57.5	75.5	18
Entire Middle Fork Coquille River	80	97	17
Watershed	**Current Solar Load**	**Target Solar Load**	**Reduction**
Camas Valley	342	73	269
Large Tributaries	400	91	309
Middle/Lower Mainstem	1037	598	439
Entire Middle Fork Coquille River	488	73	415

Shade values are percentages and solar load values are BTU/square foot/ day.

To summarize the findings of this report:

- There was a relatively small increase in shade between the current and potential vegetation of 11 to 18%.
- The relatively small increase in shade results in a fairly large reduction in solar load of 269 to 439 BTU/square foot/day.
- Water temperatures should respond well to the increase in shade.
- If any future work is done to refine/update the findings of this report there should be additional fieldwork done on all sections of the mainstem as well as on major tributaries that were not field sampled or were under sampled (Myrtle, Upper Rock, and Twelvemile Creeks).

Appendix 1. Middle Fork Coquille River Riparian Spreadsheet

Appendix 2. Drainage Area vs Active Channel Width Regressions for the Middle Fork Coquille River

Appendix 3. Model Calibration Output and Data Sheets for the Middle Fork Coquille River