North Fork Coquille River

Riparian Shade Assessment

Technical Data for
Water Quality Management Plan

Prepared for
Coquille Watershed Association

Prepared by
Bruce Follansbee, Ph.D.

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1. Introduction

The North Fork of the Coquille River was assessed for channel shading and riparian condition during the spring and summer of 2002. This report presents the procedures used in data collection, SHADOW model data inputs, methods used to fill in data gaps between field data collection plots, and the results of running the SHADOW Model.

The North 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 sun can heat 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 for the stream gives the target shade for the system. This allows an analysis of current versus target shade for each section of the river system. This analysis helps indicate where a stream is heating and where adding riparian vegetation can reduce that heating. It will be a very useful tool for the Coquille Watershed Association (CWA) to determine where riparian projects designed to address water temperature can be implemented.

The ownership of the North Fork is divided between: public lands administered by Bureau of Land Management (BLM), forest products companies (Menasha, Plum Creek), private ownership in agricultural activities, small timber owners, rural residential and Coos County lands (mostly parks). Partners in the data collection include Menasha Corporation, BLM, CWA, the Department of Environmental Quality (DEQ) and Plum Creek Timber Company.

The CWA Executive Board discussed the issue of the North Fork Coquille temperature listing and voted to pursue this shade assessment project. DEQ assembled a committee representing the major landowners with holdings along the streams of the North Fork watershed. This committee decided which streams were to be included in the shade assessment. All of the mainstem of the North Fork Coquille River and its major tributaries were included in the assessment. Minor tributary streams were included if they were fish bearing or they added at least 5% of the flow to the main channel into which they were flowing. The entities represented on the committee included DEQ, CWA, BLM, and Menasha. Some minor discrepancies were found on different versions of the project map regarding which tributaries were included in the project. The final list of streams consists of all streams selected on all three copies (DEQ, Menasha, and BLM) of the 1999 base map.

DEQ performed a preliminary division on the North Fork Coquille into approximately 715 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, a number of reach breaks were added resulting in a slightly larger number of reaches. The reasons were that some tributary streams were added to the original list, and some of the preliminary reaches were too variable based on the above criteria. The final project consists of 738 stream reaches in the North Fork Coquille River watershed. Approximately 170 reaches had the vegetation split into separate banks because the vegetation was significantly different between the two banks.

BLM assigned a staff hydrologist to collect data on the 323 reaches either on or adjacent to their lands. BLM staff completed the data collection and SHADOW analysis of the BLM portion of the watershed. BLM also provided GIS data (subwatershed areas) on other portions of the watershed. BLM contributed additional material support to the project including access to the 1997 aerial photo set for the North Fork, access to a stereoscope for aerial photo interpretation, and GIS stream layer and basemaps.

Menasha assigned staff to assist in collecting data on their lands and to supply other material support to the project. Menasha assisted project staff in locating aerial photos and collecting field data throughout Menasha holdings in the North Fork. Additional material support supplied by Menasha included access to the 2000 and 1997 aerial photo sets for Menasha holdings in the North Fork, access to a stereoscope for aerial photo interpretation, and access to records on ‘date of birth’ of plantations.

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, coordinated and staffed the early organization and start-up of the project, provided material support consisting of maps and equipment, consulted with project staff on questions of methods, and provided base funding for the project utilizing “319” grant dollars.

2. SHADOW Model Data Inputs

To run the SHADOW Model requires 11 input columns for each of the 738 reaches in the North Fork watershed. Data was entered into an Excel spreadsheet. These data input columns are:

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

2. <u>Selected Y/N</u> (tells if a reach is included in the current ‘SHADOW Model’ run or excluded),

4. <u>% Tree Overhang</u> (tells how much of the channel is shaded by tree canopy 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),

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 North 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 North Fork watershed was broken into subwatersheds to aid in the analysis. The mainstem was broken into the following sections:

- upper North Fork (NFC001-106),
- lower forested reaches (WHIT01-49)
- Fairview valley (FAIR01-49)
- Lee Valley (ECHO01-16)
- lower agricultural section (ECHO17-74)

All of the major tributaries have their own subwatershed including the following creeks:

- North Fork Creek (NFCr)
- Moon (MOON)
- Hudson (HUD)
- Woodward (WOOD)
- Evan (EVAN)
- Steinnon (STEIN)
- Steele (STEEL)
- Park (PARK)
- Alder (ALDR)
- Vaughn (VAUN)

- Cherry (CHER)
- Middle (MIDL)
- Weimer (WEIM)
- Llewellyn (LLE)
- Johns (JONS).

Additional reaches added after the initial reach identification codes were assigned the existing reach number with a letter suffix added (a-f). Many of the reaches were divided into separate banks (approximately 170) because the vegetation varied enough between the two banks that they were required to be split. In these cases the reach takes two lines of the spreadsheet with an N, S, E, or W suffix appended to the reach identification code. How these banks are treated in the model can be changed for different runs using input column 11. These designations are made just prior to an individual SHADOW model run.

To run the model, individual columns are copied from the Excel spreadsheet and pasted into a Lotus 123 spreadsheet, and the specific conditions for that run are set prior to running the model. This report presents the results from two model runs. The first uses all of the data on current vegetation to get current shade and the second uses data on *potential natural vegetation* to get *target shade*. Section 7 describes in more detail how target shade values were developed.

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 and the projects committee to determine where increases of shade can be expected in riparian areas and better tailor site management and planting prescriptions. This type of detail will allow the council 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 323 reaches located on and immediately adjacent to its lands. 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 415 reaches through aerial photo interpretation. Aerial photo interpretation on most forest reaches was accomplished using the Menasha 2000 aerial photo set (approximately 350) and a small number of reaches using the Menasha 1997 photo set. The BLM 1997 photo set was used to interpret approximately 50 reaches in the lower mainstem of the river (Echo subwatershed).

Data collected from the aerial photos was:

1. canopy overhang over the stream (decimal percent)

2. shade density of the canopy adjacent to and over 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. comments on the reach.

Topographic maps were used to determine:

1. reach lengths using a map wheel

2. reach orientation using an orientation template

3. stream gradient using a gradient template

Project staff collected additional information on the reaches and verified data collected from aerial photos through taking 219 field plots. Field plots were distributed throughout the forested upper watershed with the active support of Menasha staff (98 plots). Project staff used kayaks to take 93 plots on portions of lower Middle Creek (MIDL107-133) and the mainstem of the North Fork (FAIR28-49, ECHO01-37). Another 28 plots on Middle Creek and the lowest reaches of the mainstem (ECHO38-74) were accessed from roads.

Data collected from field plots included:

1. canopy overhang over the stream (decimal percent)

2. shade density of the canopy adjacent to and over 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)

7. existing riparian vegetation composition (using community codes)

8. notes on the reaches

The values for overhang, shade density and the existing vegetation composition collected in the field plots closely matched those determined from aerial photos.

4. Confidence in Data and Methods Used for Filling 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.

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). For overhang, shade density, and species composition, values from field plots (first level) took precedence over aerial photo interpretation (third level) if the values did not match.

Methods for Extrapolating and Interpolating Values

The 196 reaches with field plots (first level) and 323 BLM reaches (second level) had complete information, which left 219 reaches with only aerial photo and topographic map data available. For these 219 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.

<u>Tree to Channel Distance</u>: Average tree to channel distances were computed for small channels, medium channels, and large channels using the data from the 196 field plots and some of the BLM reaches. The small streams were represented by the upper North Fork (reaches 1-30), tributaries in the Whitley subwatershed, and the North Fork Creek plots; the mean distance for small streams was 10 feet (n=47). The number following the average in parentheses (i.e., n=47) is the number of values that were used to compute the average. The medium streams were represented by lower Hudson and Moon Creeks; the mean distance for medium streams was 8 feet (n=30). The large channel was represented by the lower mainstem (Echo subwatershed); the mean distance for large channels was 14 feet (n=69). 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: Some reaches owned by Menasha that didn't have field-measured tree heights had stand age (Date of Birth) information available. For these 29 reaches stand age was used to estimate the alder heights using the Alder Site Index 80 (SI80) table provided by DEQ. The SI80 table was chosen because it closely resembled alder heights measured in the field plots where the age was known. For the remaining 190 plots that lacked tree height data, a series of averages was computed for the species found in those subwatersheds. It was assumed that tree height averages within a subwatershed would be more representative than averages calculated for the whole basin. Average heights for alder, mixed hardwoods, mixed hardwood and conifer, and conifer stands were calculated for the subwatersheds listed in the table below. The averages were rounded to the nearest five feet and then used to fill in the data gaps for tree heights. All reaches that did not have a value in the field plot or BLM data columns were estimated, and the value was entered in the Input column for Tree Height.

Table 1 shows average tree heights by subwatershed of the North Fork Coquille River. Height values were taken from field plot data for different subwatersheds. The first number in each cell is the average height in feet, and the second is the number of data points (n) used to compute the average. (Private) indicates that only values from field plots on private land (no BLM) were used to compute the average in that subwatershed.

Table 1. Average Tree Heights by Subwatershed of the North Fork Coquille River.

Subwatershed	**Alder only**	**Mixed Hardwood only**	**Mixed Hrdwd/Conifer**	**Conifer only**
North Fork Creek	95/4	75/3	83/3	--
Upper North Fork NFC001-030,tribs.	70/2	100/1	75/11	155/13
upper mainstem NFC031-106	70/2	97/6	102/9	124/8
Whitley tribs.	80/3	75/2	83/7	--
middle mainstem WHIT01-49	80/3	77/4	60/3	--
Moon Creek	100/2	100/4	96/6	--
Woodward Creek	--	100/7	90/4	140/4
Fairview 01-49, and ECHO01-24	50/15	66/24	78/11	--
lower mainstem ECHO25-74	48/13	53/32	53/3	--
Hudson (Private)	87/6	98/4	75/2	--
upper Middle Ck MIDL1-30/tribs.	87/5	90/3	90/6	--
middle Middle Ck MIDL31-74	83/4	80/6	70/1	--
lower Middle Ck MIDL75-147	66/8	71/14	87/11	---

Park (Private)	--	100/1	113/3	-

Tree to Channel Slope: Average slopes from the bankfull channel to the shade trees were computed for North Fork Creek separately and for small, medium, and large channels using the data from the 196 field plots and some of the BLM reaches. North Fork Creek had a mean of 0.79 % (n=15) rounded up to 0.80. The small streams were represented by the upper North Fork (reaches 1-30) and tributaries in the Whitley subwatershed; the mean angle for small streams was 0.65 % (n=9) rounded down to 0.60. The medium streams were represented by lower Hudson and Moon Creeks; the mean angle for medium streams was 0.54 % (n=20) rounded down to 0.50. The upper large channel was represented by the Echo subwatershed (ECHO1-30); the mean angle for the upper large channel was 0.43 % (n=19) rounded down to 0.40. The lower large channel was represented by the Echo subwatershed (ECHO40-74); the mean angle for the lower large channel was 0.63 % (n=27) rounded down to 0.60. All reaches that did not have a value in the field plot or the BLM data were estimated, and the value was put in the Input column for Tree-Channel Slope.

Channel Width: BLM staff used a regression of channel width on subwatershed area to estimate the channel widths for the BLM reaches lacking field data. The regression was applicable to all of the forested reaches in the North Fork based on a comparison of measured channel widths from field plots with BLM-estimated channel widths. BLM staff also computed the subwatershed areas for approximately 200 additional reaches at the request of project staff. The regression was then used to calculate the channel width for those reaches. This left approximately 120 reaches which lacked channel width. Channel widths for these reaches were estimated using interpolation between upstream and downstream channel widths, and the value was put in the Input column for Channel Width.

5. SHADOW Model Output

In the two model runs reported here, the North banks were dropped (designated by a postscript N on the reach identification code) from the calculations on streams that run East-West: only the South bank data was used for the model input. This was done because vegetation on the North bank contributes no shade to the channel on streams that run East-West. The model output was converted to a reach weighted average, which was 81% of the whole watershed shaded. Table 2 gives the percent current and target shaded area for the subwatersheds, and the potential increase in shade to reach the target shade.

Table 2 gives the current and potential shaded area of all stream channels in the North Fork Coquille River. These values are the results of two SHADOW model runs. One predicts shade using current condition data and the second predicts shade by changing current riparian conditions to those of potential natural vegetation conditions. The reach code numbers are listed in parentheses after the reach name. The predominant land use for each creek or group of reaches is listed in the second column. Forest designates timber production areas, and Ag/RR designates mixed agricultural and rural residential areas.

Table 2. Current and Potential Shaded Area of All Stream Channels in the North Fork Coquille River.

Subwatershed	Land Use	Current Shaded Channel %	Potential or Target Shade %	Potential Shade Increase %
Fairview (FAIR01-13)	Forest	75	78	3
Fairview (FAIR14-49)	Ag/RR	67	80	13
Echo (ECHO01-74)	Ag/RR	48	73	25
Hudson Creek (HUD01-35)	Forest	86	97	13
Middle Creek (MIDL01-119)	Forest	89	93	4
Middle Creek (MIDL120-147)	Ag/RR	75	91	16
Park Creek (PARK01-22)	Forest	93	97	4
Vaughn Creek (VAUN01-10)	Forest	86	97	11
Alder Creek (ALDR01-11)	Forest	93	98	5
Cherry Creek (CHER01-20)	Forest	96	97	1
Cherry Creek (CHER21-30)	Ag/RR	74	96	22
Weimer Creek (WEIM01-12)	Forest	63	96	33
Johns Creek (JONS01-16)	Forest	95	98	3
Llewellyn Creek (LLE01-17)	Forest	77	97	20
Upper North Fork (UNC01-106)	Forest	86	94	7
North Fork Creek (NFCr01-17)	Forest	92	97	5
Whitley (WHIT01-49)	Forest	83	91	8
Moon Creek (MOON01-29)	Forest	94	95	1
Evans Creek (EVAN01-07)	Ag/RR	82	86	4
Woodward Creek (WOOD01-26)	Forest	89	96	7
Steinnon Creek (STEIN01-15)	Forest	86	97	11
Steele Creek (STEEL01-15)	Forest	95	98	3
North Fork Coquille River	All Land Uses	81	91	10

6. Model Calibration and Data Accuracy Check

A series of 23 point plots covering 100' of stream channel (as opposed to reach average plots) was selected that represented the full range of channel widths in the watershed. These plots were measured on aerial photos for canopy overhang % and shade density %. The plots were 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 solar loading is high and the SHADOW model is designed to use August 1.

The photo interpretation data and the field data were used to run the SHADOW model for the 23 point plots. The unshaded stream values were compared for the SHADOW model outputs and the Solar Pathfinder. The average difference between modeled and measured unshaded areas for the 23 points was 5%, with a range of 0-39%. Most of this discrepancy between the calibration plots and the SHADOW model output was due to systematic underestimation of the canopy overhang in the small valleys and large valleys. The canopy overhang of the current vegetation was increased 20% for all reaches in small and large valleys to adjust for this source of error.

The interpretation of stream data from aerial photos allows you to see the entire reach at once and estimate an average value for the parameter, but you can only see a magnified view of the vegetation from directly overhead. Collecting data in the field allows you to actually see the vegetation from ground level, but it is difficult to get an average value for an entire reach from one view of that reach. To check the accuracy of aerial photo interpretation relative to field data collection, 43 lines of data (FAIR28-47W and MIDL107-116) were analyzed to compare the photo interpretation data with field collected data. For percent overhang, 30 out of 43 values differed between photo and field data with a very small net difference of +0.3%. There was no systematic bias for either over- or underestimating the % overhang using aerial photo interpretation relative to field estimates. For percent shade density, 42 out of 43 values differed between photo and field data with a net difference of +2.3%. This indicates a small systematic bias averaging +5.0% in overestimating shade density using photo interpretation relative to field estimates.

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 shade for that subwatershed and provides the target shade values for the system. 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 Medium 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 "Small Valley" and "Large 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 wide channels need. Restored riparian stands that are proportional in width to the stream channel can provide 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. In all four communities, the primary shade on the channel is supplied by hardwood trees so they were used to calculate the average tree to channel distance and the average tree height (see Table 3, last column). Conifers can also provide shade, but they make up a small percentage of the trees growing close to the channel that provide primary shade on private lands. Large conifers growing farther from the channel contribute to early morning and late afternoon shade under these conditions. Conifers remain important in the potential natural vegetation by providing species diversity in riparian communities and large woody debris to the stream channels. The potential shade is a conservative estimate because conifers were not included in the calculations of average tree to channel distance and average tree height.

Steep Canyon

The first community, Steep Canyon, is found in steep, narrow V-shaped canyons (see Table 3). The streams have moderately steep gradients (4-8%) and the channels are confined. The bankfull channel ranges from 3' to 15'. There is very little or no terrace development and no floodplain development adjacent to the channel. Large hardwoods (bigleaf maple 110', myrtle 100', and alder 110') line the lower slopes and the edge of the streams at an average distance of 5' for the alders and 20' for the other species. Douglas fir dominates the slopes and reaches a height of over 200'; these large trees begin an average of 30' from the bankfull channel. Additional conifers include western redcedar (up to 20% of the shade producing conifers) and scattered western hemlock. Conifers were not included in the tree height calculations because the hardwoods immediately adjacent to the stream provide all of the shade on many of these narrow channels. BLM included 200' tall conifers in their potential vegetation because they have extensive ownership in canyons with steep slopes where much of the primary shade is provided by these large conifers. The understory is dominated by salmonberry associated with sword fern and vine maple, which also provide some shade on these narrow channels.

Medium Canyon

The second community, Medium Canyon, is found in medium sized canyons. The streams have moderate gradients (2-4%) and the channels are moderately confined or confined. The bankfull channel ranges from approximately 10’ to 25’. Fewer than five percent of the reaches in this type have bankfull channels up to 50 feet wide (bedrock channel). Conifers on the adjacent slopes dominate the potential vegetation in these wide reaches. The potential shade on these wider bedrock channel areas may be underestimated because conifers were excluded from the calculations for potential tree height. There is terrace development but little or no floodplain development adjacent to the channel. Large hardwoods (bigleaf maple 110’, myrtle 100’, and alder 110’) line the lower slopes and the edge of the streams at an average distance of 3’ for the alders and 10-15’ for the other species. Douglas fir dominates the slopes and reaches a height of over 200’; these large trees begin an average of 40’ from the bankfull channel. Additional conifers include western redcedar and western hemlock (together up to 50% of the shade producing conifers). These conifers add diversity to the riparian community and produce large woody debris for the stream channel. The understory is dominated by salmonberry with an additional component of sword fern and vine maple.

Small Valley

The third community, Small Valley, is found in smaller valleys. The streams have low gradients (1-2%) and the channels are not confined. The bankfull channel ranges from approximately 20’ to 55’. Fewer than five percent of the reaches in this type have bankfull channels up to 70 feet wide (bedrock channel). Conifers on the adjacent slopes dominate the potential vegetation in these wide reaches. The potential shade on these wider bedrock channel areas may be underestimated because conifers were excluded from the calculations for potential tree height. There is full terrace development, and the stream is usually connected to the floodplain. Alder (up to 90’) and other small hardwoods (willow, red osier dogwood) line the edge of the streams at an average distance of 5’ for the alders and 0’ for the other small hardwoods. Large hardwoods (bigleaf maple 110’, myrtle 100’, and Oregon ash 110’) cover the terrace/floodplain beginning 15’ from the bankfull channel. Douglas fir dominates the slopes and reaches a height of over 200’; these large trees begin an average of 75’ from the bankfull channel. Additional conifers include western redcedar, grand fir and western hemlock (together up to 50% of the shade producing conifers). The understory is sparse due to the full shade from the dense overstory canopy, but dense stands of Himalaya blackberry or reed canary grass develop down to the bankfull level in openings.

Large Valley

The fourth community, Large Valley, is found on the mainstem in the lower valley and continues to the confluence with the Coquille River. The mainstem has a low gradient (around 1%) and the channel ranges from 40’ to 70’ wide. There is full terrace development, and the stream is usually connected to the floodplain. Alder (up to 90’) and other small hardwoods (willow, red osier dogwood) line the bankfull channel at an average distance of 10’ for the alders and 0’ for the other species. Large hardwoods (bigleaf maple 110’, myrtle 100’, and Oregon ash 110’) cover the floodplain beginning 20’ from the bankfull channel. The understory is sparse due to the full shade from the dense overstory canopy, but dense stands of Himalaya blackberry or reed canary grass develop down to the bankfull level in openings.

Table 3 gives the characteristics of potential natural vegetation communities of the North Fork Coquille River. Bankfull channel is the channel width range in feet. Overhang is the percentage of the channel covered by tree canopy. Shade density is the percentage of sidelight blocked by the canopy. The remaining columns are tree species that produce shade. The top number is the average distance in feet between the trees and the bankfull channel; the bottom number is the average height in feet of the mature trees. The species are: ALRU red alder, ACMA bigleaf maple, UMCA myrtle, FRLA Oregon ash, Other hardwoods (willow, red osier dogwood), and All Conifers (Douglas fir, western redcedar, grand fir and western hemlock). The Potential Trees column is for the potential natural vegetation; the top number is the average distance in feet between the trees and the bankfull channel and the bottom number is the average height in feet of the mature trees.

Table 3. Characteristics of Potential Natural Vegetation Communities of the North Fork Coquille River

Community	Bankfull Channel	Overhang %	Shade Density %	ALRU	ACMA	UMCA	FRLA	Other Hardwoods	All Conifers	Potential Trees
Steep Canyon (SC)	3-15	0.9	0.9	5 / 110	20/ 110	20/ 100	-	-	30/ 200	5/ 110
Medium Canyon (MC)	10-25	0.9	0.9	3 / 110	10/ 110	15/ 100	-	-	40/ 200	10/110
Small Valley (SV)	20-55	0.6	0.9	5 / 90	15/ 110	15/ 100	15/ 110	0/ 25	75/ 200	12/105
Large Valley (LV)	40-70	0.4	0.8	10/ 90	20/ 110	20/ 100	15/ 110	0/ 25	-	15/105

9. Target Shade and Solar Loading

The solar energy input or solar load has been calculated for the latitude of the North 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 various land uses as well as for the entire North Fork Coquille River. The lower one half of the table shows the current and target solar loading. The difference between current and potential future conditions is shown in the reduction column.

Table 4. Current and Target Shade and Solar Loading of the North Fork Coquille River.

Watershed	Current Shade	Target Shade	Reduction
Forest Lands	87	95	8
Agricultural and Rural Residential Lands	69	85	16
Entire North Fork Coquille River	81	91	10
Watershed	**Current Solar Load**	**Target Solar Load**	**Reduction**
Forest Lands	276	122	154
Agricultural and Rural Residential Lands	756	366	390
Entire North Fork Coquille River	463	220	243

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

Appendix 1. North Fork Coquille Riparian Spreadsheet

Appendix 2. Model Calibration Data Sheets

Appendix 3. Site Index Tables for Douglas fir and Alder