Certified Redwood Forests and Public Trust Resources

In the FSC Certification of Mendocino Redwood Company, often times throughout the 2010 "Forest Management And Stump-To-Forest Gate Chain-Of-Custody Certification Evaluation Report" and yearly audits; the Certifying Bodies and Accreditation Services quote phrasings right out of the Forest Landscape Management documents of MRC. My favorite is "... to return the forest to desired future conditions."

Herbicides and Dead Standing Trees

Tanoak suppression, fire dangers, fuel loading.... the forest is no longer seen as an ecosystem. MRC management documents speak of "legacy operations" that have resulted in the depleted forest landscape today. And some forests are of particular concern because past management practices, namely fire exclusion and timber harvesting, have already increased the likelihood of uncharacteristic impacts from fire and insects. Segmented scientific studies support forest resource extraction and transfer of forest carbon to consumer outlets. I have not found the words "Public Trust" in any associated MRC document. Neither the Forest Stewardship Council (FSC) nor Sustainable Forestry Initiative (SFI) certification or their respective audits mention the "Public Trust".

Hence the focus is not forest management plans and operations designed to meet species' recovery goals, as well as landscape level biodiversity conservation goals. The FME (Forest Management Enterprise or MRC in this case) sees tanoak removal as a forest restoration to redwoods and Douglas fir. "The auditors confirmed that tanoak has historically been a rather small component of the forest in region. Last, not all tanoak is being eliminated from the forest. It is scattered throughout the property, and included in RSAs and tribal areas of concern to name a few. In conclusion, it was the auditors' opinion that MRC is in overall conformance to the FSC-US Standard for chemical use."

Fire Ecology - Balancing Wildlife Needs and Fire Hazard Reduction in the Central Sierra Nevada - An Ecosystem Management Strategy for Sierran Mixed-conifer Forests is a technical study that attempts to move the discussion beyond limited choices between fuels management and wildlife needs. A 49-page synthesis of current research. An Ecosystem Management Strategy for Sierran Mixed-conifer Forests. Malcolm North et al. 2009. Gen. Tech. Rep. PSW-GTR-220, USDA Forest Service, PSW Research Station
http://www.fs.fed.us/psw/publications/documents/psw_gtr220/psw_gtr220.pdf

This is an article on Coastal Redwood Forests and the Public Trust Resources which flow through public and privately owned forested landscapes. The coastal influence of the ocean, the marine layer, fog and rain, on the streams, lakes, rivers, the watershed water balance, the full hydrologic cycle of forested slopes, tree growth, soil moisture levels, aquifers, groundwater recharge, thermal ecology and ecological energetics of species, nutrient cycling. I have submitted most of this information in the form of public comments and will continue to do so.

Loss of Standing Volumetric Biomass of the Coastal Redwood Forests – The "Cumulative

Impacts and Climate Change" Section 4 of Mendocino Redwood Company Timber Harvest Plans. (Which references another document explicitly by chapter: "Fog Drip - Chapter 8.4.3.4, of MRC's draft Habitat Conservation Plan").

The section referred to above, in Mendocino Redwood Company's Draft Habitat Conservation Plan (HCP), provides sources of inconclusive research data, and at that, is selective at best. The discussion and resources cited in the Draft Habitat Conservation Plan regarding the role of fog and fog drip are incomplete. The suggested HCP Chapter provides no discussion of the role of fog and fog drip over the larger time-scale of the watershed hydrologic cycle. Neither is there a Risk Assessment evaluation of climate change quantifiers beyond the Harvest Block, (including but not limited to the landscape of the Sustainability Unit, Watershed Assessment Area or Biological Assessment Area - CA DFWS, DFG, CDF, CALFIRE, and the draft HCP area). Natural replenishment to the hydrologic cycle is separated from larger watershed dynamics of a healthy functioning forest ecosystem and filtered out through immediate response criteria in a metric of increases to streamflows. MRC forest management (silvicultural regimes) forces juvenile conifer regeneration employing methods that continue the desertification and depletion of Mendocino County redwood forests.

Regarding the role of fog drip in redwood forest ecology, this is the industrial view:
1) "loss of fog drip does not play a significant role in hydrologic changes following forest harvest"
2) "If fog drip was a significant component of hydrologic change at Caspar Creek, then soil moisture and stream flow should have decreased after logging. However it increased, suggesting little effect."
3) "timber harvest has been found to increase streamflow by diminishing transpiration and canopy interception, which offsets any reduction in fog drip"
4) "loss of evapotranspiration from forest harvest may be a more significant variable to changes in watershed hydrology than fog drip."

A Correlative Comedy of Errors

Increases in streamflow bring with it sediment loading. Ignored in the discussion are the effects on the temperatures of water inputs to streamflow after logging operations. And any increases to streamflow from soil piping are directly proportional to antecedent soil moisture.

The industry standard (argument) itself has lasted for almost 20 years, and diametrically opposes current published scientific research on watershed hydrologic cycles and landscape dynamics. It is based on the axiom that when the trees are removed from a hillside, there is more water available in the soil, and sub-surface flows are increased to the stream channels as are surface flows.

Removal of trees does 'Increase Peak Stream Flows'... but what does that actually mean?

Chittenden (1909) stated that forest cutting alone does not result in increased runoff. But, concern about overexploitation of forests and the argument that conservation could reduce floods resulted in passage of Weeks' Law in 1911. Weeks' Law authorized the purchase of private land to establish National Forests in the eastern United States "... for the protection of the watersheds of navigable streams...."

30 years later, studies at Coweeta, North Carolina, produced the first scientific evidence that converting a forest into a mountain farm greatly increased peak flows, but clear-cutting the forest without disturbing the forest floor did not have a major effect on peak flows (Hoover 1945). By the 1960's, there were 150 forested experimental watersheds throughout the United States. Lull and Reinhart in 1972, focused on the eastern United States, published their definitive paper summarizing what was known about the influence of forests and floods, as about 2,000 papers had been published reporting research results about the hydrology of forested watersheds. A decade later, Hewlett (1982) studied the major forest regions of the world to answer the question "Do forests and forest operations have sufficient influence on the flood-producing capacity of source areas to justify restrictions on forest management?" Hewlett concluded, as did Chittenden (1909) and Lull and Reinhart (1972), that the effect of forest operations on the magnitude of major floods "is apt to be quite minor in comparison with the influences of rainfall and basin storage."

In this context, the term "major floods" requires appraisal.

Clearcuts and associated logging roads (in the redwood region) have caused landslides that buried homes and communities.

Increasing Peak Flows

"A principal objective of initiating the Caspar Creek study in 1962 on the (JDSF) Jackson Demonstration State Forest, near Fort Bragg, California, was to examine the effect of improved logging practices being recommended at the time upon streamflow and sediment production."

"The effect of logging second-growth forests on streamflow peaks in Caspar Creek is consistent with the results from studies conducted over the past several decades throughout the Pacific Northwest. That is, the greatest effect of logging on streamflow peaks is to increase the size of the smallest peaks occurring during the driest antecedent conditions, with that effect declining as storm size and watershed wetness increases. Further, peaks in the smallest drainages tend to have greater response to logging than in larger watersheds." Flooding and Stormflows, Robert R. Ziemer USDA Forest Service Gen. Tech. Rep. PSW-GTR-168-Web. 1998.

Soil Moisture Levels - The Surface Of Watershed Dynamics - The Forest Floor

Dawson's "The Use Of Fog Precipitation By Plants In Coastal Redwood Forests" did much to dispel conventional wisdom deeming trees, especially old growth conifers, as harbourers of water, capturing and storing water then made unavailable to streams for example. Dawson's work indicates that fog and its interception by these giant trees contributes large volumes of water to forest habitat through the process of fog drip.

Dawson found that “during the summer months when fog was most frequent in northern California and southern Oregon, between 8-34% of the water used by the redwood, Sequoia sempervirens, was fog derived. Usually the species is dependent upon deeper soil or ground water provided by rainfall during winter rainfall events, says Dawson. Between 6-100% of the water used by the understory vegetation came from fog derived precipitation after it had dripped from the tree foliage into the soil. Hydrologic studies indicate that moisture input to the redwood forests from fog can constitute between 30-75% of the annual water budget, at certain times of the year, nearly half of the water input originated with fog!”

“As fog moves into a forested area, it travels through the canopy and the moisture is effectively stripped from the air by the tree's branches and array of needle-like foliage, which Dawson describes as a 'layered-like comb'. The water captured by the needles - an old tree collects droplets on perhaps 60 million needles, a surface area of one acre - then drips down branches and trunk to the plants growing at the base of the tree. Dawson's work suggests that fog drip can account for half of the water coming into a redwood forest in a year and is critical in maintaining the moisture that so many species depend upon in northwestern rain forests.”

Dawson also discovered that not only are the plants of coastal redwood forests using high proportions of fog water but that the presence of the trees themselves significantly influences and moderates the magnitude of water input from fog. He noted that “between 22 - 46% of the moisture input to the ecosystem was due to the presence of the redwood trees themselves (interception input) and when trees were absent interception input declined by 19-40%.”

"From a management perspective," reports Dawson, "the fact is that loss of redwood trees due to natural disasters (e.g., fire, windthrow, or floods) or from logging or other land use practices which convert the forest to open habitats dramatically alters the hydrological and ecological balance of these forests. Loss of the canopy trees would mean not only the loss of biomass, nutrients within the biomass, and the soils, but also a fundamental conversion of a once moist, cool, forested ecosystem into a more drought prone, and warmer ecosystem.”

Redwoods require prodigious amounts of moisture during the growing season, and transpiration rates of 500 gallons per day have been reported by Hewes (1981), whereas more drought-resistant associates, such as old-growth Douglas-fir (Pseudotsuga menziesii), transpire 140 gallons daily (Kline et al., 1976). Azevedo and Morgan (1974) determined that fog drip affects both water balances and nutrient cycling within coastal ecosystems. They recorded as much as 3.15 inches of fog precipitation beneath one Humboldt County redwood in 48 hours.In the mountains east of Half Moon Bay, an astounding 58.8 inches of fog drip was collected by Oberlander (1956) under an exposed, 20-foot high tanoak (Lithocarpus densiflora) in 39 days!”

At the canopy, evapotranspiration is dependent on ambient conditions - temperature and humidity, (the micro-clime of the geographic location and density of forest canopy structure, leaf surface area, and canopy height). Fog and fog drip contribute in different ways to ecosystem functions 1) in the stream channel and 2) at exposed ridges 3) hardwood stands contribute different nutrients 4) there are differences in fog moisture capture (interception) at the forest edge compared to the interior; and these must be considered across the spatial dimensions of time and at the landscape level.

It's As Clear Cut As The Caspar Creek Watershed - Science In Defense Of Logging;

After the trees are gone, surface evaporation from soils is not considered important to the water balance and the variable compliment to evapotranspiration. It is promoted that soil moisture levels are protected from evaporation by the hard, dry, sun baked surface of soil, which, after logging may have been subjected to fire (as a mechanical means) to reduce the fire hazard from slash.

In their discussion of "Fog Drip" MRC forest timberland management documents give no consideration to 1) the ceiling height of low clouds and fog, 2) the tree heights of the dominants by dbh class and basal area, 3) the importance of trees along ridge elevations (where now fire roads between cutover hillslopes of brush exist), 4) the contribution of fog and fog drip to the full hydrologic cycle of watersheds, 5) the inland extent of coastal marine layer influences (fog – fog drip) not always independent of rain in the hydrologic time scale of watershed dynamics).

Jackson Demonstration State Forest Caspar Creek Studies are generally cited for supportive documentation - research from the most cut-over clearcut watershed in Jackson Demonstration State Forest (JDSF) the history of which is fraught with contentious protests and lawsuits by the surrounding communities throughout the 1990's to a just few years ago.

Anyway, back to the actual studies in Caspar Creek, and their application to the forest practices and THP review process and public comments. Canopy height is important. The trees in the Caspar Creek studies were no more than 120 years of age. The fog traversed clearcuts to reach the trees, elevations of ridges ranged between 200-220 meters.

What was the impact on fog (moisture content, flow) by the temperature differential 1) over the clearcut landscape and, 2) the forested stands? Does the additional warmth cause the fog to rise, or adversely impact air moisture levels?

"No Tree Left Behind" Watershed Hydrological Impacts: The Roshomon Coverup

The "loss of evapotranspiration from forest harvest may be a more significant variable to changes in watershed hydrology than fog drip." The standard of cookie cutter responses - from the 2007 study titled: "Effects Of Timber Harvest On Fog Drip And Streamflow, Caspar Creek Experimental Watersheds." (E.T. Keppeler)

This of course might seem an obvious statement, but it is not conclusive as to the role of either fog, fog drip or evapotranspiration - the full hydrologic cycle within drainages and at the watershed level is not covered in the Habitat Conservation Plan (HCP). Soil moisture evaporative losses post-harvest are not considered. The HCP gives no relative consideration to moisture level inputs and real world spatial time-scales of fog, fog drip, or persistence levels of fog events across the HCP area and the relation to ecosystem functions. Instead, the Timber Harvest Plan and HCP, use select parts of studies to support it's monologue 'discussion'.

What of the effects of timber harvest on fog? Fog density, height, and type – low clouds and fog, a warm dry fog, or cold wet fog, are all important considerations in a discussion or study regarding fog drip. The Caspar Creek study referenced in the THP and the HCP, is shown in the following mosaic of two images. The image, for comparative purposes, shows clear cut hillslopes west of the study area, and the study collection locations.

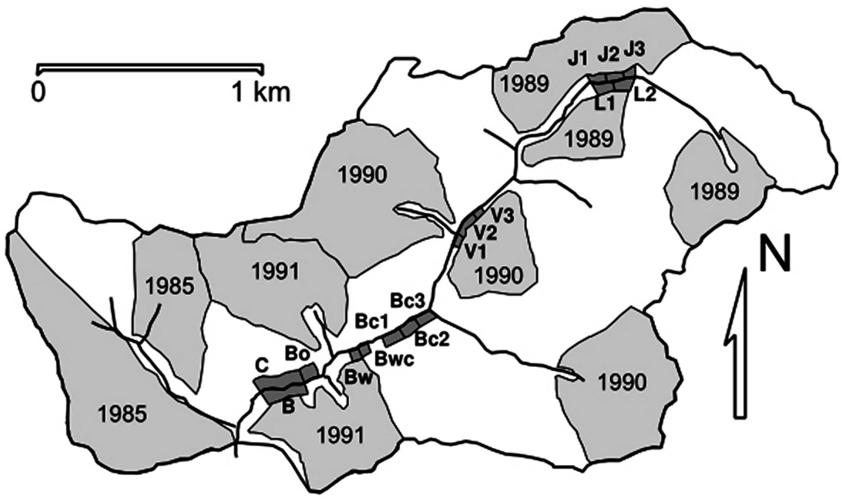


Figure 3—Location of the North Fork Caspar Creek tree-fall study plots, showing clearcut unit boundaries, year cut, study plots, and plot names. See table 1 for plot descriptions. Plot JL is located on the floodplain between the J plots and the L plots.

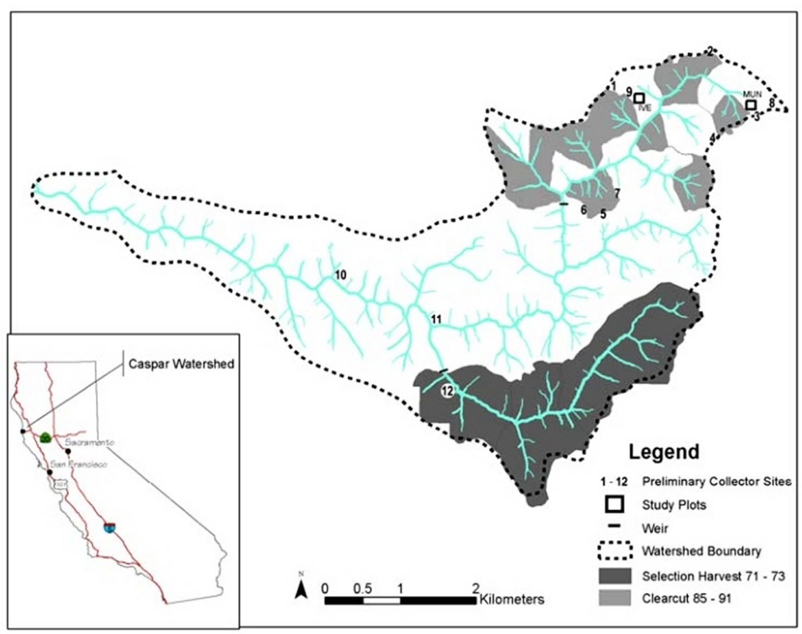


Figure 1—Caspar Creek watersheds, harvest areas, and fog-drip sampling sites.

Conversely, what are the effects of clearcuts on fog?

What is not discussed in the 2007 research paper ("Effects of Timber Harvest on Fog Drip and Streamflow, Caspar Creek Experimental Watersheds, Mendocino County, California" - Elizabeth Keppeler), is that GP owned the forestland immediately west of the JDSF portion of Caspar Creek and clearcut large sections in the early 1990's. GP even left Bull Pine and Coast Pine for canopy and stocking requirements, and took every tree on the south slopes near Rd 409. Only legal action by Paul Katzeff retained the large trees at the top of the ridge that border his land, providing wind protection (an area of 10 acres, for 99 years, a precedent setting case).

Densely forested watersheds have a very different time-scale regarding fog or rainfall inputs, and a broader geographic area of saturation where inputs would have measurable effects over greater distances from harvested areas.

How fog effects rates of evapotranspiration, how it reforms into atmospheric moisture, the transfer of nutrients to the soil, the flow of water from trees to soil, and groundwater recharge, the role of humus and forest litterfall as it deepens over the years of stand age and gains water retention capacity is not compared – discussed – or mentioned in terms of the hydrologic cycle contributions or inventory growth. Keppeler gives it mention in one sentence: "Fog plays an important role in the regional ecology by moderating evapotranspiration."

The role fog and fog drip play in forest ecology, watershed dynamics, tree growth, and soil nutrients, is dismissed in the THP/HCP discussion. "Increased streamflow" is seen as a positive metric. Apparently this is to coincide with the warm summer months of June, July, August, when the study's data collection took place, and when flowing water in the stream channels is considered generally low.

Upon reading the full studies referenced, three watershed effects that are detailed in the very same studies cited in individual THP's and referenced in "Fog Drip - Chapter 8.4.3.4" of MRC's draft HCP are excluded from the discussion of Peak Flows:
1) Increased summer flows did not buffer summer temperature effects.
2) The amount of slow water habitat on the NFC increased after logging, but reports no corresponding increase in biomass of stream vertebrates.
3) These discharge impacts are variable and relatively short-lived.

Modified Riparian Conditions

In "Flooding and Stormflows", Robert R. Ziemer found - "Increased stormflow volume after logging was the most significant variable explaining differences in suspended sediment load (Lewis, these proceedings). Further, logging has increased soil moisture and summer lowflow (Keppeler, these proceedings), subsurface and soil pipe flow (Keppeler and Brown, these proceedings), woody debris (Reid and Hilton, these proceedings), and modified other riparian conditions. The ecological significance of these changes remains to be determined."

Indeterminate Ecological Significance

Elizabeth T. Keppeler, in "The Summer Flow and Water Yield Response to Timber Harvest" states: "Streamflow changes due to logging are most evident during the long, dry summer season typical of northwestern California. During this prolonged recession, zones of deep perennial saturation maintain streamflow (baseflow) and that fog plays an important role in the regional ecology by moderating evapotranspiration."

In the studies cited in the THP/HCP, it is stated that the removal of the forest canopy, especially near the ridges, probably resulted in less fog interception and drip. "The pipeflow swales are located near the ridge in the NFC headwaters. Here, one might expect fog drip to play a more prominent role in the water balance than in the watershed overall, but July pipeflow increased dramatically during the first few postlogging seasons, suggesting that this was not the case."

The studies go on to state: "The impacts of the Caspar Creek harvest treatments on stream and riparian ecology are more difficult to discern than the physical changes. An increase in summer discharge implies that the stream is less susceptible to water temperature increases. Maximum water temperatures increased about 9 ºC (from 16 ºC to 25 ºC) after right-of-way clearing and road-building in the SFC riparian zone (Krammes and Burns 1973). Increased summer flows did not buffer these temperature effects. On the NFC, stream temperature changes after logging were not significant (Cafferata 1990, Nakamoto, these proceedings). The use of stream-side canopy retention zones on Class I and II channels was probably far more important in preventing increases in stream temperature than the summer streamflow enhancement."

Managed Forest Conditions vs Resilience and Biodiversity

"Perhaps a more important effect of enhanced summer discharges is the increase in aquatic habitat developed in the channel. Higher discharge levels increased habitat volumes, and, as witnessed at the tributary gages, lengthened the flowing channel network along logged reaches. Nakamoto (these proceedings) concludes that the amount of slow water habitat on the NFC increased after logging, but reports no corresponding increase in biomass of stream vertebrates. In terms of both stream temperature and habitat availability, the summer flow enhancements are of greater importance than the increases in total annual water yield because it is during the summer streamflow recession that temperature and habitat carrying capacity are most critical. However, these discharge impacts are variable and relatively short-lived."

Keppeler concludes: "Moisture savings due to reduced evapotranspiration appear to override fog precipitation losses at this site."

TRANSLATION: Reduced forest cover is equated with moisture savings, that savings flows into the streams... Regarding "Fog Drip - Chapter 8.4.3.4" of MRC's draft HCP - this is a segmented view of watershed hydrologic processes timeline, leaving out of the water balance equation 1) surface evaporation after the trees are gone, prior to re-vegetation, and 2) associated ecosystem functions and services, i.e., nutrient cycling.

Even brief periods of rain (after throughfall ceases) leave a mist of fog that has been shown to remain in the canopy for up to two days, slowing evapotranspiration. "Fog Precipitation Losses" is a calculation of fog drip, which does not occur until the canopy, (needles etc.) are saturated and droplets form. The hours of the day over the course of a year that this reduces evapotranspiration is not considered in detail in supporting documentation of cited studies. The conclusion, as stated by Keppeler: "Moisture savings due to reduced evapotranspiration appear to override fog precipitation losses at this site" is inconclusive and unsupported in further studies cited in these comments and not applicable to protecting the Public Trust resources of the State.

From Nutrient Cycling To Sediment Transport

"Timber harvest has been found to increase streamflow by diminishing transpiration and canopy interception which offsets any reduction in fog drip." As these comments will show, increased streamflows per above, are washing away the Public Trust and beneficial uses of forest nutrients in canopy capture of fog.

In fog shrouded canopies, reduced evapotranspiration and reduced evaporation contribute positively to the redwood region's coastal influences on watershed processes and flow in a state of equilibrium over time. In the Caspar Creek studies, Keppeler states: "average fog drip at ridge-top sites would augment dry-season precipitation by 63 percent."

Why would it be that MRC's discussion of fog drip and forest watershed hydrology is limited to a focus on subsurface flows, and input to stream channels, surface and land movements? Aside from mass wasting events, landslides, etc., how does this relate to redwood growing stock, and ecosystem requirements for cool, moist conditions given the data present in other studies referred to in these comments?

The importance of fog, and fog drip to regrowth of the forest within the range of coastal influence is not discussed in Chapter 8.4.3.4, of MRC's draft HCP. What management options (silvicultural prescriptions over the duration of the HCP) would achieve a positive increased input to forest hydrology, redwood ecology, and overstory interception? This would have been a much more useful discussion in the THP Section under CEQA "Alternatives Considered."

How is the role of fog (including fog drip as throughfall, stemflow, infiltration) to redwood ecology enhanced by silvicultural proposals over the term of the HCP? Industrialized cut-over watershed studies do not suffice for supportive documentation in MRC forest restoration management under it's Option A Planning Documents. Does MRC's HCP only address the silvicultural effects on forest hydrology in terms of the soil water balance and swales, landslides, mass movement, soil pipes, flow, pore size, saturation, and peak flows?

Soil piping and subsurface flows are limited by soil type to certain depths as are the roots of the trees. Below this level, soil moisture remains almost constant, and it is known that the soil moisture at this depth and below do not contribute to streamflow. It is also known that evaporation from forest litter is moderated by canopy cover, and that transpiration leads to moisture condensation, which under the right conditions, contributes to precipitation. With the right conditions, whether rainfall or fog drip, there is infiltration.

The full hydrologic cycle is not considered. Groundwater recharge is not given full consideration due to the 'immediate response' preference of increased soil moisture and subsurface flows and the corresponding increases in streamflows as indices of forest health. Lag time differences between infiltration and streamflows are explained by juggling a few of the known variables.

Studies referenced in the THP and HCP, leave out groundwater recharge and watershed processes over the spatial time-scale beyond the harvest cycle and criteria of post-harvest stocking standards, and conclude that increased streamflows are reduced after regeneration of soil surface vegetation. But it is well known that every regolith has many cracks, crevices, fractures and folds that direct subsurface flows downward. The more vertical inclined flows and seepage (that reach the greater depths of regoliths) are dependent on this lag time on a watershed scale over distances beyond the flagged areas of the harvest block and adjacent streamchannel.

Interpretive Degrees Of Separation – The Coast Range And Big River (Mendocino)

Citing the Caspar Studies of Keppeler, a Timber Harvest Plan (THP) can state: “The coast range ridges and mountains provide an effective barrier to inland penetration of marine layers.”

In contrast, what E. T. Keppeler actually states in her research paper “The Summer Flow and Water Yield Response to Timber Harvest” is that: “The Coast Range forms a partial barrier to this marine layer...”

“Literature suggests that fog plays a crucial role in the ecology of the Pacific Northwest. In this region, warm, moist air contacts cool coastal waters, lowering temperatures below the dew point and forming fog. This fog layer may travel far inland depending on the strength of the onshore breeze and local topography. The Coast Range forms a partial barrier to this marine layer, preventing penetration to inland areas except where breaks in topography occur such as along river valleys.”

In my opinion, onshore breezes seem to have increased in recent years. It is also not borne out by USGS 7.5 minute topographical maps that that the Coast Range is an “effective barrier to inland penetration of marine layers.” Up the wide Big River back to it's South Fork, just over the ridge from the Navarro drainage, the nearest highest peak is Cameron at 1400 feet, and most of the surrounding plateau is 1000 feet in elevation. The predominant NW winds which drive the fog as stated by Keppeler would push the fog inland through the broad South Fork Big River channel - wide and low with slow gradients from 400 to 800 feet mostly, to near the coast range where the hillslopes rise quickly at Bowman Ridge.

Mathison Peak near Kaisen Gulch on the Albion River is the highest peak to the west. and the average topographical elevation surrounding the peak is approximately 400-600 feet. To the east is Bowman Ridge where in fact the 'Coast Range' starts to rise, very quickly to a near average peak/ridge elevation of 2000 feet. Meaning that, if the fog is effectively blocked from further penetration inland beyond the Coast Range as stated in the response of THP 1-14-148 MEN, then Mettick Creek, along with Poverty Creek which flows into Mettick Creek and join the South Fork Of Big River, would be very high collection points of fog and fog drip, as beneficial input mechanisms to canopy density and streamflow temperatures, soil moisture levels, soil nutrients, litterfall, canopy foliar nutrient cycling, groundwater recharge (GWR), and understory forest food resources for flora and fauna.

What role do the moisture and coolness of fog have in the life cycle of the NSO? What climate change vulnerability mitigation options or proposals does MRC intend for listed species? What are the cumulative effects on NSO residency by 5 to 7 years continuous nearby operations?

The "Halfway To Hell" THP while stating in it's description of the post harvest basal area as "high to moderate amount of growing stock retained post harvest" … or "an abundance of large conifers shall be retained post-harvest" does not quantify how the THP is not expected to have near-term cumulative significant impacts on fog drip and maintenance of habitat for NSO life cycle requirements including dispersal. This leads on to another concern.

Predation Variable In The Calculations

There is no discussion in the draft HCP, or MRC's Management Plan, regarding dispersal, and dispersal habitat/routes between the Activity Centers in the Albion River WAA, The Navarro River WAA, and the SF Big River WAA. In each case, the term WAA may be interchangeable with the use of the designated Sustainability Unit. The convergent timing of logging operations, current owl dispersal (or nesting) and the time-scale of habitat loss through to sufficient recovery as habitat for the NSO is not detailed in either the HCP or THP. The role of fog and fog drip in these dispersal patterns are not discussed. The average dispersal distance can be as small as 3.8 miles, that places the NSO in the area of the nearest Barred Owl sighting (1.5 miles from Mettick Creek as noted in THP). It is not discussed how the presence of fog and canopy cover benefit protection of the NSO against predation by Barred Owls.

The calculated increased streamflows and measured increases in soil moisture, interception losses (evaporation at the canopy) and transpiration losses, post-harvest and removal of trees - are not proven in the research cited in the HCP/THP to be beneficial to aquatic habitat and increased biomass of aquatic communities. Increased streamflows are discussed at length in these following comments. Increased streamflows are simply a measurable immediate response of watershed functions, variable to the size of the watershed, and sivilcultural prescription, and changing climatic factors.

"If fog drip was a significant component of hydrologic change at Caspar Creek, then soil moisture and stream flow should have decreased after logging. However it increased, suggesting little effect (Keppeler 1998)."

Paper Metric

“Timber harvest has been found to increase streamflow by diminishing transpiration and canopy interception, which offsets any reduction in fog drip. This was concluded by Keppeler in 2007 in her post harvest analysis of a 65 percent selective harvest by volume and a 50 percent clearcut by area in the Caspar Creek watershed.”

“Given the proposed silvicutltural prescription and the high to moderate amount of growing stock retained post harvest, this THP is not expected to have a significant effect on fog drip in Mettick Creek or Little North Fork Navarro Watersheds. An abundance of large conifers shall be retained post-harvest that will continue to input fog precipitation into the watershed. Any decrease in fog drip that does occur by removing large conifers will be offset by reduced transpiration and interception.”

Cumulative Impacts At The Ridges

When trees are taken from fog shrouded ridges, is not the soil moisture level affected on both sides of the ridge? This variable is not considered in any discussion of impacts to watershed hydrology from logging operations, but would be cumulative, across the landscape.

Based on limited data of actual spatial/temporal occurrences of fog events over the area of the HCP, the Sustainability Unit, Harvest Blocks and THP boundaries, the studies cited are inconclusive, and their applicability as supporting documents in the HCP/THP analysis of “Fog Drip” is negligible.

Fog and Fog Drip are two related phenomena, just as soil moisture levels and canopy moisture levels. Both are important to moisture levels required by redwood forests and provide the environmental mechanisms for stand growth and to moderate inputs to stream channels (sediment, temperatures of input) and seepage to groundwater.

“Reid and Lewis (in research on the role of foliage interception) estimate post-drip canopy storage to be about one mm. A similar value is expected for potential storage of condensed fog before drip is significant. The effect of this wetting of the canopy is important in ameliorating moisture stress by direct foliar absorption and reduced transpiration losses. In 1999, fog drip occurred during 29 days, but solar radiation data collected at Caspar Creek indicate the presence of fog or cloud cover during more than a third of days in the study period. Although the canopy may not have been saturated to the point of drip by every fog event, enhanced humidity and reduced insolation and air temperatures moderated actual evapotranspiration rates.”

Keppeler concludes: “The climatic and topographic conditions that influence the distribution and frequency of fog along the California coast vary considerably, so fog drip is expected to be more significant at some sites than others. Certainly, fog has a pervasive effect on redwood ecology, but the indirect effects of reduced evapotranspiration are probably larger than the direct effects of fog-drip inputs to soil moisture and groundwater at all but the most coastal locations. Only by a more comprehensive research effort might the spatial and temporal variations of fog water inputs in this region be more fully defined.”

What's missing is a discussion of watershed responses to the hydrologic cycle of the wet temperate redwood region on the North Coast influenced by coastal weather patterns, marine layers and fog, precipitation, etc., reaching to inland areas, giving consideration to lag time and trophic layer energetics on detritus nutrient cycling. Larger time-scales based upon the understory ecosystem functions and services including forest food resource, flora and fauna, life cycles of listed species and their prey base, and the role of fog and fog drip.

Using a spatial time-scale of one year, what is the total contribution of fog drip? What is the average optimum height/diameter at which tree crowns induce the precipitation known as fog drip? Is fog thickest with higher moisture levels in denser canopies that penetrate the fog layer? In the Caspar Creek studies, the trees were not old enough, nor tall enough to capture the fog and induce the amounts of fog drip as recorded in many of the studies that were cited by E. T. Keppeler, whereby her studies were supposed to contrast the known data and presumptions. Two large canopy collectors in two different sites failed, there was no data, but the study was published.

Equally important, Keppeler goes on to state: “Using the average annual rainfall from two North Fork gauges between 1993 and 1997 (1314 mm), a percentage cut of 37 percent, assuming no recovery of vegetation, and not including the loss of fog drip, the annual water balance of the North Fork was theoretically enhanced by as much as 229 mm (or 17 percent of average annual precipitation) during this five-year post-harvest period. In comparison, monitoring data indicate that increases in North Fork annual yield averaged 73 mm for five years after partial clearcutting. This equates to a net increase of 197 mm (73/.37) per year in streamflow from the clearcuts during this five-year post-harvest period - the net effect of reduced transpiration, interception, fog drip, and changes in soil moisture and groundwater storage. Differences between expected and observed changes are attributable to changes in soil moisture and groundwater storage, progressive hydrologic recovery from revegetation over the five-year period, annual variations in weather, and, especially near the ridges, some decrease in fog drip.”

Changes In Soil Moisture And Groundwater Storage

“The mean values for the five ridge-top sites averaged 39 mm per year during the four month sampling period. This value is only three percent of the mean annual precipitation (1170 mm) at Caspar Creek, and so would represent only a minor influence on the annual water budget. However, only five percent of the annual rainfall (62 mm) occurs between May and September, so the average fog drip at ridge-top sites would augment dry-season precipitation by 63 percent.”

Drawing on Keppeler's research, what is not discussed in MRC's HCP Fog Drip - Chapter 8.4.3.4, of MRC's draft HCP, nor THP documents is the spatial time-scale, of fog events, duration of moisture levels and it's relationship to fog burn-off, inland penetration, nutrient delivery to support growth of understory and the canopy contribution in the overstory trees' continued growth. Nor is it discussed the role of fog in the canopy structure (biota) and habitat requirements for the NSO and Murrelet.

There are two kinds of evaporation: 1) by interception which is covered in said studies referenced in the THP. But post harvest there is also evaporation from soils. Canopy openings, roads, landings all contribute to this evaporation.

Studies cited in the HCP/THP are pretty much all in agreement on inputs to streamflows. It was determined that increased subsurface flows and inputs to summer streamflows were variable, and later diminished due to recovery of soil moisture by revegetation after the first 5-7 years.

All research in the chapter on Fog Drip referenced by MRC's HCP only 'discuss' increases to streamflow, and subsurface flows, in the context of the effects of timber harvest on fog/fog drip and increased streamflows. These could be classed as immediate response studies, only.

As stated in Chapter 8.4.3.4, of MRC's draft HCP on Fog Drip and referenced in THP's the key centerpiece of the grammar and phrasing is the descriptive word “increase”. But no 'discussion' is given as what that increase means in terms of the Watershed Assessment Area beyond the THP boundaries, or the ecosystem resilience. THP's state confidently that increases are not likely to be significant.

Adding to the 'discussion' on “Fog Drip” in MRC's draft HCP as applicable to this THP, Robert Ziemer states in “Flooding and Stormflows” that:

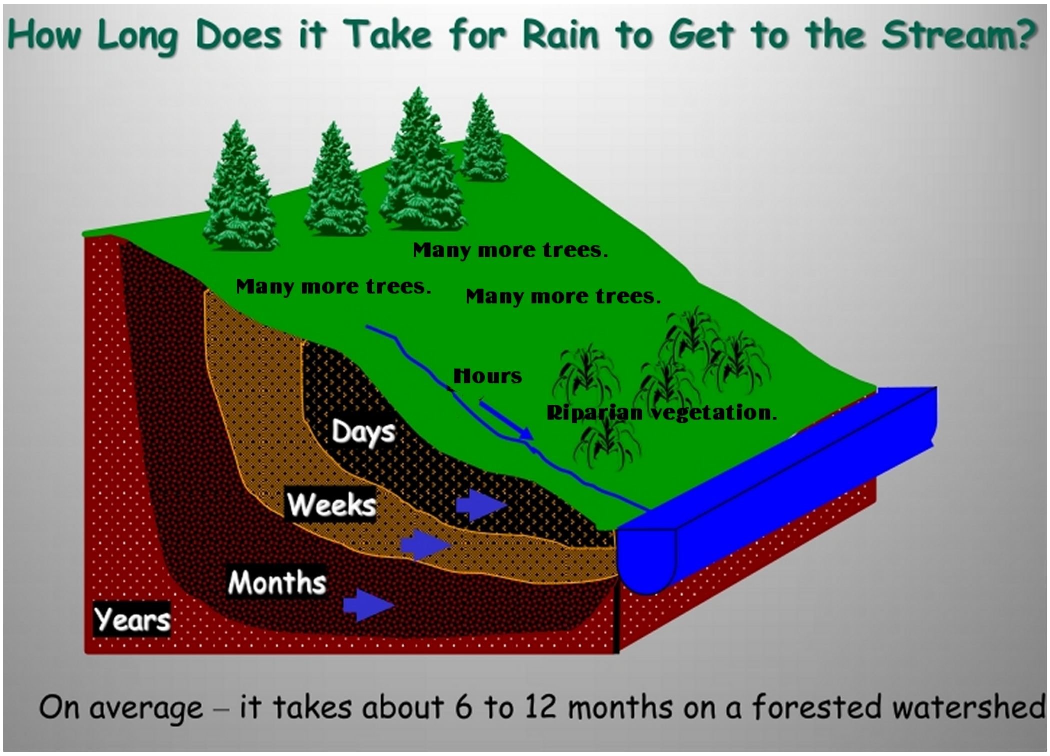
“The greatest effect of logging on streamflow peaks is to increase the size of the smallest peaks occurring during the driest antecedent conditions, with that effect declining as storm size and watershed wetness increases. Further, peaks in the smallest drainages tend to have greater response to logging than in larger watersheds.”

“However, increased stormflow volume after logging was the most significant variable explaining differences in suspended sediment load (Lewis, these proceedings). The ecological significance of these changes remains to be determined.”

There is the significance in soil composition and litterfall relating to evaporation and lag time to groundwater recharge mechanisms over the hydrologic time-scales of hillslope drainages and watersheds. This same concern applies to steep gravelly slopes which would benefit by depth of that layer of hummus on the forest floor, and slowing subsurface flows, allowing the flows to exploit irregularities in the regolith that allow seepage to reach groundwater.

Groundwater recharge processes at the watershed level and across the landscape are metrics of the Public Trust resources that flow through MRC lands. The importance of the maintenance of seepage across hillslopes and the micro-climes of exposed ridges on Class 2 and Class 3 watercourses is not addressed. Increased streamflows are a temporary variable.

The following image illustrates soil composition and litterfall lag time scaled for a forested watershed.



The extreme degrees of slopes in THP 1-14-148 MEN and the soil type classification, along with the hardwood component, and dbh/canopy contribution present an ideal filtration system for GWR. (Units 1 and 3 have trees of a diameter class that will not be grown again to that size on these sites over the duration of the HCP). Yet no discussion is given as to the importance to the SF Big River WAA of fog interception and the fog drip that occurs bringing nutrient replenishment to the forest soils and GWR by the full hydrologic cycle.

Fog Drip, the hydrologic cycle, Soil Permeability and Seepage, Groundwater recharge:

Appendix H in the HCP/NCCP addresses instream permeability of gravel: "Stream Gravel Permeability - Conditions of intra-gravel flow are often described by - apparent velocity, which is defined as the rate of seepage through bed material, expressed as the volume of liquid flowing per unit time through a cross section. Because cross sectional area includes both the particles and the voids (pore spaces), apparent velocity is slower than the actual (pore) velocity of water flowing through the voids (Pollard 1955). Apparent velocity is the product of hydraulic head and substrate permeability (Darcy's law)."

Soil types and Erosion ratings on the steep slopes suggest percolation through the soil types which would allow seepage from infiltration (fog drip and rainfall) - as ecosystem functions, these processes of the hydrologic cycle are also dependent on soil moisture, but more dependent upon lag time. The journey of moisture once it reaches the forest floor to then reach the actual soil surface through the leaf litter is critical.

The water balance equations used in the supporting documents referenced in the HCP/THP do not appropriately address nutrient cycling and transpiration ratios, or GWR recharge rates as inputs to the hydrologic cycle, and/or watershed dynamics. The forest edge is where most of the below-canopy effects of fog might be expected. Beyond this zone, the importance of fog is much greater in the canopy than below it."

Measurable Influences On The Functional Ecology Of Redwood Forest Systems

In "Fog Water and Ecosystem Function: Heterogeneity in a California Redwood Forest (2009)" a study in a redwood forest in Sonoma County, it is discussed that "the absence of water in soil moisture in the interior of the forest is evidence of lesser water availability in those locations, corroborating the physiological data indicating greater water stress on trees in the interior of the forest - more negative xylem pressure potential and transpiration rates that were a smaller percentage on average of the maximum transpiration rate measured. Trees at the edge had more water available for transpiration and yet the less negative values for redwood needles at the edge suggested more conservative water use in these trees Although this may seem contrary to what was found for transpiration using the sapflow data, it is consistent with the fact that edge trees experience more demand for water because of their greater leaf area and edge position (with greater wind velocities and higher evaporative conditions relative to interior trees) where they show daily stomatal closure when demand exceeds soil water supply."

"Although the forest floor in the forest interior received little fog water, the forest canopy was exposed more consistently to fog even when the fog did not accumulate in sufficient amounts to produce throughfall. Canopy wetness occurred on many more days than throughfall in the interior of the forest. This frequent wetness helped relieve water stress relative to dry crowns by reducing transpiration (Kerfoot 1968; Simonin and others, unpublished) and perhaps also through crown water uptake which occurred on 20–50% of days in the fog season."

"As such, although there were on average fewer than five fog events per summer capable of substantially increasing the moisture content of the soil, and these increases were seen only at the forest edge, the water intercepted directly by tree crowns and held there had a significant functional impact. The combination of canopy wetness and uptake, and associated available soil moisture for root water uptake supports the idea that fog can partially decouple tree crown water status from soil water status and have measurable influences on the functional ecology of redwood forest systems (Burgess and others 2006; Simonin and others unpublished)."

Fog Nitrogen deposition to the canopy also was greater than that to the soil. The study's "estimate of atmospheric fog deposition (0.78 kg N/ha/season) is approximately half of total bulk deposition to the Sonoma site (1.88 kg N/ha/y) and equal to the annual average wet (rain) deposition (0.77kgN/ha/y; 2003–2005) measured at the nearest National Atmospheric

Deposition Program site in Hopland CA (CA45, NADP). Thus although rain accounts for 89% of N reaching the forest floor across the entire forest, rain deposits only twice as much N to the canopy as fog because fog is highly chemically concentrated. This result is consistent with other studies of fog chemistry (Weathers and others 1986, 1988; Collett and others 1999; Fenn and others 2000; Vitousek 2004)."

"The compounded deposition of both water and N to the western edge of the forest may also be ecologically significant when viewed over longer time scales. For example, we observed greater fine root density and translocation of organic material to greater depth of 60cm in the soil at the western edge of the forest with many fine roots compared to less than 30 cm in other parts of the forest (Ewing and others, unpublished). This contrast in soil development could be a function of differences in water deposition, plant production, understory composition, decomposition, history, or some combination of these factors. As most of these factors may also be related to the higher water and nutrient deposition contributed by fog to the windward edge of the forest, the gradient in fog water inputs may have an important influence on soil characteristics and genesis."

"As in the rainy season, substantial vertical processing of N occurred as water passed through the canopy. Processing of N also clearly occurred in the soil during the times that fog water reached and wet the soil sufficiently to allow throughfall collection. This difference between edge and interior sites in vertical processing of N further underscores the potential importance of fog in ecosystem function and the likelihood that microbial communities and processing, differ in relation to fog input."

Fog and Ecosystem Functions And Services:
How are the influences of rain and fog combined in ecosystem structure and function?

"Although wet N deposition to the canopy was approximately two times greater in the rain than fog season, approximately 10 times more N came through the canopy during the rain com pared to the fog season."

"As noted above, trees at the windward forest edge have greater total leaf area, and litterfall data support a hypothesis of greater forest production at the edge. Litterfall, one integrative measure of overall plant production, shows a spatial pattern that suggests biological averaging of rain and fog influences; litterfall declines linearly from the windward edge to interior rather than exponentially as throughfall does in the fog season, perhaps because of the more horizontally homogeneous contributions in the rain season and the influence of fog throughout all of the forest canopy. Nevertheless, greater litterfall and soil organic content at the windward edge of the forest and the differences in tree function and leaf isotopic signatures at the edge relative to the forest interior suggest that the effect of fog on ecosystem function may be in some way proportional to the amount of fog water deposition and nutrient flux."

"Together these data from rain and fog seasons show profound seasonal differences not only in ecosystem fluxes and processing from atmosphere through soil but also in the degree of coupling among ecosystem compartments within this redwood forest ecosystem. Canopy and soil processing of N deposition were clear in both seasons, and these transformations, and their differences across seasons, along a vertical transect through the ecosystem highlight the importance of considering multiple dimensions of an ecosystem when quantifying such functions as nutrient cycling. On a horizontal transect through this system, spatial patterns are strongly related to season. During the rain season there is a coupling from atmosphere to soil water as result of vertical fluxes, and heterogeneity in inputs and tree activity are at their minima. The fog season, in contrast, features distinct horizontal heterogeneity in water and nitrogen fluxes to edge versus interior zones of the forest as well as a vertical decoupling of the tree crowns and soils. This decoupling in ecosystem function between edge and interior zones suggests that although fog may be influencing tree function in the forest canopy throughout the entire stand, in the absence of fog drip to the forest floor, other ecosystem processing, such as soil nutrient cycling via microbial activity, belowground respiration, or water uptake by plant leaves in the interior zone would be lower or absent."

"A gradient in the deposition of water and nitrogen (N) exists from the edge of a redwood forest to the interior during the summer fog season, but not during the winter rain season. The relative importance of fog in coastal redwood ecosystem function, were measured as water and inorganic N concentrations and flux as well as transpiration, canopy water uptake, water stress, and litterfall in a redwood forest in Sonoma County, California."

The research addressed specific objectives; "(1) quantify the spatial and temporal fluxes of water and N from canopy through surficial soil, (2) determine whether the magnitude and spatial heterogeneity of these fluxes differed for horizontally and vertically delivered materials, and (3) relate these measures of ecosystem inputs and processing to measures of redwood tree water use and forest production." (From) "Fog as a Creator of Heterogeneity in Three Dimensions Horizontal Variability and Edge Effects" Fog Water and Ecosystem Function: Heterogeneity in a California Redwood Forest (2009)
Holly A. Ewing, 1 * Kathleen C. Weathers, 2 Pamela H. Templer, 3 Todd E. Dawson, 4 Mary K. Firestone, 5 Amanda M. Elliott, 2 and Vanessa K. S. Boukili

"Fog as a Creator of Heterogeneity in Three Dimensions Horizontal Variability and Edge Effects" Fog Water and Ecosystem Function: Heterogeneity in a California Redwood Forest (2009) is incorporated by reference in it's entirety.

MRC's HCP can be shown to have been selective in their cursory review of the role and contribution to the hydrologic cycle and watershed processes by fog and fog drip.

Groundwater Recharge, the Health of the Forest, and the Public Trust

"In determining whether the watershed energetics of the catchment are in equilibrium, research using chloride (atmospheric deposition) has found that there is a smaller recharge and higher chloride concentration after forest clearance. Forested landscapes over time have larger groundwater recharge capacity, and lower chloride rates." (from) National Center For Groundwater Research And Training, "Estimating Groundwater Recharge in a Coastal Area with Vegetation Changes"

The “infiltration-evapotranspiration trade-off” hypothesis which predicts increased streamflows (peaks and a net gain) to baseflows, has not been adequately tested and is barely understood.

“The upper canopy interrupts the energy of heavy rains, reducing the erosive forces on the land. As precipitation continued downward, it entered into the mid forest canopy. This realm was comprised of lush, epiphytic gardens festooned with bryophytes (mosses, hornworts, liverworts) and lichens. Bryophytes can hold 1.5-15x their weight in water and ancient trees average 80 lbs of bryophyte and lichen biomass (dry weight) per tree. When saturated, up to 145 gallons of water can be temporarily stored in the canopy of a single old-growth tree. One might hypothesize that on a landscape scale, this moisture laden bryosphere could moderate humidity levels (vapor pressure) in the forest canopy, signaling the trees to reduce evapotranspiration rates. A recent study found that certain species of canopy bryophytes are colonized by nitrogen-fixing cyanobacteria, helping provide trees with nitrogen, an element that is often lacking in forest soils.”

“Much of the rain that falls in forested landscapes is intercepted by vegetation and lost to evaporation. Rain that does make it to the forest floor is called “through-fall”. Due to the open and spacious structure of old-growth forests, through-fall rates are as much as 2x higher than in younger forests.”

“Healthy soil forms the basis of productivity in all terrestrial ecosystems, yet the life in soil and its effects on our environment are perhaps the least understood of all Earth’s biological processes. Soil houses an estimated 95% of the Earth’s terrestrial biodiversity, while containing 3x the amount of carbon that is held in aboveground vegetation. The thin layer of living soil that once covered the entire North Coast region provided the foundation of innumerable processes for terrestrial and aquatic organisms.”

“Ancient forests accumulated a thick absorbent layer of forest duff, insulating the living soil from weather extremes, while reducing moisture loss. Holding the forest duff in place was a filamentous mat of fungal strands (mycorrhizae) that formed a living-web of erosion control. Beneath the layers of forest duff existed a complex subterranean ecology, teeming with an unimaginable cosmos of microbial life. This underground community worked closely with the surrounding forest ecosystem, co-evolving mutually beneficial relationships that had developed over thousands of years.”

“Trees supply the energy for soil life by converting carbon dioxide (co2) through photosynthesis into a carbohydrate-based high energy food. This food is made available to the soil community through a nectar-like substance exuded from the trees roots; the energy rich nectar supplies the power for soil life. Soil life provides the services necessary for the trees.”

“An unimpaired soil community works symbiotically with the forest, increasing the efficiency of water and nutrient uptake. Elaine Ingham, an acclaimed soil microbiologist states, that a healthy soil ecology can reduce plant’s water needs by up to 70%. This symbiosis and mutualism may explain at least one link to the reduced water needs of old-growth trees.”

“The young geologies of North Coast forest lands tend to have high porosity, permeability, and a gravel-like structure, i.e., they drain quickly. The “sponge-effect” was created in part, by vast underground networks of mycelial threads (hyphae) that bound soil particles; forming aggregates which created a favorable soil architecture for water retention. Recent studies have shown that glomalin, a glue-like substance produced by mycorrhizal fungi, is responsible for the majority of carbon (up to 40%) that is present in soil. Glomalin’s glue-like properties form aggregates that can persist in the soil for decades. Humus (another form of stable carbon) which is abundant in old growth forests, can hold up to 4x its weight in water.”

“In a healthy forest ecosystem, the tight cycling of water and nutrients between trees and the living soil creates what ecologists call a “biological dam”. This means that the wealth of the ecosystem is stored (immobilized) and continuously recycled between soil organisms and the surrounding forest community, so long as no major disturbance disrupts the cycle. It’s through this process that the structure of the sponge is developed over the course of centuries. Hence, it’s the soil life that creates the sponge and it’s the forest that creates and maintains the conditions conducive to that soil life.” Taken from “Restoring the Sponge on the North Coast; A Whole Systems Approach” by Kyle Keegan.
http://lostcoastoutpost.com/2012/aug/23/restoring-sponge-north-coast-whole-systems-approac/

Also In the research paper, “Fog, Clouds and the Maintenance of Ecosystems: Mist Opportunities” author K.C. Weathers states: “In particular, the “infiltration-evapotranspiration trade-off” hypothesis which predicts increased streamflows (peaks and a net gain) to baseflows, has not been adequately tested.”

“Soil water profiles suggest that during the dry-season, natural forests depend on deep soil moisture and groundwater. Catchments with a higher proportion of forest cover upstream have been observed to sustain flow longer into the dry-season.”

“These hydrologic responses provide some support towards the “infiltration-evapotranspiration trade-off” hypothesis in which differences in infiltration between land-cover rather than evapotranspiration determines the differences in groundwater recharge, low flows and dry-season flow. Groundwater recharge is the most temporally stable under natural forest, which helps to sustain dry-season flow downstream in higher order streams that sustain local communities and agro-ecosystems. In addition to spatial scale effects, greater attention also needs to be given to the role of hydrogeology within the context of its implications for hydrologic services at the watershed level and at the landscape scale.”

Fog, Clouds and the Maintenance of Ecosystems: Mist Opportunities? Weathers, K. C.
AA(Institute of Ecosystem Studies, Box AB, Millbrook, NY 12545 United States
American Geophysical Union, Fall Meeting 2006, abstract #B14A-06

These comments depict the contrary information in relevant MRC documents and it's draft Habitat Conservation Plan to current scientific research and are thus considered “significant new information” under CEQA.

THP's covering Mendocino Redwood Company forestlands, as written (Section 3), state in part: "It is entirely consistent with CEQA, and pertinent case law to approve a project that has it's potential environmental impacts avoided or reduced to relative insignificance, as is the case here … rather than...."

But "potential environmental impacts avoided or reduced to relative insignificance" has not been shown to be the case.

In the case of the Northern Spotted Owl; consideration must also be given to the residency function of NSO habitat. By residency function, it is meant the expenditure of energy to capture prey, the energetic requirements in the daily life of a Northern Spotted Owl, the ecological energetics of it's metabolic rates as an individual, and parental effort. For a more scientific explanation, the full depth of discussion is presented in "Thermal Ecology And Ecological Energetics Of California Spotted Owls" and is incorporated by reference: (see below)

The "Cumulative Impacts" of concurrent and successive operations within a watershed (Sustainability Unit) over a 20 year period, may well cause or bring about significant impacts to the Base Metabolic Rate of the NSO by raising their Field Metabolic Rates.

"Owls (order Strigiformes) as a group have much lower metabolic rates than other birds. Their BMR averages 66% and their metabolizable energy (ME) intake averages 76% of that predicted for non-passerine birds (Wijnandts 1984). Even among a group known for low metabolic rates, the California Spotted Owl stands out as exceptional. Its BMR is 18% lower and its ME intake 44% lower than predicted by Wijnandts' (1984) strigiform equations, suggesting that its FMR should also be relatively low. Indeed, the FMR of California Spotted Owls is a remarkably low 249 kJ day, only 34% of that predicted for a 563-g non-passerine bird (Williams et al. 1993).

Thermal Ecology and Ecological Energetics of California Northern Spotted Owls

"...compared with their rate of energy expenditure, Spotted Owls have relatively high rates of water flux. Indeed, their water economy index (WEI) is higher than that of most other birds (Nagy and Peterson 1988), suggesting that they are profligate water users."

"Many carnivorous and frugivorous birds obtain sufficient water from their food and do not need to drink (Goldstein and Skadhauge 2000). California Spotted Owls do not drink under laboratory conditions, but they do drink in the field (JAB and PJH, pers. obs.) and acquire about 40% of their total water requirement by drinking. Why California Spotted Owls have such relatively high rates of water flux under field conditions is unknown, but their greater need for water in the field may contribute to their old growth habitat preference."

(The above quoted sections) and the full depth of discussion presented in "Thermal Ecology And Ecological Energetics Of California Spotted Owls" are incorporated by reference: "Thermal Ecology And Ecological Energetics Of California Spotted Owls"

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http://www.sierraforestlegacy.org/Resources/Conservation/SierraNevadaWildlife/CaliforniaSpottedOwl/CASPO-Weathers01.pdf

Climate Change Vulnerability Assessment Of Cumulative Impacts To The NSO
(Habitat Disturbance And Modifications)

"Survival rates may vary with habitat. For instance, analysis of northern spotted owl data found increased ($P \leq 0.03$) persistence, an index of survival, in areas with greater amounts of older (>120 years) forests. NSO occur in closed-canopy, uneven-aged, late-successional and old-growth forests. Although variable, most spotted owls disperse less than 19 miles. Females, 3- to 4-year-old adults, and individuals with no mate in the current or previous season were most likely to disperse from their territory. The average adult dispersal distance was 3.8 miles. The most common causes of spotted owl mortality are predation and starvation."
Authorship and citation: Meyer, Rachelle. 2007. "Strix Occidentalis" In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer) Available May 20, 2015
http://www.fs.fed.us/database/feis/animals/bird/stoc/all.html

"Strix Occidentalis" is incorporated by reference in it's entirety.

Strictly speaking:
CEQA Guidelines Section 15088.5 requires a lead agency to recirculate an EIR for further review and comment when significant new information is added to the EIR after public notice is given of the availability of the Draft EIR but before certification. New information includes: (i) changes to the project; (ii) changes in the environmental setting; or (iii) additional data or other information. Section 15088.5 further provides that "new information added to an EIR is not 'significant' unless the EIR is changed in a way that deprives the public of a meaningful opportunity to comment upon a substantial adverse environmental effect of the project or a feasible way to mitigate or avoid such an effect (including a feasible project alternative) that the project's proponents have declined to implement."

Section 15130(a) of the CEQA Guidelines requires that an EIR discuss the cumulative impacts of a project when the project's incremental effect is determined to be cumulatively considerable. The discussion of cumulative impacts must evaluate whether the impacts of the project will be significant when considered in combination with past, present, and future reasonably foreseeable projects, and whether the project would make a cumulatively considerable contribution to those impacts.

Inasmuch as the correlative Draft HCP and the THP together, are considered to be the functional equivalent of an EIR, in this case, this THP cannot be approved given the significant new information presented in these comments.

Respectfully,
Tomas DiFiore
08/31/15_Comments_MRC_draft HCP_THP

Tomas DiFiore