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Dear CalFire:

The Friends of the Gualala River have asked me to comment on the Dogwood Timber Harvest Plan (Dogwood THP; 1-15-042 SON Gualala Redwood Timber L.L.C.).

I have been a professional aquatic biologist since 1980 and have worked in 42 California counties. During my career I have worked on over 500 waterways. I was as a consulting biologist for other consulting firms between 1980 and 1989, and then founded my own company, Aquatic Systems Research, from 1989 to 2001 and from 2008 to the present. Consulting expertise included instream flow assessment, relative abundance surveys either by electrofishing or snorkel observation, habitat delineation and stream restoration. I have also worked for NOAA's National Marine Fisheries Service, Southwest Region between February 2001 until September 2008 as their Water Rights Specialist, and Fish Ecologist. I was the first and only Enforcement Biologist for the Office of Law Enforcement, National Marine Fisheries Service. I also served as a planning commissioner for the Town of Loomis, California and chaired that commission during the Town's first General Plan.

The project proponent, Gualala Redwood Timber L.L.C., proposes to harvest of second growth coastal redwood trees that are located in flood prone areas where the stream channel usually moves (alluvial reach). The riparian zone typically occupies these flood prone areas. Other timber harvest activities include: annual installation and removal of flatcar bridges, installation of permanent culverts, the use of fords and construction of logging roads and other timber harvest infrastructure.

THE LIABILITY OF EXEMPTIONS TO CONSULTATION

The Dogwood THP provides no evidence of consultation with Regional Water Quality Control Board (RWQCB) for water quality, United State Army Corps of Engineers (USACE) for activities on a flood plain or NOAA's National Marine Fisheries Service (NMFS) for federally listed anadromous fish. So there is no agency guidance how to avoid or minimize adverse effects of their timber harvest from these three trustee agencies. I assume the project proponent is claiming

exemptions, for instance, a USACE 404 exemption for normal silvicultural activities, allowing the majority of fill discharges exempt from the Clean Water Act. The assumption must be that exempted projects cause little harm and if the project proponent adheres to the timber harvest rules it is free from any liability.

Here is an example of how that is a big misassumption. I was part of an interdisciplinary NMFS team documenting ESA Take of Threatened steelhead by a timberland conversion to vineyard near Laytonville, CA (Cluer and Li 2005) and our team was awarded NOAA's highest honor, the Bronze Medal, for that work. Although the landowner had an approved timber conversion plan and complied faithfully to Timber Harvest Rules, he was cited by Office of Law Enforcement National Marine Fisheries Service for Take of federally listed Threatened steelhead because the timberland conversion to vineyard measures were inadequate to prevent ESA Take. The adverse effect that resulted in Take was drastic reduction in steelhead abundance in conjunction with measured exposure to concentrations of suspended sediment and known duration of that exposure (Newcombe and Jensen 1996). The landowner pleaded guilty to the ESA Take charge and was fined (Milbury, 2007). Later, RWQCB also cited him for water quality violations (California Regional Water Quality Control Board, North Coast Region Order No. R1-2006-0084).

The Board of Forestry's Anadromous Salmonid Protection Rules, 2009 were developed shortly after this ESA Take case.

It should be noted that the data collected that was the basis for ESA Take conviction occurred after the landowner became aware of NMFS's interest and proceeded to rock the roads, install rolling dips in the vineyard roads, sloped the vineyard roads to the outside bends to drain them and many other erosion preventative measures. The initial suspended sediment concentrations were much higher than those we recorded for the Take case. I conclude from my experience on this case that sedimentation even from minor disturbances may prove to be lethal and could be subject to ESA Take penalties.

It is not only the project proponent that may be liable if ESA Take occurs, but also the agency that permits that activity. In the precedent setting case, Richard Strahan, a private citizen, sued the Massachusetts Department of Fish and Game because they permitted lobster traps in known migratory corridors of the Endangered Right Whale. He argued that these permitted traps posed a significant entanglement threat to the whales, and the court agreed with him (Strahan vs. Diodoti et al. [Massachusetts Department of Fish and Game]). CalFire has oversight of Timber Harvest Plans. CalFire, like the Massachusetts Department of Fish and Game, may be liable if their oversight is inadequate in any way.

The Dogwood timber harvest of second growth redwood is proposed to take place almost entirely in a low-lying flood prone area. The California Department of Forestry and Fire Protection (CalFire) has been so concerned about adverse affects

in flood prone areas in coast redwood country that it convened a multi-agency committee (Riparian Protection Committee) to identify typical adverse effects and develop prescriptions to avoid, minimize, and mitigate for these effects. The Riparian Protection Committee's findings have been published in a white paper (CalFire 2005). In lieu of agency consultation, the project proponent should adopt this approach detailed in CalFire (2005), especially to adhere to the streamside buffer zones where harvesting Sequoia redwoods would be prohibited. I ask CalFire to incorporate entirely CalFire (2005) by reference into my comments.

LISTED SPECIES UNDER THE ENDANGERED SPECIES ACT

There is scant mention of listed fish species in the project area. Coho salmon and steelhead occurred in the Gualala watershed historically. NOAA's National Marine Fisheries Service (NMFS) is not even mentioned as an agency that was consulted by the project proponents. NMFS and not the U.S. Fish and Wildlife Service (USFWS) has trustee responsibility for Endangered Species Act (ESA) listed anadromous fish. Section 10 of the Endangered Species Act (ESA) deals with endangered species consultation for nonfederal projects. This section is where Habitat Conservation Plans are developed. Without such consultation the project proponent will be without the protection of Incidental Take and would be subjected to ESA Section 9 penalties. NMFS lists two species of anadromous salmonid that are listed under the Endangered Species Act of 1973 that occur in the Gualala River watershed:

- Central California Coast Coho Salmon (*Oncorhynchus kisutch*) were listed as Threatened on October 31, 1996 and upgraded to Endangered on June 28, 2005, had their range extended on April 2, 2012 and their Critical Habitat designated on May 5, 2005.

An endangered species is a species is in danger of extinction throughout all or a significant portion of its range.

Coho salmon abundance has decreased over time in the Gualala watershed and may be near extirpation. A disturbance such as this timber harvest may complete that process due to cumulative impacts. i. e., the death by a thousand cuts.

Coho Salmon, in particular, are closely associated with coast redwoods. In my experience, Coho Salmon distribution in streams tends to be discontinuous. Long stretches of no Coho Salmon with a high abundance pool every once in a while. These hot spots tend to be deep pools with lots of cover and shade with very little stream current. Redwood trees that fall into the river tend to make these kinds of habitat. Coho salmon adults tend to limit their upstream migrations to the lower gradients of the watershed (generally less than 2%). When Coho salmon and steelhead are sympatric, they segregate. Coho salmon are generally found in pools and steelhead occupy the riffles.

The Riparian Protection Committee has linked flood prone areas with a 20-year recurrence interval to be important to Coho Salmon life history. The proposed Dogwood timber harvest may be in that zone.

- Northern California Steelhead (*Oncorhynchus mykiss*) were listed as Threatened on June 7, 2000 and reaffirmed as Threatened on January 5, 2006. Their Critical Habitat was designated on September 2, 2005.

A species is considered threatened if it is likely to become endangered within the foreseeable future.

Steelhead has the most variable life history pattern of the anadromous salmonids. They can spend from one to three years rearing in freshwater and that like time in the ocean. Sometimes they only emigrate as far as the estuary before returning to freshwater. When immigrating into freshwater, some adult steelhead travel all the way up to the headwaters to spawn. Despite this variable life history that would enable steelhead to respond widely to varying environmental conditions, steelhead abundance has declined throughout its distribution in California.

“Take” of a listed species not only includes the species, but the critical habitat where it resides. Therefore, habitat modification (Sometimes called adverse modification) or degradation that harms listed species is also Take.

“**Harass**” is defined as “an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering.”

A letter from NMFS South West Region Administrator Rodney McInnis to Stan Dixon, Chairman of the Board of Forestry and Fire Protection dated June 22, 2009, addressed changes in the Threatened or Impaired Watershed Rules (T/I rules) intended to protect listed anadromous salmonids and their habitat in forest settings. Mr. McInnis stated that “...the legal standard for non-Federal timber harvest operations in California is “no take” for many ESA listed species... and that this standard should also apply for salmon and steelhead.” Mr. McInnis further states that sedimentation is one of the major factors in degradation of anadromous salmonid habitat in California.

LACK OF PLANNING FOR ADVERSE EFFECTS TO FISH AND WILDLIFE RESOURCES

The draft Dogwood timber harvest plan identifies a long list of potential project related adverse effects to fish and wildlife resources, but does not provide much actions to avoid, minimize, or mitigate for these adverse effects. The project proponent generated this list, so the project proponent believes these adverse effects may occur. The project proponent does not address many of these project-

related potential adverse effects. Here is their list with the potential significance to federally listed species and their approach if any:

- Loss of natural bed or bank. This would potentially be adverse modification of critical habitat based on cumulative impacts. Gualala Redwoods L.L.C. provides no identified measures. This is a significant omission.
- Relocation of stream channel. This would potentially be adverse modification of critical habitat. Gualala Redwoods L.L.C. provides no identified measures. This is a significant omission.
- Change in contour of bed, channel or bank. This would potentially be adverse modification of critical habitat, most likely a cumulative impact. Gualala Redwoods L.L.C. provides no identified measures. This is a significant omission.
- Change in the gradient of bed, channel or bank. This would potentially be adverse modification of critical habitat. Gualala Redwoods L.L.C. provides no identified measures. This is a significant omission.
- Change in channel cross-section (confinement or widening), This would potentially be adverse modification of critical habitat. Gualala Redwoods L.L.C. provides no identified measures. This is a significant omission.
- Degradation or aggradation of channel. This would potentially be adverse modification or Take of critical habitat due to cumulative impact. Gualala Redwoods L.L.C. provides no identified measures. This is a significant omission.
- Accelerated channel scour. This would potentially be Take of listed species or adverse modification of critical habitat. Gualala Redwoods L.L.C. provides no identified measures. This is a significant omission.
- Loss of bank stability during construction. This would potentially be Take of fish or adverse modification of critical habitat. Gualala Redwoods L.L.C. provides bridge support and bridge abutment hardening, and hardening of roads.
- Increase of channel erosion during construction. This would potentially be Take of a listed species or adverse modification of critical habitat. Gualala Redwoods L.L.C. provides BMPs for erosion and sediment control.
- Change in channel form (e.g., loss of pools or riffles). This would potentially be adverse modification of critical habitat, probably as a cumulative impact. Gualala Redwoods L.L.C. provides no identified measures. This is a

significant omission.

- Loss or decline of instream channel habitat. Habitat is already degraded and Coho salmon are near extirpation. This would be a cumulative impact. This would potentially be adverse modification or Take of critical habitat. Gualala Redwoods L.L.C. provides no identified measures. This is a significant omission.
- Change to, or loss or decline of natural bed substrate. This would potentially be adverse modification or Take of critical habitat. Gualala Redwoods L.L.C. provides no identified measures. This is a significant omission.
- Restriction or increase in sediment transport. This potentially could be Take of listed species or adverse modification of critical habitat. Gualala Redwoods L.L.C. provides no identified measures other than sediment and erosion BMPs. BMPs may be inadequate to address this because prior projects have caused aggradation that has degraded the habitat. This is a cumulative impact.
- Increased turbidity. NMFS has charged Take of listed species in the past for this. Gualala Redwoods L.L.C just offer sediment and erosion control BMPs.
- Loss or decline of riparian and/or emergent marsh habitat. These habitats provide resilience to climate change. Gualala Redwoods L.L.C. provides no identified measures. In terms of climate change, ecosystem resilience and water quality, this is a significant omission. There is no mention of a wetland delineation. I understand that Gualala Redwoods L.L.C.'s cut on the Buckeye Creek floodplain completely disturbed the ground within the wetlands.
- Colonization by exotic plant and animal species. Gualala Redwoods L.L.C. promises not to plant, seed or otherwise introduce invasive exotic plant species, nothing regarding animal species
- Direct take of fish or other aquatic species including redds – The Gualala Redwoods L.L.C. proposed protective fish measures that were at least naïve. Fish hazing simply will not work. I am doubtful that the project proponent will comply with the opinion of a fisheries technician with no declared authority. How much authority will the fisheries technician have? At minimum, the Fisheries Technician should have authority to prevent heavy equipment work until areas to be disturbed by heavy equipment activity are cleared of fish. Acceptable evidence would be the pass depletion data. This current fish protection plan is woefully inadequate and must be revised before this timber harvest plan is approved.
- Change in flow depth, width, or velocity. This would potentially be adverse

modification of critical habitat. Gualala Redwoods L.L.C. provides no identified measures. This is a significant omission.

- Disturbance from project activity. This description could mean just about anything. The project proponent identifies mostly BMPs for erosion control. I see no comprehensive program to address any of the many potential project adverse effects identified by the project proponent.

Since the project proponent identified these adverse effects, it is their responsibility to address how to avoid, minimize, or mitigate for them. These must be included in the Timber Harvest Plan.

TIMING OF TIMBER HARVEST ACTIVITIES

Since temporary flatcar bridges will be installed after June 15 and removed before October 15 of each year of the project, I assume this is when timber harvest activities will take place. The premise of the June 15 start date is that anadromous salmonid smolt emigration is typically completed by then. The end date of October 15 assumes the beginning of the rain season in mid December. This allows two months for disturbed areas to stabilize due to seeding before the arrival of fall storms, the increase in stream flow level, the return of increased risk of erosion, and the return of adult anadromous salmonids.

These start and stop dates are based on long-term hydrological records that may be irrelevant because the weather pattern is clearly changing.

The start date is not as risky because nothing yet has been disturbed and the hydrograph is descending, i.e., streamflow is declining, so risk of erosion is relatively low. However, the end date of October 15 assumes there is sufficient time to clean up from all timber harvest activities before the rain season and the returning high flows that also bring returning adult anadromous salmonids.

Historically, rain season begins in earnest in the middle of December. However, October 15 is no longer a safe end date because the rain pattern is changing. Recent rain has occurred as early as June and July that were typically dry months and heavy rain sufficient to cause runoff has occurred before October 15. Intensity of these early rain events has also increased. It would be prudent to add an early warning provision to the stop date such as long term weather forecast of a storm some defined intensity to give early warning that wet weather is coming and begin to shut down operations. The risk is not getting out in time and having timber harvest infrastructure compromised by high stream flows that create erosional events from bridge site failure, road failure and the like to cause ESA Take of listed Coho salmon or steelhead.

For listed anadromous salmonids in the Gualala watershed, this time period of timber harvest activity is after the adults have returned to freshwater and have spawned, and after the embryos have emerged from the gravels. Annual emigration

by smolts or post-spawned steelhead adults to the sea has been pretty much completed by mid June. Potential adverse effects are largely limited to the life stage of rearing of juveniles of Coho Salmon and Steelhead and their rearing habitats.

LOCATION OF TIMBER HARVEST ACTIVITIES

The Dogwood Timber Harvest is located in the inherently unstable flood prone alluvial reach of the stream near lagoon and estuary habitats. Alluvial reaches are inherently unstable because the gradient is low and where bedload deposition is unpredictable. Multiple stream channels are typical in alluvial reaches and channel avulsion is common. Channel migration is also expected. Any activity that disturbs the channel is risky and must be carefully considered to avoid catastrophic adverse effects.

The proximity of the proposed timber harvest to estuarine/lagoon habitats also threatens very important anadromous salmonid habitat. It is the place where salmonid juveniles and smolts stage in preparation for life in the ocean. If this habitat is compromised, anadromous salmonid growth will be compromised and ultimately survivorship in the ocean.

Dr. Jerry Smith of San Jose State University has documented the importance of lagoon and estuaries for anadromous salmonids in California for many years. Juvenile salmonid growth in lagoon and estuary habitats is twice as high as in the headwater reaches (See Hayes *et al.* 2008). This rapid estuarine growth occurs just prior to smolts leaving for the ocean. It is well known that larger sized smolts that leave for the ocean increases their chances of returning as an adult for all salmonid species (Shapovalov and Taft 1965). Lagoon and estuary habitats should be considered vital, i.e., the most important, to the welfare to the point of being vital to both the Endangered Coho salmon and the Threatened steelhead. Damage to the lagoon or estuary could seriously diminish run size of either Coho Salmon or steelhead.

The Dogwood Timber Harvest reach is near the mouth of the Gualala River. As such, all sediment in the watershed ends up here. Sediment adversely affects lagoons and estuaries at least in the following ways:

- Changes in the natural sediment budget that affect bedload transport and ultimately habitat type representation.
- Deposits of sediment reducing interstitial space in the riffle substrate, which directly reduces aquatic invertebrate species diversity, relative abundance, and production.
- Sediment deposition reducing stream bottom roughness that degrades fish rearing habitat, and causes reduced growth in fishes.

- Interferes with photosynthesis of aquatic plants.
- Reduces dissolved oxygen concentrations from biological oxygen demand (BOD).
- Reduces lagoon or estuary volume.
- Reduces habitat quality.
- Increase turbidity reduces feeding efficiency, reducing growth, and ultimately reducing survivorship.
- High concentrations of suspended sediment mechanically clog gills to interfere with fish respiration.
- Kills fish outright.

Waters (1995) has a comprehensive review of sedimentation in streams. I request that the contents of Waters (1995) monograph be incorporated into my comments by reference.

TEMPORARY FLATCAR BRIDGES

The reason for annual installation and removal of the flatcar bridges is the reach where they would be located is also where the stream channel is moving. These near lagoon stream reaches generally have low gradients where the nature of sediment deposition encourages channel avulsion. Stream channels move in this zone, so bridges would probably be serviceable only for a year. Put in another perspective, the project proponent is gambling to harvest redwood under instable geomorphic conditions where Federally listed species will be harmed if timber harvest infrastructure fails

It would be prudent for any agency approving any timber harvest plan, especially one that proposes to harvest in a location that is inherently unstable and where federally list species reside (typically, in high relative numbers) to show they were comprehensive and complete in their approval process in case the timber operation has an erosional episode that harms or kills listed salmon or steelhead. It would limit their potential liability.

Here are relative risks of installation and removal of temporary flatcar bridges in a zone of active channel migration. The stream will be on the descending limb of its annual hydrograph and is nearing its base flow when these bridges are installed. Sediment generated from this activity will likely remain locally due to lack of carriage water to transport sediment very far downstream, so typical adverse

sediment effects would be local. Because of the low streamflow risk of bank destabilization is lower for bridge installation than removing the bridge. The high stream flows return shortly after the temporary bridge is removed in October. Please amplify what will be performed to protect the disturbed areas where the bridge has been removed. At least two really bad things could happen during high flows: one or both banks become destabilized releasing enormous sediment to the lagoon and estuary, or the high flows works against the bridge abutments typically in a gyre and erodes the bank to form a head-cut, which would release much more sediment downstream because the head-cut will move upstream, sometimes for a considerable distance. Once formed head cuts are very difficult to stop.

PREPARATIONS FOR BRIDGE INSTALLATION AND FISH HAZING

The Description of their intended plans left me wondering whether the project proponents have any experience dealing with fish issues. The polite description of their plan is naïve.

2.34.3 -5. How are you determining preferred pathway to move fish out of the way of heavy equipment and bridge structures? Is it your preference or the likely direction fish use to escape? The direction you may want the fish to go is not necessarily the direction the fish will actually go. The fish are going to be evasive. That is all you know.

2.34.3-6 Determine the number of field support technicians. This depends on what method chosen to move the fish from the construction zone. Chasing fish with dip nets to scare them away is folly. Likewise pushing them with seine is questionable. Sites may be too deep, too rough in bottom profile, too fast in stream velocity or too wide. Number of personnel with this technique directly depends on the width of the stream at that location. On the other hand, electrofishing using pass depletion the fisheries biologist will require at least three or four other personnel: The Electrofisher operator, two netters, and two carrying fish buckets.

2.34.3-7. Provide a demonstration to field support technicians of the fisheries impact minimization plan. Sounds like the project proponent intends to hire field support technicians that are untrained, inexperienced rookies.

2.34.3 this is a duplicate number. It should be 2.34.4. The fisheries impact minimization plan is the silliest thing I've ever heard of. I have been chasing fish with dip nets most of my life. The concept of fish hazing won't work because dip nets cannot direct in which direction a fish will try to escape. You can't shoo fish away from heavy equipment as described. Fish are wary and experts at evading by behaving unpredictably. This aquatic version of driving the fish by beating will never work. Fish may escape between the beaters or hide in local cover. By the way, this described hazing could be easily be interpreted as harassing the fish, which is a form of "Take."

2.34.4-3 The hands off approach to special status fish. I have been a professional fisheries biologist since May of 1980. I have yet to experience a special status species leaving an area on its own accord.

If removal of fish is desired, the only efficient fish removal method is to block off the desired area with blocking nets and electrofish that area using pass depletion techniques until the location is depleted of fish. Flatcar bridges are near 45 feet long and 10 feet 5 inches wide. Figure out how much maneuvering room is needed by the heavy equipment to install or remove the bridge and add that room to the bridge space.. Block with blocking nets upstream and downstream of that space to prevent fish from entering that space. Now, remove the fish within that space, then install or remove the bridge, finally remove blocking nets after installation or removal of bridge is accomplished. Nets should not be expected to keep fish out of that space if kept in the stream for more than 24 hours.

Fish mortality associated with electrofishing is much reduced if water conductivity is measured and use the least voltage that still catches fish. The fisheries biologist has to develop these relationships because there are no published data. Morning electrofishing tends to kill far fewer fish because water temperatures are cooler

LOGGING ROADS

There is mention of use of local gravels to harden roads. When will the gravels be collected? It is likely the desired size of rocks to harden the roads is the same size that anadromous salmonids use for spawning. Do not collect gravel until June 15. . An assessment of rock availability in the desired clast size should be made to make sure they are in excessive amounts.

Unimproved roads such as logging roads are typically the major source of nonpoint source pollution in streams. At a minimum, unimproved roads should be rocked to harden the roads so as to reduce fine sediment production. Rolling dips should be incorporated to these roads to minimize stormwater accumulation on the road that increases erosion. There should be stormwater drains located on the outside bends of the road to eliminate stormwater accumulation in the inside bends. Pacific Watershed Associates (2017) have developed a handbook to minimize adverse effects from undeveloped roads and it has been updated this year. I request the contents of the PWA (2017) be incorporated my comments by reference.

FISH MONITORING

California Department of Fish and Wildlife (CDFW) recommends monitoring various sites of interest for fish presence in their Streambed Alteration Agreement with the project proponent. This reduces monitoring to site-specific locations and is inadequate since both sedimentation and stream temperature increases in streams are not static, but adversely affect areas downstream. Therefore, project monitoring should consider the downstream effects of any adverse effects.

“Water will not be drafted directly from the wetted channel in areas where fish may be present”. Who determines whether fish are present? What technique of fish presence will be used?

CULVERTS

Steelhead can occupy the entire length of these watersheds. Therefore permanent culverts must 1) avoid being undersized that creates a velocity barrier to returning spawning adults and increases erosion around the culvert, and 2) Culverts must be kept on grade to avoid becoming a migration barrier. NMFS has developed guidelines for salmon passage at stream crossings. I request that these guidelines be incorporated into my comments by reference.

Treatment of culverts and fords seem reasonable. Is the use of fords at locations where the waterway is typically dry during timber operations? If they are wet, it is a better idea to use your temporary flatcars.

HARVESTING TIMBER

There is no description of how to harvest the trees and minimize generation of sediment. How far will trees be skidded? How will sediment from skidding be managed? Are wetlands to be avoided?

WATER TEMPERATURE

Most streams in California that support coldwater species have peak water temperatures that stress these species in July and August. This is probably due to the lack of a healthy riparia (riparian zone). Sequoia redwoods are tall trees. Timber harvest of Sequoia redwoods would reduce topographic shade to the stream, allowing greater insolation of the stream surface thus warming the stream water. The ESA-listed salmon and steelhead are coldwater species and stream temperatures in late July and August are thought to be limiting factors in rearing juvenile salmonids, so it would be prudent to minimize harvest in conditions that would increase stream temperatures, for instance, avoid cutting on the south bank when the stream has an east-west orientation (Theuer et al. 1984).

MISCELLANEOUS

There is an opportunity to enhance Coho salmon habitat in conjunction with the timber harvest. As mitigation, Coho salmon rearing habitat could be enhanced with strategic placement of large redwood in areas lacking cover. These trees must be sufficiently large to have a long residence time and be placed in such a fashion to encourage in channel scour and avoid bank scour.

ARE SEQUOIA REDWOODS TOO VALUABLE TO JUST CUT DOWN?

Improving current stands and restoring Sequoia redwood distribution to historical representation would be a good thing given the present trajectory of climate warming. Sequoia redwoods are riparian trees that are really good at sequestering carbon. Because of this, project proponents should investigate whether preserving Sequoia redwood can qualify as offsets or anything similar to the mitigation banking concept in Cap and Trade program, Compliance Offset Program, forest carbon program, or anything else related to AB 32, the Global Warming Solutions Act of 2006. The project proponent may earn more income preserving trees than cutting them down.

Sequoia redwoods also enhance the watershed hydrologic budget by capturing water from fog. This is really important because virtually all Northern California coastal watersheds are demand stressed.

The habitat in the Gualala watershed is degraded. Harvesting Sequoia redwoods would further degrade riparian conditions. Sequoia redwoods are a riparian species. California's riparian habitat distribution is less than ten percent of historical. Harvesting Sequoia redwoods from the riparian zone vegetation degrades habitat in a wide variety of ways:

- 1) Harvesting Sequoia redwoods reduces shade and increases air temperatures. I have experienced a 30 degree Fahrenheit difference in air temperature between being in the open air and being under full streamside canopy.
- 2) Harvesting Sequoia redwoods reduces shade and increases surface water temperatures through increased exposure to the sun. This may reduce the amount of time that Gualala River is suitable to coldwater species such as steelhead trout or Coho Salmon.
- 3) Harvesting Sequoia redwoods could decrease the extensive root network that either stores groundwater or retards down slope water movement or augments streamflow. In experimental streams in Oregon, streams remained flowing through intact riparian zones, but were dry immediately upstream and downstream where streamside vegetation had been removed. During winter the reach that contained the riparian zone remained open while those reaches without riparian vegetation were frozen over. Clearly, riparian vegetation stores more water than it loses through evapotranspiration.
- 4) Harvesting Sequoia redwoods reduces the number of redwoods that convert carbon dioxide, a greenhouse gas to oxygen. Enhancing the riparian zone by not harvesting Sequoia redwoods is one way to mitigate for climate warming and maintain ecosystem resilience.
- 5) Harvesting redwoods may reduce other riparian plants dependant on their presence. The absence of these plants together with the redwoods in the reduced riparian zone decreases the efficiency to trap fine sediment

terrestrially and prevent sedimentation in the stream bottom that degrades steelhead trout and Coho Salmon spawning habitat.

- 6) A reduced riparian zone provides less detritus to the stream, which results in less aquatic invertebrates and lower fish populations. The basis for most of the energy in stream ecology is wood, twig and leaf litter (Cummins 1974; Vannote *et al.* 1980). Detritus, where aquatic invertebrates break down these materials and are then consumed by fish, frogs, birds and the like, drives stream energetics. Streams are detritally driven in contrast to terrestrial systems where it begins with primary producers. Riparian zones provide virtually all of the leaf litter and wood to the stream
- 7) Less riparian vegetation also adversely affects birds. Avian migrants are initially almost totally dependant upon aquatic invertebrates for food since they typically arrive in the spring prior to the seasonal population expansion of terrestrial invertebrates. The condition of Riparian vegetation is also excellent bird habitat. Less riparian vegetation reduces bird habitat availability.
- 8) Less riparian vegetation reduces fish food from terrestrial sources. During the summer when the water is at its warmest and very stressful for coldwater fish species, the aquatic invertebrate community is pupating (becoming dormant and unavailable as fish food). This is when the terrestrial invertebrate community is at its most abundant. High food intake is one of the strategies fish can use to resist high water temperatures.
- 9) Oregon State professor emeritus Hiram Li and his students (Torgerson *et al.* 1995; Torgerson *et al.* 1999) were interested in coldwater sources as thermal refugia for Chinook salmon in eastern Oregon desert streams. He used forward-looking infrared (FLIR) cameras mounted on fast helicopters to record near synoptic stream temperatures of many streams. Summer high temperatures are an important factor in determining distribution and abundance of coldwater species. Virtually all the coldwater areas were associated with robust riparian zones or nick points in the planform, where aquatic invertebrate and fish abundance and diversity were very high, and water tables were shallow. A shallow water table is very important because water is a substance that is very resilient to temperature change. This is the desired condition to resist warming climate and should be considered with any land use development decision.
- 10) The riparian zone has high oxidation-reduction potential, so it has the ability to remove complex chemicals such as estrogen-mimic detergents, pesticides from polluted waters. Reducing the riparian zone reduces this ability and ultimately reduces water quality.

Sincerely,

Stacy K. Li, Ph.D.
Principal ASR
NMFS retired

Citations

California Regional Water Quality Control Board, North Coast Region Order No. R1-2006-0084 for Administrative Civil Liabilities Complaint in the matter of Stuart Bewley Alder Springs Ranch for Violations of Waste Discharge Prohibitions contained in the Water Quality Control for the North Coast Region.

CalFire. 2005. Flood prone area considerations in the Coast Redwood Zone. Riparian Protection Committee, California Department of Forestry and Fire Protection: 56 pp.

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