Forest Practices Biomass Work-Group
Wrap-Up Document: Buckets 4-5
March 30, 2012

Note: text added to "Topics" or "Existing Forest Practices Rules" boxes are highlighted in red. Emphasis added is underlined.

Proposed order of discussion

1. State lands/roads
2. C storage
3. Soil productivity
4. Sustainability, biodiversity, and ecosystem functionality
5. Other issues

State lands only.

Unique to state lands, due to requirements of HB 2481.

Topic: Timing
1. State timber contracts require that the purchaser complete road abandonment work. How does this interplay with a biomass collector coming back to the site. Do they need to re-abandon the road again?
Existing Forest Practices Rules
See RMAP reporting and annual work plan requirements resulting from 5 year RMAP extension process.
Existing BMP's/Science Related to Issue
N/A
Comments: *Do you think rule change is needed? Guidance? Other?* *What specific changes/guidance is needed?*
Yes, a rule change is needed. It is not feasible to re-abandon a road. DNR is going to have to either change the rule requirement and contract some road work out (road abandonment, not general road maintenance as currently required pre and post timber harvest) separately post biomass, or be more creative in their approach; e.g., develop some type of "alternate plan" rules for only those harvest units with biomass removal associated with them that allow for exemptions to existing State rules under specific road abandonment conditions.

Outside the jurisdiction of existing FP Rules.

Forest Practices currently have no jurisdiction over this issue.

Topic: Carbon Storage
Should carbon storage be addressed by FP rules? It is not currently within our statutory authority.
Existing Forest Practices Rules
None specific, however a number require leaving of timber, slash and debris: WAC 222-30-020 (11) Wildlife reserve tree management. Western Washington, Three wildlife reserve trees, Two green recruitment trees and Two down logs per acre shall be left. In Eastern Washington, Two wildlife reserve trees, Two green recruitment trees and Two down logs per acre shall be left. WAC 222-30-040 Stream bank integrity. Avoid disturbing brush and stumps, and leave stumps and large tree root systems. WAC 222-30-060(5) Direction of yarding. Type S or F Water channel below 100-year flood level or within RMZ, care should be taken to minimize soil disturbance and prevent logs from entering water. WAC 222-30-070(8) Skid trail maintenance. Within 200 feet of typed water… use (leave)… slash to

minimize sediment delivery to stream.
WAC 222-30-100(3) Landing cleanup. Dispose or pile slash accumulations that would prevent reforestation.
WAC 222-16-010 "Completion of harvest" definition. Preparation for reforestation including the timing of slash disposal.
WAC 222-16-010 "Site preparation" definition. Preparation for reforestation; removal of slash, scarification, slash burning.

Existing BMP's/Science Related to Issue

- Johnson & Curtis 2001
  - Effects of forest management on soil C and N storage: meta analysis
  - Significant differences were found, however, in the effect on soil C and N among harvest methods, with sawlog harvesting causing significant increases in soil C and N and whole-tree harvesting causing slight decreases
  - Residue management after harvesting can have a large effect on mineral soil C and N in coniferous forests
  - On average, residue removal (i.e., whole-tree harvest) caused a 6% reduction in A horizon C and N whereas leaving residues on site (i.e., sawlog harvest) cause an 18% increase (compared to controls).
- Ares et al. 2007
  - The Fall River Long-Term Site Productivity study in coastal Washington: site characteristics, methods, and biomass and carbon and nitrogen stores before and after harvest
  - The ratio of total C above the mineral soil to total C within the mineral soil was markedly altered by biomass removal, but proportions of total N stores were reduced only 3 to 6 percent owing to the large soil N reservoir on site.
- Gershenson et al. 2010
  - Accounting for Carbon in Soils
  - Leaving residues on-site has an overall positive effect on soil carbon stocks in conifer-dominated ecosystems via direct incorporation of C into the soil and the maintenance of soil microclimate conducive to reduced decomposition.
  - Soil carbon losses can be minimized where retention of post-logging debris on site is maximized.
  - High disturbance site preparation activities, such as plowing, deep ripping, etc. will have significant negative effects on soil carbon, with potential losses as high as 30%, and should be avoided.
  - Limit high disturbance site preparation activities to 10% of the total project area to minimize loss of soil C.
    - *FP Rules only require mitigation for soil disturbance of >10% inside Equipment Limitation Zone (ELZ) of Type N waters?*
  - Almost universally, whole tree harvests reduce soil carbon amount, by as much as 20%, while sawlog (bole only) harvests that leave residues such as bark, branches, etc. on site result in no significant losses, or in some cases gains in soil carbon of as much as 40%.
  - Since initial losses from harvest activities can be as high as 20% of ecosystem carbon, an inter-harvest period of adequate length (at least 50 years) is critical for ensuring that such losses are replenished.
  - Ensuring appropriately long intervals between thinning treatments, and ensuring that biomass residues are left onsite is critical in order to minimize soil carbon losses.
- Evans and Ducey 2010
  - Carbon accounting and management of lying dead wood (LDW)
  - LDW: Any piece(s) of dead woody material from a tree, e.g., dead boles, limbs, and large root masses, on the ground in forest stands. Lying dead wood is all dead tree material with a

minimum average diameter of 5" and a minimum length of 8'. Anything not meeting the measurement criteria for lying dead wood will be considered litter. Stumps are not considered lying dead wood.
    - *Analogous to CWD*
  - Past harvesting that removed a significant proportion of the large trees has created a lack of LDW in many ponderosa pine forests. Government guidelines encourage increased retention of large snags and retention of between 5 and 13 t/ac (8.3 and 22 MT of CO2eq/ac) of LDW.
  - Western interior forests: Current LDW levels may be higher than historic levels because of fire suppression, though forest management often reduces LDW more than fire alone...Management, particularly salvage logging or whole-tree harvesting, tends to reduce LDW over the long term.
  - Because they often lack large log legacies from previous stands, managed forests have less LDW than unmanaged Pacific coastal forests. Therefore, preserving large logs and snags in managed forests helps maintain LDW. Bole-only harvests and retention of 20% of live trees can increase LDW in Pacific coastal forests.
  - LDW is an important pool of carbon in the Pacific Northwest
    - 10.1 tons of LDW biomass per acre
    - 4.4% LDW as a percentage of total forest carbon
  - In Pacific Coastal forest types Dead Wood makes up
    - 12% of Total Forest Carbon
    - 15% of Forest Carbon Excluding Soil Carbon
  - Differing levels of LDW are driven by the disturbance regimes and stand development processes specific to each forest type. Because of this variability, LDW retention requirements should be as ecologically specific as possible, at least to the level of the forest types
  - Striking the balance between LDW retention for ecological values, including carbon, and fire threat management requires site-specific evaluation.
  - One argument against basing LDW retention guidance on the carbon it stores is the uniqueness of the other ecological roles LDW plays. Other forest structures (such as live trees) could sequester the carbon lost from LDW, but nothing can replace the habitat, hydrologic function, regeneration, or nutrient cycling role that LDW plays.
  - Salvage harvesting tends to reduce LDW carbon as the stand develops because of the removal of snags, which provide a long-term source of dead wood to the LDW pool.
  - In planning for the maintenance of LDW carbon, managers need to consider the common disturbances for each forest type…Where disturbances add to LDW accumulation, salvage plans should take into account the possibility that other sources of LDW may be reduced for decades after the disturbance
  - In areas where disturbances, notably fire, may reduce the LDW carbon pool, management strategies should focus on maintaining large pieces of LDW that are unlikely to be completely consumed and will remain on-site for decades.
  - Improved forest management can increase C storage by
    - increasing the overall age of the forest by increasing rotation ages
    - increasing the forest productivity by thinning diseased and suppressed trees
    - managing competing brush and short-lived forest species
    - increasing stocking of trees on understocked areas
- Slesak et al. 2010
  - <u>Soil Respiration and Carbon Responses to Logging Debris and Competing Vegetation</u>
  - High amounts of logging- debris retention (i.e., 80% coverage) reduced microbial respiration, probably due to a decrease in soil temperature and a subsequent reduction in belowground OM decomposition.
  - The total soil C concentration was significantly higher in the 80% coverage treatment at

Matlock, but there was little difference between the 0 and 40% coverage treatments, which would be expected given the similar microbial respiration rates between those treatments.
    - It appears that there is an effect of logging debris on the total soil C pools at these sites, but the effect is limited to situations where relatively large amounts of debris are retained and are undetectable when the initial soil C pool is large.
    - Given the magnitude of increase in soil C in the 80% coverage at Matlock, much of the accumulation can be attributed to sources within the soil rather than inputs at the surface.
        - *Similar to indirect effect of debris retention on seedling survival and productivity at these sites (due to vegetation suppression).*
- Hudiburg et al. 2011
    - <u>Regional carbon dioxide implications of forest bioenergy production</u>
    - Energy policy implemented without full carbon accounting and an understanding of the underlying processes risks increasing rather than decreasing emissions.
    - Sixteen of the 19 ecoregions [in WA, OR, and CA], representing 98% of the forest area in the region are estimated to be carbon sinks (Fig. 1a; exceptions are drier ecoregions where annual productivity is low and fire emissions are relatively high).
    - Even though forest sector emissions are compensated for by emission savings from bioenergy use, fewer forest fires, and wood product substitution, the end result is an increase in regional CO2 emissions compared to BAU as long as the regional sink persists.
    - As long as the current in situ NBP persists, increasing harvest volumes in support of bioenergy production is counterproductive for reducing CO2 emissions. In this study region, the current in situ NBP in tree biomass, woody detritus and soil carbon is more beneficial in contributing to reduction of anthropogenic carbon dioxide emissions than increasing harvest to substitute fossil fuels with bioenergy from forests.
- Malmsheimer et al. 2011
    - <u>Managing Forests because Carbon Matters: Integrating Energy, Products, and Land Management Policy</u>
    - Policies that ignore how forests fit into the broader economic, environmental, and social framework can fall far short of the possible reductions in carbon emissions and lead to counterproductive mitigation strategies that are environmentally and economically unsustainable.
    - The effect of harvest and replanting on soil carbon is difficult to generalize, as much depends on the initial soil depth, the depth to which soil is sampled, and postharvest site preparation.
    - Whole-tree harvesting for biomass production has little long-term effect on soil carbon stocks if surface soil layers containing organic material (O horizon) are left on site, nutrients are managed, and the site is allowed to regenerate.
        - *Inconsistent with Johnson & Curtis 2001…depends on time scale?*
    - Short-rotation woody crops, as well as landowners' preferences—based on investment-return expectations and environmental considerations, both of which will be affected by energy and environmental policies—have the potential to increase biomass supply.
    - As we move forward with policy discussions regarding the many positive roles of US forests at local, national, and global scales, it will be imperative that objective, science-based analysis and interpretations are used and that particularly close attention is paid to the assumptions underlying the analyses.
    - US policymakers should take to heart the finding of the Intergovernmental Panel on Climate Change in its Fourth Assessment Report when it concluded that "In the long term, a sustainable forest management strategy aimed at maintaining or increasing forest carbon stocks, while producing an annual sustained yield of timber, fibre, or energy from the forest, will generate the largest sustained mitigation benefit."
- Forest Sector Workgroup 2008

- Climate Change Mitigation: Final Report
- Recommendations for how Washington forest landowners can participate voluntarily in an offset or other credit mechanism under a regional greenhouse gas cap-and-trade system.
- The Workgroup recommends a dual offset and non-offset approach to increasing and/or retaining carbon storage through forest management, including recognizing and incentivizing forest landowners for current significant contributions to carbon storage.
- The offset approach would be based on a ―business as usual‖ baseline, with marketable offsets created by forest management projects that ensure carbon storage above that baseline, persisting for at least 100 years. Contractual and regulatory safeguards would guarantee project performance against reverses. Administrative simplicity would also be a program goal. Workgroup agreement to this approach on baseline is contingent, as described in number 4 below.
- Storage can be a combination of in-forest storage and storage in harvested wood products. All storage pools with significant change would be subject to accounting.

BMPs from other states

- Carbon-specific BMPs are lacking in other states due to uncertainty and debate over the science
- Dead wood and slash disposal BMPs in general: Stewart et al. 2010, Table 24
- Stewart et al. 2010
  - Potential positive and negative environmental impacts of increased woody biomass use for California
  - C does play a key role in improving the soil quality in terms of water holding capacity, drainage and as a structural anchor for other nutrients.
  - A recent meta-analysis of 432 soil C response ratios from temperate forest harvest studies around the world concluded that overall forest soil C storage dropped by 8 +/- 3% (Nave et al., 2010). The losses were concentrated in the forest floor and were generally higher in hardwood forests and in sandy Spodosol soils. Nave et al. (2010) also suggested that alternative residue management and site preparation techniques can mitigate or negate these losses.
- California Board of Forestry and Fire Protection 2008
  - California has a "No Net Loss" target based on the current 2004 GHG inventory, which shows a roughly 5 million metric tons (MMT) CO2e net uptake in the forest sector. The target requires the forest sector, through the Board of Forestry and Fire Protection, to develop a plan (measures) to maintain current sequestration levels in a forest environment that is at risk of losses from land-use change, catastrophic disturbance (such as wildfire, insects and disease), and reduced management levels. The 5 MMT target is a minimum goal for the forest sector, but the sector has the potential to achieve a greater amount of carbon sequestration and offsets.
- Pennsylvania
  - Less course woody biomass will remain on the forest floor, which in turn can reduce food supply for beneficial insects and substrates for mycorrhizal fungi that promote tree growth [DOE/Joint Genome Institute, 2008] which states, in part: "Mycorrhizae are critical elements of the terrestrial ecosystems, since approximately 85 percent of all plant species, including trees, are dependant on such interactions to thrive. Mycorrhizae significantly improve photosynthetic carbon assimilation by plants,"

Comments:
Do you think rule change is needed? Guidance? Other?
What specific changes/guidance is needed?

May consider something similar for Washington to California Board of Forestry and Fire Protection act of 2008 cited above. Looking at land-use change over time and catastrophic disturbance (wildfire, insects and disease). This ties into the larger issue of carbon sequestration and GHG emissions, further defining

"biogenic" material, and digging into different methods of "accounting" both locally and regionally. The current ceiling for Washington's forestry sector GHG emissions may also have to be revisited. Beyond the scope of this committee's objectives so will need to be addressed in different forum.
The Matlock data and Fall River study indicate that potential limitations in C resulting from biomass removal are site specific and depend largely on soil characteristics. Where soil C is naturally high the response from forest biomass removal is negligible. In areas where soil C is substantially limited (e.g., thin, low Site quality soils), may have a need to consider greater retention levels.

Topic: Retention Levels
1. Is soil quality within the jurisdiction of the Forest Practices Rules to regulate? 2. Revisit: How much biomass should be left on site to ensure soil quality is maintained? How much slash needs to be left for wildlife and soil quality, to control and reduce surface run-off, maintain ecosystem functionality (harvest cycle is a contributor = potential metric), and contribute to reforestation efficacy? (from flag list)
Existing Forest Practices Rules
RCW 76.09.010 Legislative finding and declaration. (1) The legislature hereby finds and declares that the forest land resources are among the most valuable of all resources in the state; that a viable forest products industry is of prime importance to the state's economy; that it is in the public interest for public and private commercial forest lands to be managed consistent with sound policies of natural resource protection; that coincident with maintenance of a viable forest products industry, it is **important to afford protection to forest soils**, fisheries, wildlife, water quantity and quality, air quality, recreation, and scenic beauty. (2) The legislature further finds and declares it to be in the public interest of this state to create and maintain through the adoption of this chapter a comprehensive statewide system of laws and forest practices rules which will achieve the following purposes and policies: (a) Afford protection to, promote, foster and encourage timber growth, and require such minimum reforestation of commercial tree species on **forest lands as will reasonably utilize the timber growing capacity of the soil following current timber harvest**; (b) **Afford protection to forest soils** and public resources by utilizing all reasonable methods of technology in conducting forest practices; (c) Recognize both the public and private interest in the profitable growing and harvesting of timber; (d) Promote efficiency by permitting maximum operating freedom consistent with the other purposes and policies stated herein; (e) Provide for regulation of forest practices so as to avoid unnecessary duplication in such rules; (f) Provide for interagency input and intergovernmental and tribal coordination and cooperation; (g) Achieve compliance with all applicable requirements of federal and state law with respect to nonpoint sources of water pollution from forest practices; (h) To consider reasonable land use planning goals and concepts contained in local comprehensive plans and zoning regulations; (i) Foster cooperation among managers of public resources, forest landowners, Indian tribes and the citizens of the state; (j) Develop a watershed analysis system that addresses the cumulative effect of forest practices on, at a minimum, the public resources of fish, water, and public capital improvements of the state and its political subdivisions; and (k) Assist forest landowners in accessing market capital and financing for the ecosystem services provided to the public as a result of the protection of public resources. (3) The legislature further finds and declares that it is also in the public interest of the state to encourage

forest landowners to undertake corrective and remedial action to reduce the impact of mass earth movements and fluvial processes.
(4) The legislature further finds and declares that it is in the public interest that the applicants for state forest practices permits should assist in paying for the cost of review and permitting necessary for the environmental protection of these resources.
WAC 222-30-020 Harvest unit planning and design
(9) Future productivity. Harvesting shall leave the land in a condition conducive to future timber production except:
(a) To the degree required for riparian management zones; or
(b) Where the lands are being converted to another use or classified urban lands as specified in WAC 222-34-050.

Existing BMP's/Science Related to Issue

The Finnish approach to ensuring forest sustainability is to classify different sites according to the risks associated with biomass removals from these sites and to then apply different management recommendations based on these classifications. Site classifications include:

- mesic uplands and sites with fertile soils,
- sub-xeric and xeric sites,
- barren upland sites with lichens,
- peatland forest sites,
- stands with rocky soils,
- stands with low levels of available nutrients,
- water conservation areas,
- managed stands with more than 75 percent spruce, and
- stands where biomass removals have previously been performed through WTH clearcutting systems. (Evans et al. 2010).

The UK's guidance classifies sites according to soil types as being of low, medium, or high risk and lists associated slash and stump removal management actions for each of these soil classifications. The assessment of site suitability for biomass harvests is to be based on the most sensitive soil type that covers greater than 20 percent of the site area. The guidelines suggest that site-specific risk assessments should be carried out before each harvest and should include a soil test. (Evans et al. 2010).

WTH clearcutting systems can increase soil nutrient losses by up to 7 percent, lead a reduction in site productivity of up to a 10 percent, and have been linked to an increased rate of loss of biodiversity in managed forests in Sweden…The general approach of Sweden's guidelines and regulations is to classify different sites according to the risks associated with biomass removal at these sites. Different recommendations are then applied based on these classifications (Evans et al. 2010).

To hedge against the risk of soil nutrient depletion, the Swedish Forest Agency introduced additional wood ash recycling requirements in 2008; these supplement existing guidance on fertilization. The updated guidelines and regulations require that ash be applied to sites if the amount of harvest residues removed over the course of a rotation exceeds a half ton per hectare (0.2 tons per acre)…In Sweden, typical biomass removals are 0.5–1 ton per hectare, so recycling is de facto required on most sites. The prescription is to apply 2–3 tons per hectare every ten years and not to exceed two applications (i.e., 6 tons of ash per hectare).
Is fertilization cost effective?

FSC Indicator 6.5.c limits multiple rotations of whole tree harvesting to sites where soil productivity will not be harmed.

Retain logging slash on site, especially on sites with nutrient-limited and coarse-textured soils which are more susceptible to forest productivity declines following nutrient removals because of shallow forest

floor layers and low soil mineralization rates (Page-Dumroese et al. 2010).

Summary of soil productivity protection measures from [all six] states with existing biomass harvesting guidelines (Stewart et al. 2010, Table 27)
• Sensitive soil types
  o Retain as many tops and branches as possible on low fertility sites, sallow soils, coarse sandy soils, poorly drained soils, steep slopes, and other erosion-prone sites (Maine)
  o Avoid additional biomass harvests from erosion-prone sites; install erosion control devices (Minnesota)
  o Avoid biomass harvesting on ombrotrophic, organic soils deeper than 24 inches; aspen/hardwood cover types on shallow soils (8 inches or less to bedrock) (Minnesota)
  o Do not harvest FWD on shallow soils (bedrock within 20 inches of surface; Wisconsin)
  o Do not harvest FWD on dry, nutrient-poor, sandy soils (Wisconsin)
  o Do not harvest FWD on soils classified as dysic Histosols (wetland soils with 16 inches organic material, nutrient-poor and low pH; Wisconsin).
  o For shallow soils and droughty sands, consider retaining 33% or more of the FWD post-harvest (Minnesota)
  o On shallow, nutrient poor soils, consider leaving additional residue (more than 33%; Michigan)

Kimsey et al 2011 • Forest soil productivity risk assessments within a geographic information system (GIS) based on soil and geologic parent material properties and thresholds or limits that have been observed to positively or negatively affect forest growth. • Soil nutrient status was derived as a combination of rock nutrient status and surface soil organic matter content • Soil disturbance susceptibility was built on soil rutting hazard (i.e., compaction and displacement) and soil erosion hazard • a unit-level management tool and BMPs for the differing risks assessed (Table 4)
Comments: *Do you think rule change is needed? Guidance? Other?* *What specific changes/guidance is needed?*
RCW Chapter 76.09.010 explicitly calls for the designation of FP Rules to protect forest soils *per se*.
Add to WAC 222-30-020 Harvest unit planning and design or its Board Manual (exists?).
Assume preexisting biomass and breakage provide enough nutrients for most sites, if this material is retained throughout a rotation
Prohibit biomass collection where risk to soil productivity is high or severe: • Site class IV and V, red alder (?), noncommercial (?), marginally commercial (?) and on certain soil types (nutrient-limited and coarse-textured soils; captured by site class?) unless the landowner can demonstrate the proportion of N to be removed (above-ground N: total N) is <20% (via direct measurement, Evans 1999) • Can map as "slash leave areas" (polygons) and verified during FPA screening process
Develop a new unit-level management and screening tool based on forest soil productivity risk assessments (Kimsey et al 2011) that incorporates • Soil nutrient status: a combination of rock nutrient status and surface soil organic matter content • Soil disturbance susceptibility: soil rutting hazard (i.e., compaction and displacement) and soil erosion hazard • Compare with site class and soil compaction screening tools in use Develop BMPs for the differing risks assessed

Topic: Definitions
Sustainability. A definition of sustainability is not currently contained in the Forest Practices Rules. Ecologically sustainable forestry. A definition of ecologically sustainable forestry is not currently contained in the Forest Practices Rules. Biological Diversity. A definition of biological diversity is not currently contained in the Forest Practices Rules.
Topic: Ecosystem Functionality
1. What is the possibility for the Forest Practices Rules to apply an ecosystem functionality approach to rules, in general. Increasing the scale of management – a crosswalk of conservation measures under existing HCP. 2. Revisit: How much biomass should be left on site to ensure soil quality is maintained? How much slash needs to be left for wildlife and soil quality, to control and reduce surface run-off, maintain ecosystem functionality (harvest cycle is a contributor = potential metric), and contribute to reforestation efficacy? (from flag list) 3. No FP Rules for cumulative effects of traditional harvest at the watershed scale. (from flag list)
Existing Forest Practices Rules, Legislation and Statues
WAC 222-30-010 Policy--Timber harvesting. (emphasis added) *(1) This chapter covers all removal of timber from forest lands in commercial operations, commercial thinning, salvage of timber, relogging merchantable material left after prior harvests, postharvest cleanup, and clearing of merchantable timber from lands being converted to other uses. It does not cover removal of incidental vegetation or removal of firewood for personal use. To the extent practicable, the department shall coordinate activities using a multiple disciplinary planning approach. *(2) The goal of riparian rules is to protect aquatic resources and related habitat to achieve restoration of riparian function; and the maintenance of these resources once they are restored. *(3) The rules provide for the conversion and/or treatment of riparian forests which may be understocked, overstocked or uncharacteristically hardwood dominated while maintaining minimum acceptable levels of function on a landscape scale. The diversity of riparian forests across the landscapes is addressed by tailoring riparian prescriptions to the site productivity and tree community at any site. *(4) Wetland areas serve several significant functions in addition to timber production: Providing fish and wildlife habitat, protecting water quality, moderating and preserving water quantity. Wetlands may also contain unique or rare ecological systems. The wetland management zone and wetland requirements specified in this chapter are designed to protect these wetland functions when measured over the length of a harvest rotation, although some of the functions may be reduced until the midpoint of the timber rotation cycle. Landowners are encouraged to voluntarily increase wetland acreage and functions over the long-term. WAC 222-16-080 Critical habitats (state) of threatened and endangered species
SSHB 2481 • The legislature finds that biomass utilization on state forest lands must be accomplished in a manner that retains organic components of the forest necessary to restore or sustain forest ecological functions. • The department must specify in each contract an annual volumetric limit of the total cubic volume or tons of forest biomass to be supplied from a specific unit, geographically delineated area, or region within a watershed or watersheds on an ecologically and operationally sustainable basis.
RCW 76.09.010 Legislative finding and declaration. (1) The legislature hereby finds and declares that the forest land resources are among the most valuable of all resources in the state; that a viable forest products industry is of prime importance to the state's economy; that it is in the public interest for public and private commercial forest lands to be managed consistent with sound policies of natural resource protection; that coincident with maintenance of a viable

forest products industry, it is important to afford protection to forest soils, fisheries, wildlife, water quantity and quality, air quality, recreation, and scenic beauty.
RCW 76.09.350 Long-term multispecies landscape management plans — Pilot projects, selection — Plan approval, elements — Notice of agreement recorded — Memorandums of agreements — Report, evaluation. The legislature recognizes the importance of providing the greatest diversity of habitats, particularly riparian, wetland, and old growth habitats, and of assuring the greatest diversity of species within those habitats for the survival and reproduction of enough individuals to maintain the native wildlife of Washington forest lands. The legislature also recognizes the importance of long-term habitat productivity for natural and wild fish, for the protection of hatchery water supplies, and for the protection of water quality and quantity to meet the needs of people, fish, and wildlife. The legislature recognizes the importance of maintaining and enhancing fish and wildlife habitats capable of sustaining the commercial and noncommercial uses of fish and wildlife. The legislature further recognizes the importance of the continued growth and development of the state's forest products industry which has a vital stake in the long-term productivity of both the public and private forest land base. The development of a landscape planning system would help achieve these goals. Landowners and resource managers should be provided incentives to voluntarily develop long-term multispecies landscape management plans that will provide protection to public resources. Because landscape planning represents a departure from the use of standard baseline rules and may result in unintended consequences to both the affected habitats and to a landowner's economic interests, the legislature desires to establish up to seven experimental pilot programs to gain experience with landscape planning that may prove useful in fashioning legislation of a more general application. (Status?)
Existing BMP's/Science Related to Sustainability/Ecologically sustainable forestry
Ecologically sustainable forestry: ''perpetuating ecosystem integrity while continuing to provide wood and non-wood values; where ecosystem integrity means the maintenance of forest structure, species composition, and the rate of ecological processes and functions within the bounds of normal disturbance regimes.'' (Lindenmayer et al. 2006)
The natural forest provides a model for sustainable resource management; therefore, responsible forest management imitates nature's dynamic processes and minimizes impacts when harvesting trees and other products…Due to the difficulties of defining appropriate time frames and spatial scales, the concept of forest sustainability is best thought of as an adaptive process that requires regular monitoring and recalibration. Consequently, these guidelines are presented not as static targets to be maintained at all times in all places, but rather as guideposts on a path to sustainability. (Forest Guild 2010).

Forest Stewardship Council (FSC)
• The rate of harvest of forest products shall not exceed levels which can be permanently sustained.
• The sustainability of harvest levels is based on documented data on growth and regeneration, site index models, and classification of soils, appropriate to the scale and intensity of the operation.
• Ecological functions and values shall be maintained intact, enhanced, or restored, including:
  ○ Forest regeneration and succession
  ○ Genetic, species, and ecosystem diversity
  ○ Natural cycles that affect the productivity of the forest ecosystem.

Pennsylvania DCNR • Any use of forest products must preserve the full range of benefits and functions the forest provides and its capacity to regenerate a healthy future forest • For biomass to be considered a renewable resource, the proportion of wood volume growing needs to be greater than the amount harvested in any given year. Vigorous regeneration is essential to maintain a sustainable supply of biomass.
Michigan's biomass guidelines: as "market opportunities expand for woody biomass, it is crucial that

harvesting and removal of woody biomass be done using sustainable forest management principles and practices that are ecologically, economically, and socially appropriate."

Maryland's biomass guidelines address the charge of the Maryland Climate Action Plan: "All biomass will be sustainably harvested without depriving soils of important organic components for reducing erosion, but will maintain soil nutrient structure, and will not deplete wildlife habitat or jeopardize future feedstocks in quantity or quality."

Existing BMP's/Science Related to Ecosystem Functionality

Management- induced homogeneity and simplification (Carey & Harrington 2001)

(1) is a real danger to diversity, resiliency, and susceptibility to invasions of exotic plants (Carey, 1998; Carey et al., 2000; Halpern et al., 1999; Heckman, 1999; Thysell and Carey, 2000),
(2) may result in small-mammal communities non-supportive of predators populations (Carey et al., 1992; Carey and Peeler, 1995), and
(3) may produce environments inhospitable to specific species with concomitant fragmentation effects on those species (Gillesberg and Carey, 1991; Carey et al., 1992, 1999c; Ryan and Carey, 1995).

- Thus, we conclude that active management for complexity on long rotations may be necessary for conservation of the diverse values attributed to forests (Carey and Curtis, 1996; Carey et al., 1999a,b,d).

FSC Indicator 6.3.f requires that "management maintains, enhances, or restores habitat components and associated stand structures, in abundance and distribution that could be expected from naturally occurring processes"; these habitat components include "live trees with decay or declining health, snags, and well-distributed coarse down and dead woody material."

Wildlife will benefit most from a conservation strategy that optimally combines both fine filter and coarse filter approaches (Hunter 1990, Lindenmayer et al. 2006).

- Fine filter approach: focuses on rare or specialized species/habitats
- Coarse filter approach: protecting entire ecosystems

California Forest Practices Rules

- Subchapter 2, Article 1, 897 Implementation of Act Intent (b)(2)
  - Individual [Timber Harvesting Plans] shall be considered in the context of the larger forest and planning watershed in which they are located, so that biological diversity and watershed integrity are maintained within larger planning units and adverse cumulative impacts, including impacts on the quality and beneficial uses of water are reduced.

Extra care should be taken working in or around forested wetlands because of their importance for wildlife and ecosystem function. Wetlands are often low-fertility sites and may support rare natural communities, so removal of DWM may be inappropriate (Forest Guild 2010).

Existing BMP's/Science Related to Biological Diversity

Biodiversity plays an important role in sustaining ecosystem function, resiliency, and adaptability (i.e. nutrient cycling, carbon sequestration, watershed functions, site productivity, air and water filtration)

California Forest Practices Rules (Article 9) explicitly state that biomass harvests should not be allowed to reduce biological diversity within stands or across the landscape through the reduction of suitable wildlife habitat.

Common guiding principles for biodiversity conservation (Stewart et al. 2010)

- Connectivity
  - The linkage of habitats, communities, and ecological processes at multiple spatial and temporal scales
  - Utilize a combination of a structurally complex matrix, corridors with different attributes, and stepping stones (Fischer et al. 2006)
- Stand structural complexity
  - Vertical and horizontal (3D) complexity: multiple layers, large living and dead trees, uneven age structure, gaps, plant species diversity, variable patterns in stem locations, and dead and

downed wood
• Landscape heterogeneity
  o Avoid homogenizing forest landscape structure over space and time
  o Do not apply the same retention levels everywhere
  o Reinstating heterogeneity is particularly important in landscapes dominated by vast areas of intensively managed, structurally simple monocultures (Fischer et al. 2006)
• Range of natural variability
  o Avoid pushing stand structure outside the historic range of conditions
  o Vary the size and intensity of disturbances
• Maintenance of intact aquatic ecosystems (Lindenmayer et al. 2006)

Management implications for sustaining biodiversity (Bunnell et al 2002) • Ensure sustained provision of dying and dead wood • Retain trees and snags of both hardwoods and favored conifer species (larch, Douglas-fir, ponderosa pine), particularly where hardwood species are not abundant. Avoid creating monocultures of less preferred species, such as lodgepole pine. • Retain a range of size and age classes of dead wood • Ensure that some large trees or snags are retained • Meet dead wood requirements for larger species in areas where the emphasis is not on intensive fiber production • Don't do the same thing everywhere • Limit salvage logging after forest fires
Comments: *Do you think rule change is needed? Guidance? Other?* *What specific changes/guidance is needed?*

"Sustainability", "biodiversity" and "ecosystem functionality approach " are not outside of the jurisdiction of the FPR/RCW
• FPR include protection of riparian and wetland functions
• Need to expand to uplands functions (wildlife, biodiversity, soil productivity, C storage)
• Need to manage over larger spatial and temporal scales
  o cumulative effects across watershed/landscape scales and across rotation(s)
  o maximize habitat structural complexity and spatial heterogeneity
  o mimic natural disturbances or intermediate frequencies, scales, and intensities of disturbance
  o retain and recruit vertical and horizontal complexity, understory vegetation, and a well-developed forest floor
  o retain and recruit biological legacies: dead and downed wood, snags/cavity trees of varied size, species, and decay classes

Long-term multispecies landscape management plans (RCW) and Watershed Analysis (WAC) are potential tools (if amended)
Need to add a policy statement to our FPR or BM • timber harvest shall be planned in the context of the larger landscape in which it is located across the full harvest cycle, so that biological diversity and ecosystem integrity are maintained and adverse cumulative impacts on public resources and soil productivity are minimized. • an adaptive process moving towards sustainability as the ultimate outcome • should incorporate the concepts outlined above
Need slash retention in unbuffered forested and type B wetlands because of their importance for wildlife and ecosystem function. • May be covered if we limit biomass removal on low-fertility sites and natural communities

Topic: Other Issues

1. Reforestation species: will species shift for biomass production? Mostly in outer limits of RMZ. NOTE: This is 'thin ice' with regard to telling landowners what to plant. (Silviculture)
2. Interim Step: Biomass industry infrastructure in eastern Washington is so immature it is not possible to address what constitutes appropriate biomass harvest on the Eastside of the Cascades.
    a. Need a field trip. Spring 2012. Public and private lands; pre and post- harvest. (Disturbance)
3. Aquatics emphasis in rules; not a lot that relates to uplands with regard to disturbances. Gaps in rules related to uplands vs. aquatics. (Disturbance)
4. Forest Health Bill excluded riparian areas because CMER was supposed to be looking at that. Not in the rules. (Disturbance)
5. Dynamic forest products market that defines end use of all products. (Disturbance)
6. We can't currently determine the efficacy of the existing FP rules with regard to dead wood and slash disposal. (Dead wood, slash disposal, carbon storage)
7. L&I rules conflict with replanting and the ability to leave snags. Leaving snags is important for wildlife habitat. Clumping is one potential solution. (Wildlife, Biodiversity, and Cultural Resources)
8. Site prep information where rules discuss harvest, salvage, etc. (Wildlife, Biodiversity, and Cultural Resources)
9. Will shrub layer be collected in the future for utilization as biomass? (Wildlife, Biodiversity, and Cultural Resources)

Existing Forest Practices Rules

WAC 222-34-010 Required reforestation — West of Cascades Summit.

1) Reforestation - where required.

a) Unless the harvest application indicates that the land will be converted to another use, or the lands are identified in WAC 222-34-050 as having a likelihood of conversion to urban uses, reforestation is required for forest lands harvested after January 1, 1975 in the following instances:

i) Clearcutting; or

ii) Partial cutting where 50 percent or more of the timber volume is removed within any 5-year period, unless the department determines that the live trees remaining will reasonably utilize the timber growing capacity of the soils.

b) Reforestation is not required where:

i) Individual dead, dying, down or windthrown trees are salvaged; or

ii) A tree or trees not constituting a merchantable stand are removed from lands in actual use for other purposes; for example, removal of individual trees from lands used for farming or grazing; or

iii) Trees are removed under a thinning program reasonably expected to maximize the long-term production of commercial timber; or

iv) An average of 190 vigorous, undamaged, well-distributed seedlings per acre of a commercial tree species are established on the area harvested (up to 20 percent of the harvested area may contain fewer than 190 seedlings per acre, but no acre of the harvested area with timber growing capacity may contain less than 150 seedlings per acre); or

v) A minimum of 100 vigorous, undamaged, well-distributed saplings or merchantable trees per acre of a commercial species or combinations thereof, remain on the area harvested.

2) Reforestation standards. A harvested area is reforested when that area contains an average of 190 or more vigorous, undamaged commercial species seedlings per acre that have survived on the site for at least 1 growing season. Up to 20 percent of the harvested area may contain fewer than 190 seedlings per acre, but no portion of the harvested area with timber growing capacity may contain less than 150 seedlings per acre. The department may determine that less than an average of 190 seedlings per acre is acceptable if fewer seedlings will reasonably utilize the timber growing capacity of the site.

3) Competing vegetation. Competing vegetation shall be controlled to the extent necessary to allow

establishment, survival, and growth by commercial species.

4) Artificial regeneration standards.

a) Satisfactory reforestation - clearcuts. Satisfactory reforestation of a clearcut harvest occurs if within 3 years of completion of harvest, or a period of from 1 to 10 years as determined by the department in the case of a natural regeneration plan, the site is restocked to at least the acceptable stocking levels described in subsection (2) of this section: Provided, That regeneration failures from causes beyond the applicant's control will not result in violation of this section, but supplemental planting or reforestation may be required except in riparian management zones (see WAC 222-34-030(4)).

The department may grant an extension of time for planting or seeding if suitable seedlings or if seeds are unavailable, or if weather conditions or other circumstances beyond the forest land owner's control require delay in planting or seeding.

i) Reforestation species. Where the species proposed for reforestation after timber harvesting differs from the removed stand, the department may approve use of the proposed species where the reforestation plan reveals that the proposed species is preferable from any of the following standpoints:

A) Site data indicates better potential production for the proposed species than the existing species.

B) Control of forest insects or diseases.

C) Greater economic return.

ii) Seedling or seeding standards. Except as approved by the department to qualify as acceptable reforestation, the seedlings or seeds must be from an appropriate seed source zone. The department shall establish seed zones and guidelines for their use.

b) Satisfactory reforestation - partial cuts. Where reforestation is required in connection with a partial cut, the harvest application shall include a plan for stocking improvement. The plan shall be approved unless the department determines that it will not reasonably utilize the timber growing capacity of the site.

5) Natural regeneration standards. A natural regeneration plan may be approved as acceptable reforestation if:

a) A seed source of well formed trees of commercial tree species, capable of seed production is available.

b) The owner of the seed source agrees in writing not to harvest the seed source for the time period specified in the plan, or until issuance of a satisfactory reforestation inspection report.

c) The seed source must consist of:

i) Seed blocks of sizes and locations shown on the plan and satisfactory to the department; or

(ii) An average of at least 8 individually marked, well-distributed, undamaged, vigorous, windfirm seed trees per acre of plantable area and no inadequately stocked area is more than 400 feet from the nearest seed tree; and

(iii) Competing vegetation shall be controlled to the extent necessary to allow establishment, survival, and growth by commercial species.

(6) Any alternate plan for natural reforestation may be approved if it provides a practical method of achieving acceptable stocking levels as described in subsection (2) of this section within a period of 1 to 10 years.

WAC 222-34-020 Required reforestation — East of Cascades Summit.

1) Reforestation - where required.

a) Unless the harvest application indicates that the land will be converted to another use, or the lands are identified in WAC 222-34-050 as having a likelihood of conversion to urban use, reforestation is required for forest lands harvested after January 1, 1975 in the following instances:

i) Clearcutting; or

ii) Partial cutting where 50 percent or more of the timber volume is removed within any 5-year period, unless the department determines that the live trees remaining will reasonably utilize the timber growing capacity of the soils

b) Reforestation is not required where:

i) Individual dead, dying, down or windthrown trees are salvaged; or

ii) A tree or trees not constituting a merchantable stand are removed from lands in actual use for other purposes, for example, removal of individual trees from lands used exclusively for farming or cultivated pasture; or

iii) Trees are removed under a thinning program reasonably expected to maximize the long-term production of commercial timber; or

iv) An average of 150 vigorous, undamaged, well-distributed seedlings per acre of a commercial tree species are established on the area harvested (up to 20 percent of the harvested area may contain fewer than 150 seedlings per acre, but no acre of the harvested area with timber growing capacity may contain less than 120 seedlings per acre); or

v) A minimum of 100 vigorous, undamaged, well-distributed advanced regeneration, saplings or merchantable trees per acre of a commercial tree species or combinations thereof, remain on the area harvested.

2) Reforestation standards. A harvest area is reforested when that area contains an average of 150 or more vigorous, undamaged commercial species seedlings per acre that have survived on the site for at least 1 growing season. Up to 20 percent of the harvested area may contain fewer than 150 seedlings per acre, but no portion of the harvested area with timber growing capacity may contain less than 120 seedlings per acre. The department may determine that less than an average of 150 seedlings per acre is acceptable if fewer seedlings will reasonably utilize the timber growing capacity of the site.

3) Competing vegetation. Competing vegetation shall be controlled to the extent necessary to allow establishment survival and growth by commercial species.

4) Artificial regeneration standards.

a) Satisfactory reforestation - clearcuts. Satisfactory reforestation of a clearcut harvest occurs if within 3 years of completion of harvest or a period of from 1 to 10 years as determined by the department in the case of a natural regeneration plan, the site is restocked to at least the acceptable stocking levels described in subsection (2) of this section: Provided, That regeneration failures from causes beyond the applicant's control will not result in a violation of this section, but supplemental planting may be required except in riparian management zones (see WAC 222-34-030(4)).

The department may grant an extension of time for planting or seeding if suitable seedlings or seeds are unavailable, or if weather conditions or other circumstances beyond the forest landowner's control require delay in planting or seeding.

i) Reforestation species. Where the species proposed for reforestation after timber harvesting differs from the removed stand, the department may approve use of the proposed species where the reforestation plan reveals that the proposed species is preferable from any of the following standpoints:

A) Site data indicates better potential production for the proposed species than the existing species.

B) Control of forest insects or diseases.

C) Greater economic return.

ii) Seedling and seed standards. Except as approved by the department to qualify as acceptable reforestation, the seedlings and seed must be from an appropriate seed source zone. The department shall establish seed zones and guidelines for their use.

b) Satisfactory reforestation - partial cuts. Partial cuts not meeting the specifications of subsection (1)(b)(iv) or (v) of this section shall have a seed source as required in subsection (5)(c)(ii) of this section.

5) Natural regeneration standards. A natural regeneration plan may be approved by the department as acceptable reforestation if:

a) A seed source of well-formed, vigorous trees of commercial tree species capable of seed production is available.

b) The owner of the seed source agrees in writing not to harvest the seed source for the time period specified in the plan or until issuance of a satisfactory reforestation inspection report.

c) The seed source consists of one of the following, or combinations thereof:

i) Seed blocks which total a minimum of 5 percent of the area of each 40 acre subdivision or portion thereof harvested: Provided, That the seed block should be reasonably windfirm, at least 1/2 acre in size,

and reserved in locations shown on the plan and approved by the department; or

ii) A minimum of 4 undamaged seed trees per acre, well distributed over each 40 acre subdivision or portion thereof harvested: Provided, That the distance from seed trees of harvested areas that are not adequately stocked should not be more than 200 feet. Seed trees shall be of commercial tree species, vigorous and of seed-bearing age and size.

6) Any alternate plan for natural reforestation may be approved if it provides a practical method of achieving acceptable stocking levels as described in subsection (2) of this section within a period of 1 to 10 years.

WAC 222-34-030 Reforestation — Plans — Reports — Inspections.

1) Reforestation plans. Reforestation plans must be submitted with the application or notification except where no reforestation is required. The department shall designate difficult regeneration areas utilizing silvicultural information. When a forest practice is proposed for such an area, the department may require additional information regarding harvest systems and post harvest site preparation, as well as regeneration. The department shall approve the reforestation plan for difficult regeneration areas if it determines that such a plan will achieve acceptable stocking according to WAC 222-34-010 and 222-34-020.

2) Reforestation reports. The landowner, forest landowner, or his/her designee shall file a report with the department either at the time of completion of planting or reforestation or at the end of the normal planting season. When artificial seeding is used the report shall be filed 2 growing seasons after seeding.

3) The reports in subsection (2) of this section must contain at least the following:

a) The original forest practices application or notification number.

b) Species reforested, planted, or seeded.

c) Age of stock planted or seed source zone.

d) Description of actual area reforested, planted, or seeded.

4) Inspection; supplemental planting or reforestation directives.

a) Within 12 months after a reforestation report is received, the department shall inspect the reforested lands. The department shall issue written notice to the landowner, forest landowner, or his/her designee stating whether supplemental planting or reforestation or further inspection is required within 30 days after the deadline for inspection or the reforestation shall be deemed satisfactory.

b) If the inspection shows that acceptable stocking levels have not been achieved, the department shall direct the forest landowner to perform supplemental planting in accordance with the planting standards of WAC 222-34-010 (3) and (4)(a)(ii), 222-34-020 (3) and (4)(a)(ii): Provided, That:

i) In lieu of such supplemental planting, the department and the forest landowner may agree on a supplemental reforestation plan.

ii) Supplemental planting or reforestation shall not be required where in the opinion of the department planting or reforestation is not feasible due to rocky ground, dry conditions, excessively high water table or other adverse site factors and the department determines that there is little probability of significantly increasing the stocking level.

iii) Where supplemental planting or reforestation has been required by the department, the landowner, forest landowner, or his/her designee shall file a report of supplemental planting or reforestation upon completion.

iv) Except where stocking improvement is necessary to protect public resources and is feasible, further supplementary planting shall not be required where acceptable stocking levels have not been achieved after two properly performed supplemental plantings.

c) Within 12 months after a supplemental planting or reforestation report is received, the department shall inspect the reforested lands.

d) Evidence of compliance. The department shall within 30 days after the deadline for inspection or reinspection and when requested by the forest landowner confirm in writing whether acceptable stocking levels have been achieved, provided field conditions do not prevent the department from properly

evaluating the reforestation.

e) Where a natural regeneration plan has been approved by the department, the department may allow up to 10 years to achieve acceptable stocking levels.

WAC 222-34-040 Site preparation and rehabilitation.

1) Heavy equipment. Heavy equipment shall not be used in connection with site preparation or rehabilitation work:

a) When, because of soil moisture conditions or the type of soils, undue compaction or unnecessary damage to soil productivity would occur or erosion would result in damage to water quality; or

b) Within riparian management zones, Type A and B Wetlands, wetland management zones, or within equipment limitation zones of Type Np and Ns Waters on slopes of 30 percent or less. On slopes greater than 30 percent heavy equipment shall not operate within 50 feet of Type S through Ns Waters unless a site specific plan has been approved by the department.

2) Surface water drainage. Where site preparation or rehabilitation involves contouring or terracing of slopes, drainage ditches, or similar work:

a) The gradient of ditches or other artificial water courses in erodible soils shall not cause significant stream, lake, pond, or wetland siltation.

b) Ditches and other artificial water courses shall not discharge onto any road, landing or fill.

c) Ditches and other artificial water courses shall not be constructed to discharge onto the property of other parties without their consent.

3) Stream channel realignment. Where work involves deepening, widening, straightening or relocating the channel; or bulkheading, riprapping or otherwise stabilizing the banks of a Type S or F Water, a hydraulic project approval is always required, and the work shall be done only:

a) After consultation with any party having an appropriation permit or registered right to appropriate waters from the affected stream segment in cases of streams used for domestic water supplies.

b) Where no significant adverse effects on either the peak or minimum water levels or flows downstream can be expected.

c) In a manner not expected to result in long-term damage to public resources or to adjacent or downstream property.

Existing BMP's/Science Related to Issue

Comments:
Do you think rule change is needed? Guidance? Other?
What specific changes/guidance is needed?