Forest Practices Biomass Work-Group
DRAFT: Wrap-Up Document

BMPs/Science & Comments/Conclusions

March 8, 2012

Prioritization "Buckets"

1. Biomass only.

Unique to biomass collection.

Topic 1: Definitions
1. There is currently no definition of "Forest Biomass" in Washington's Forest Practices Rules.
Existing BMP's/Science Related to Issue
Biomass is vegetation removed from the forest, usually logging slash, small-diameter trees, tops, limbs, or trees not considered merchantable in traditional markets. (Evans et al. 2010)
Woody biomass is defined as material from trees and woody plants, including limbs, tops, needles, leaves and other woody parts that are by-products of forest management, ecosystem restoration or hazardous fuel reduction treatments (ODF 2008).
CWM has been defined as more than 6 inches in diameter at the large end and FWM that is less than 6 inches in diameter at the large end (Minnesota Forest Resources Council 2007).
The USDA Forest Service defines CWM as downed dead wood with a small-end diameter of at least 3 inches and a length of at least 3 feet, and FWM as having a diameter of less than 3 inches (Woodall and Monleon 2008).
Fine woody debris: Any woody material 0.01-3" diameter Coarse woody debris Any woody material 3-10" diameter Logs: Any woody material greater than 10" diameter Stumps: Any snag less than 10 feet tall (Stewart et al. 2010)
Comments: *Do you think rule change is needed? Guidance? Other?* *What specific changes/guidance is needed?*
Yes, under WAC 222-16-010 (General Definitions).
Residual woody biomass: the fine woody debris (FWD) and coarse woody debris (CWD) that is produced as a byproduct of forest practice activities. Residual woody biomass does not include tree roots, stumps, needles, leaves, logs, snags, merchantable stems, forest floor/duff, pre-existing FWD and CWD, or understory vegetation or trees. Only stumps that are removed for the purpose of forest health, road construction, or conversion to non-forest land uses qualify at residual woody biomass. Only small-diameter trees that are removed for the purpose of forest health or stand enhancement (i.e., thinning) qualify at residual woody biomass.
Fine woody debris (FWD): tree tops, branches, and bark and small-diameter trees that are less than 3" in diameter at the large end
Coarse woody debris (CWD): tree tops and branches and small-diameter trees that are greater than 3" in diameter at the small end
Small-diameter trees:
Existing "slash" and "debris" definitions are volume-based and are not specific enough to be included in the definition of residual woody biomass as is.

Topic 2: Retention Levels
1. How much biomass should be left on site to ensure that forest resources/forest function is maintained? 2. Is the "bottom line" of retention, currently in the FP Rules, sufficient under the possibility of a market for more product that would have otherwise been left behind? 3. Rules lack retention targets for fine woody debris. 4. Is there a need for slash retention rules/BMP's? 5. Should special areas where ground wood is particularly important be identified? 6. Should the fact that stumps cannot be removed be clarified in light of an emerging biomass sector?
Existing BMP's/Science Related to Issue
Broad approach: Maintain ecosystem function (target background levels)
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." (Evans et al. 2010)
FSC: 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.
Stewart et al. 2010, Table 24: Summary of dead and downed wood retention targets from states with existing biomass harvesting guidelines • Retain the forest floor, litter layer, root systems, stumps • Retain as many logs/snags and as much slash as possible • Retain a minimum number of logs/snags and and a minimum percent or volume of slash   o % left intentionally plus assumed incidental breakage (10-15%) • Retain woody debris from multiple tree species and size classes, with an emphasis on larger structures • Retain more debris in stands with little woody debris prior to harvest • Retain and limit disturbance to pre-existing CWD/FWD
Soil productivity BMPs (broad) • Soil disturbance classification (Scott 2007)   o Limit soil disturbance to class 1, minimize class 2, and avoid classes 3-5 • Where possible, delay yarding after felling to allow slash/needles to dry and fall off in more even distribution across the site • Stewart et al. 2010, Table 27: Summary of soil productivity protection measures from states with existing biomass harvesting guidelines
Soil erosion/unstable slopes (see topic 3)
Soil compaction (see topic 4)

Wildlife/biodiversity BMPs (broad)
• Wildlife will benefit most from a conservation strategy that optimally combines both fine filter and coarse filter approaches (Hunter 1990, Lindenmayer et al. 2006).
  o Fine filter approach: focuses on rare or specialized species
  o Coarse filter approach: protecting entire ecosystems
• Carey & Johnson 1995

- Our empirical data suggest that 15-20% cover of coarse woody debris on the forest floor, well distributed across the site, would be adequate for most small mammals, whereas 5-10% cover would not allow the mammals to reach their potential abundances. But coarse woody debris, especially large, standing and fallen dead trees, is not only an important habitat component for forest floor small mammals, but also provides critical habitat elements for birds (Carey et al. 1991) and amphibians (Bury et al. 1991a, Corn and Bury 1991b).

- How Should We Spatially Distribute Dying and Dead Wood? (Bunnell et al 2002b)
  - Maintain a target density of 2-3 large snags (> 50 or 30 centimeter diameter) per hectare, among 10-20 smaller snags per hectare through the rotation. However, ensure variation in densities, not an even distribution everywhere.
  - Providing for future recruitment of snags in coniferous stands is necessary to ensure that target densities are maintained through the rotation and after harvest. Suggested densities do not apply to each hectare of forest. Because of the diversity of organisms using snags, variability in density of snags must be maintained within and among stands.
  - Maintain a range of log sizes from 6 cm to >50 cm in diameter at densities of 100 to 200 cubic meters/hectare or more
  - Maintain patches of snags and DWD of at least 1-3 ha using both aggregated and dispersed retention
  - Meet dead wood requirements for larger species in areas where the emphasis is not on intensive fiber production.
- Retain as much dead wood as possible (FWD, CWD, logs, snags) from various size and decay classes and tree species
  - Retain 7-25 den trees and 6-12 snags per acre (MO)
  - Retain at least 1.6 logs per acre (at least 16 feet in length and 12 inches in diameter on the coast and 6.5 feet in length and 3 inches in diameter in the interior; BC).
  - In areas under uneven-aged management, retain a minimum of 6 secure cavity and/or snag trees per acre, with one exceeding 18 inches DBH and 3 exceeding 12 inches DBH. In areas lacking such cavity trees, retain trees of these diameters with defects likely to lead to cavity formation. (NH)
  - In areas under even aged management, leave an uncut patch for every 10 acres harvested, with patches totaling 5 percent of the area. Patch size may vary from a minimum of 0.25 acre. Use cavity trees exceeding 18 inches DBH or active den trees as nuclei for uncut patches. Remember, the larger the tree, the more species that can use it. Riparian and other buffers can help to satisfy this goal. (NH)
  - Leave up 15 to 30% of harvestable biomass as course woody debris.
- Stewart et al. 2010, Table 25
  - Retain some green wildlife trees (trees with cavities and rot; GRTs)
  - Retain some mast-producing trees (hardwood species) and shrubs of various species and size classes
  - Retain fruit-producing shrubs and trees
  - Retain biological legacies in clumps and buffers
  - Retain slash piles that show evidence of use by wildlife
  - Avoid biomass harvests within sites where endangered or threatened plant or animal species are known to exist (practices should protect and enhance habitat)
  - Avoid/limit biomass harvesting in areas of high conservation value/sensitive sites (wetlands, springs/seeps, vernal pools/ponds, riparian zones, cliffs, caves)
  - Avoid harvest activity in leave tree clumps
  - Avoid damaging existing downed woody debris, especially large (18+ inches) hollow or rotten logs and rotten stumps during harvesting operations (including tree falling, skidding, and road and skid trail layout).

- Avoid disrupting upturned tree roots during the breeding season to protect nesting birds.
- Avoid "hard edges," by creating a gradual transition into harvested areas
- Consider creating travel corridors in large harvests (>40 acres)
- Leave additional woody debris in stands with low levels of woody debris prior to biomass harvests
- Avoid biomass harvests more than once per rotation to prevent a decline in the quantity and quality of woody biomass pools over time

- Oregon
  - Select silviculture treatments that provide a diversity of forest structure so a wider range of habitats for wildlife and understory plants can provide for overall biodiversity.
  - Hagar and others (2004) suggest using a variety of thinning intensities and patterns, from no thinning to very widely spaced residual trees, to maximize avian diversity at the landscape scale and structural diversity both within and among stands.
  - Pilliod and others (2006) suggest that managers should retain refugia of untreated stands and critical habitat elements, particularly slow to recover features such as large-diameter down wood and snags, to increase habitat heterogeneity, benefit the greatest number of species over time, minimize the effects of direct mortality, and accelerate recovery.
  - We believe there is an adequate amount of literature informing the potential effects of woody biomass removal on forest species to warrant a precautionary approach to its management until further research can be conducted.

Carbon storage BMPs (broad)

- Gershenson et al. 2010
  - Limit high disturbance site preparation activities to 10% of the total project area to minimize loss of soil C.
  - Since initial losses from whole tree harvest 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
  - One argument against basing [lying dead wood: CWD] 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.
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Site-specific approaches:

Soil productivity

- Retain logging slash on site, especially on sites with nutrient-limited and coarse-textured soils (Page-Dumroese et al. 2010).
- Stewart et al. 2010 (Table 27): soil productivity protection measures from states with existing biomass harvesting guidelines
  - Sensitive soil types
    - 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)
    - Avoid additional biomass harvests from erosion-prone sites; install erosion control devices (Minnesota)
    - 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)
- Do not harvest FWD on shallow soils (bedrock within 20 inches of surface; Wisconsin)
- Do not harvest FWD on dry, nutrient-poor, sandy soils (Wisconsin)
- Do not harvest FWD on soils classified as dysic Histosols (wetland soils with 16 inches organic material, nutrient-poor and low pH; Wisconsin).
- For shallow soils and droughty sands, consider retaining 33% or more of the FWD post-harvest (Minnesota)
- On shallow, nutrient poor soils, consider leaving additional residue (more than 33%; Michigan)

Soil erosion/unstable slopes (see topic 3)

Soil compaction (see topic 4)

Wildlife/biodiversity
- To determine the degree to which an ecosystem is fully functional, a manager can determine which habitat elements and associated species could be influenced by the proposed management activities (positively or negatively), determine the set of KEF categories associated with the affected species [using the SHP/ICBEMP/DecAID databases] and compare this with other alternative management activities or expected changes in wildlife habitats, structures, and elements over time (Marcot 2002).
- CWD
  - WRT, GRT: Prioritize largest
  - Range of size and decay classes
  - Avoid damaging existing DWD, especially large (18+ inches) hollow or rotten logs and rotten stumps during harvesting operations
- FWD:
- Duff/litter layer
- Understory shrubs/herbs
- Non-merchantable trees
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Carbon storage
- Slesak et al. 2010
  - 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
  - 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.

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

There is a need for both broad (%) and site-specific metrics. The broad, ecosystem function approach encompasses potential impacts to all forest resources, is easiest to implement, and helps compensate for scientific uncertainty. The site-specific approach is appropriate where the risks to forest resources are the greatest.

Metrics
- % ground cover, % bare soil (problematic, but incorporates pre-existing levels of debris)
  - Also consider depth
- % trees (simpler, but does not incorporate pre-existing levels of debris)
  - Example: retain slash from 1/3 of trees harvested

• Total = % left intentionally plus assumed incidental breakage (10-15%)
Retention levels for both FWD and CWD are needed because they serve distinct ecological functions.
Performance-based rules vs. qualitative (prescriptive?) rules • Performance-based rules are more robust to market fluctuations • More appropriate for guidance to be prescriptive
Site-specific soil impacts: risk management approach (see 10/24/11 white paper)
Need to complete Landscape Level Wildlife Assessment models • to identify species/guilds dependent on CWD and FWD • to identify gaps in the Rules

Potential rule revisions
• Snag retention
  ○ To ensure retention of snags of sufficient size, abundance, distribution, and variable degrees of decay to support wildlife associated with snag habitat.
• Snag recruitment
  ○ To ensure recruitment of snags into landscapes deficient in snags of sufficient size, abundance, distribution, and degrees of decay to support wildlife associated with snag habitat.
• Green tree retention
  ○ To ensure retention of trees of sufficient size, abundance, and distribution to support wildlife associated with large tree habitat.
• Green tree recruitment
  ○ To ensure recruitment of large trees into landscapes that are currently deficient of large trees of sufficient size, abundance, and distribution to support wildlife associated with large tree habitat
• Down woody material retention
  ○ To ensure logs of sufficient size, abundance, distribution, and degrees of decay are retained on site to support wildlife associated with down wood habitat.
• Down woody material recruitment
  ○ To ensure recruitment of down woody material into landscapes that are currently deficient in down woody material of sufficient size, abundance, distribution, and degrees of decay to support wildlife associated with down wood habitat
• Duff and litter layer retention
  ○ To support wildlife associated with duff and litter habitat
• Duff and litter layer recruitment
  ○ To allow development of deep duff and litter layers into landscapes that are currently deficient in duff and litter layers of sufficient depth, development, and distribution to support wildlife associated with duff and litter habitat.

Carbon storage • FP Rules only require mitigation for soil disturbance of >10% inside Equipment Limitation Zone (ELZ) of Type N waters • Limit high disturbance site preparation activities to 10% of the total project area to minimize loss of soil C. • Where the initial C pool is small, retain 40-80% cover of logging debris • Adopt a “no net loss” of forest C sequestration levels

Topic 3: Slope
What is the percent slope threshold at which biomass should not be collected due to risks collection with pose on soil erosion, water quality, etc.?

Existing BMP's/Science Related to Issue

• Retain at least 30% of the fine woody debris on slopes conducive to ground-based harvesting and 50% or more on steeper slopes. (Harrison et al. 2011)
• Incorporated into soil site risk assessment?
  ○ soil erosion and/or mass wasting hazard metrics (see 10/24/11 soil operational guidelines)
• Cram et al. 2007
  ○ Given similar vegetation cover types and soils, forest prescription guidelines and on-site priorities [should] be focused on not necessarily avoiding all traffic but rather on minimizing severe surface disturbance [large areas of exposed bare soil] particularly on steep slopes.
  ○ Although exposed soil is subject to runoff and erosion, the confluence of adjacent litter and slash piles will help slow runoff and promote infiltration.
  ○ Scattering slash, straw mulching, and erosion control blankets can cover exposed mineral soil resulting in increased infiltration, and reduced runoff and sedimentation (surface remediation at highly disturbed sites, Robichaud et al. 2005)

Comments: *Do you think rule change is needed? Guidance? Other?* *What specific changes/guidance is needed?*
Incorporate into soil site risk assessment
Limit high disturbance site preparation activities to 10% of the total project area

Topic 4: Soil Health/Compaction
On sensitive soils, should biomass collection should be limited to the landings during certain seasons (allow removal during dry soil conditions or prohibit a return to the site)?
Existing BMP's/Science Related to Issue

- Elliot 2009: Table 1, typical BMPs to follow to minimize impacts of biomass use
  - Onsite practices
    - Minimize mineral soil exposure
      - Minimize turnarounds with equipment
      - Use designated skid trails
      - Use harvesters with longer booms
    - Avoid working when soils are wet
      - Winter logging may work
    - Avoid dragging logs
      - Lift ends with skidders
      - Use grapple skidders or forwarders
    - Minimize the amount of traffic
    - Mitigate skid trails
      - Install frequent water bars
      - Cover trails with slash
    - Use low ground pressure equipment
      - Bigger tires or tracks
      - Note: Smaller vehicles make more trips
- Limit the areal coverage of equipment corridors (Stewart et al. 2010).
- Position limbs and tree tops on equipment travel corridors as a protective mat to reduce exposure and compaction of soil (Hartsough et al. 1994; Page-Dumroese 1993).
- Use well-planned systems of designated equipment corridors to limit the total area disturbed during harvest (Moghaddas and Stephens 2008; Page-Dumroese et al. 2010).
- Avoid biomass collection when soil moisture is high (Han et al. 2009).
- Utilize historic/preexisting skid trails to help minimize cumulative soil disturbance from multiple harvest entries (Page-Dumroese 2010, Stewart et al. 2010).
- Limit the areal coverage of equipment corridors (Stewart et al. 2010).
- Angima & Terry 2011: Chapter 5, Managing Soil Disturbance
  - Avoid situations in which the risk is high because of site conditions and time of year. Schedule higher-risk soils during the driest time of the year. Take extra precautions when operating during higher-risk conditions.
- Cover skid trails with slash during harvest operations
- Where skidders are used, mark and flag “high and dry” equipment corridors to limit the total area disturbed during harvest (“designated skidtrails”, not logger’s choice)
- After the initial harvest, do not reenter the site beyond the landings to collect woody biomass

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

Yes. The above recommendations should be sorted and incorporated into the following rules accordingly: WAC 222-30-045 Salvage Logging within Riparian Management Zones; WAC 222-30-050 Felling and Bucking; WAC 222-30-060 Cable Yarding; WAC 222-30-070 Ground Based Logging Systems; WAC 222-30-080 Landing Cleanup; WAC 222-30-090 Postharvest Site Preparation; WAC 222-30-100 Slash Disposal and Prescribed Burning;

A thorough “crosswalk” needs to be competed between specific WACs and the above recommendations to determine the degree to which rules/BMPs need to be revised. Some rules may require very little if any changes, other more substantive changes.

2. Timber issues that affect biomass.

Primarily an issue with timber harvest, road construction, etc., but that has or could relate to the impacts of biomass collection.

Topic 1: Definitions
Evaluate the definitions of: -Slash -Salvage -Debris -Hazard -Harvest -Risk -Consequence
Existing BMP's/Science Related to Issue
Silviculture Revisit terms contained in specific treatments (the entire definitions section of the WACs should be revisited as they pertain to biomass harvest).
Piece size is missing from the rules to define both ends of the size spectrum for "biomass" collection. Slash is defined as "pieces of woody material containing more than 3 cubic feet resulting from forest activities" and debris is defined as "woody vegetative residue less than 3 cubic feet in size resulting from forest practices activities."
Consider FWD and CWD as subsets of "debris"
Bigger issue: Definitional evaluation of "salvage" and "harvest" to avoid unintentional harvest (SEPA loophole if separate FPA for biomass = salvage)
Comments: *Do you think rule change is needed? Guidance? Other?* *What specific changes/guidance is needed?*

Topic 2: Timing
1. Will road abandonment and slash disposal requirements interfere with the need for forest biomass to cure over a period of 6-18 months? 2. Biomass harvest could challenge DNR's ability to monitor for compliance with FP rules.
Existing BMP's/Science Related to Issue
Comments: *Do you think rule change is needed? Guidance? Other?* *What specific changes/guidance is needed?*
Road construction and maintenance (WAC 222-24) • Postpone access road abandonment until after biomass collection • Ensure all local RMAP work is still completed within annual report timelines • Ensure that roads are maintained and "storm proofed" immediately after tree bole harvest, and before biomass collection, while retrievable biomass is drying