BMPs: Wildlife, Biodiversity, and Cultural Resources

Conservation Caucus Summary

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Wildlife

Background

- Habitat structural elements potentially affected by woody biomass harvests (Stewart et al. 2010)
  - Dead and downed wood (pre-existing) and harvested generated slash
    - Snags
    - Coarse woody debris (logs, stumps and other woody material >3" diameter)
    - Fine woody debris (leaves, needles, branch tips, forest floor, and other woody material less than 3" diameter)
  - Understory shrub and herbaceous layers
  - Non-merchantable trees
  - Wildlife trees
    - decaying live trees, cavity trees, mast producing trees
  - Upland and aquatic habitats
  - The impacts to wildlife from biomass harvests are typically assumed to be determined by the level of manipulation of structural components and the sizes, numbers and arrangement of residual habitat elements. The majority of impacts will be associated with habitat manipulation, fragmentation, and loss.
- Wildlife functions served by dead wood
  - Foraging, nesting, denning, roosting, cover, movement/dispersal, courtship, microclimate control
- Species with large home ranges will likely be able to move to a more suitable habitat patch during and after a biomass harvest more easily than limited dispersers (Stewart et al. 2010).
- Impacts of biomass harvest will be greatest for species with home ranges that closely match the size of, or are smaller than the biomass harvest unit (Hagar 2007).
- Effects on prey extend through the food web to higher trophic levels
- Given the number of species associated with non-coniferous vegetation in conifer-dominated forests [N=78 species in OR and WA], maintaining habitats that support diverse plant communities, particularly broad-leaved trees and shrubs, will be an important component of management strategies intended to foster biodiversity (Hagar 2007).
- Marcot 2002
  - Each species serves key ecological functions (KEF), beyond species-habitat relationships
  - Dead wood provides habitat, at least in part, for a wide array of species with such a broad set of trophic and dietary relations, dispersal roles, and organismal, soil, wood, water, and vegetation relations
  - Dead wood as the center of a "functional web" of ecological roles

        - Control of insect or vertebrate populations, pollination, creation of feeding or nesting opportunities for other species, and soil structure and aeration by burrowing and digging.
    - No one wood decay element (i.e., snags, logs) provides for all functional groups of wildlife and different wood decay elements play complementary roles in providing for all functions collectively
    - 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.

Management approaches

- 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).
- 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
    - Coarse filter approach: protecting entire ecosystems
- Retention targets for dead and downed wood should be developed to reflect the requirements of a suite of focal species whose habitat requirements encompass the needs of the majority of species present (Lambeck 1997).
- Two approaches focusing on species interactions may protect important ecosystem functions. The first is conserving keystone species; the second is maintaining species diversity within functional groups (Fischer et al. 2006).

Biodiversity

Background

- Gene, species, habitat, ecosystem, and landscape diversity and the processes that sustain these at various spatial and temporal scales (Lindenmayer et al. 2006, Hunter 1990).
    - *One of many definitions…see Stewart et al. 2010 for discussion*
- 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)
- Biodiversity provides benefits from the direct consumption of raw materials and products produced by forests (i.e. timber, energy and fuels, food, non-timber products).
- 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
        - Avoid homogenizing forest landscape structure over space and time
        - Do not apply the same retention levels everywhere
        - 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
        - Avoid pushing stand structure outside the historic range of conditions
        - Vary the size and intensity of disturbances
    - Maintenance of intact aquatic ecosystems (Lindenmayer et al. 2006)

Management approaches

- Bunnell et al 2002: management implications for sustaining biodiversity
    - 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
- Lindenmayer et al. 2006
    - We define ecologically sustainable forestry as ''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.''
    - Stand-level conservation strategies within off-reserve forest
        - Habitat within management units or stands
        - Retention of structures and organisms at time of regeneration harvest
        - Trees with hollows (and recruits), large decaying logs, understory thickets, gaps and anti-gaps
        - Creation of structural complexity through stand management activities
        - Lengthened rotation times
        - Application of novel silvicultural systems to meet stand-level goals
        - Variable retention harvest system (VRHS), novel thinning systems
        - Appropriate fire management regimes and varied prescriptions between stands

        - Consideration of adjacency to other vegetation/stands (= landscape context)
        - Management of additional kinds of disturbances (e.g. grazing)
        - Targeted management strategies for particular species
        - Control strategies for unwanted species (e.g. weed management, feral animal control)
        - Consideration of natural disturbance regimes as template for logging regimes
        - Stand level patterns and quantities of biological legacies that remain after natural disturbance events
    - Attempts to conserve forest biodiversity must be multi-scaled – with appropriate conservation strategies at the level of individual trees through to landscape and regional levels.
- Active management (thinning) in middle-aged, small diameter stands can diversify understory habitat and accelerate development of old forest characteristics, such as large diameter trees and patchy understories, that are currently lacking (Lehmkuhl et al. 2002).
- Carey & Harrington 2001: <u>Management- induced homogeneity and simplification</u>
  (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 <u>active management for complexity on long rotations may be necessary for conservation of the diverse values attributed to forests</u> (Carey and Curtis, 1996; Carey et al., 1999a,b,d).

<u>State BMPs for Wildlife & Biodiversity</u>

- Common themes
    - 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.

- 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
- *Summarized in Stewart et al. 2010, Table 25*

- 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.

- 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.

Summary

- Maximize habitat structural complexity and spatial heterogeneity across the landscape
- Mimic natural disturbances or intermediate frequencies, scales, and intensities of disturbance
- Retain and recruit vertical and horizontal complexity, understory vegetation, and a well-developed forest floor
- Retain and recruit biological legacies: dead and downed wood, snags/cavity trees,
  - vary size, species, decay classes
- Greater emphasis on CWD than on FWD
- Avoid biomass harvests within sites where endangered or threatened plant or animal species are known to exist or in areas of high conservation value/sensitive sites

Cultural Resources

State BMPs

- The National Historic Preservation Act of 1966, as amended, establishes the National Register of Historic Places and provides for State and Tribal Historic Preservation Officers to implement the national preservation program.
- Connecticut
  - Identify areas of special concern for the landowner, such as cultural sites containing stonewalls, historic foundations or walking trails.
- Michigan
  - The Sustainable Soil and Water Quality Practices on Forest Land manual covers legal requirements and regulations related to cultural and archaeological resources
- Minnesota
  - Cultural resource means any site, building, structure, object or area that has value in American history, archaeology, architecture, engineering or culture that is at least 50 years old.
    - Historic structures, archaeological sites, cemeteries, traditional use areas and historic areas.
  - Potential damaging effects to cultural resources resulting from forest land management activities include:
    - Soil disturbance
    - Soil compaction
    - Rutting
    - Changes in public access
    - Changes in vegetation which is part of a cultural resource
    - Damage to above-ground features
  - Check existing cultural resource inventories to determine whether any important cultural resources are known to be present within a given area.
  - Conduct a pre-field review of documentary information
  - Assess cultural resource potential
  - Identify cultural resources in the field
  - Assess management alternatives

- At high-sensitivity sites:
  - Avoid the highly sensitive areas identified within the project area.
  - Protect the cultural resource by means of the treatment and mitigation practices described in *General Guidelines: Protecting Cultural Resources* and applicable sections of the activity-specific guidelines.
  - Bring in a cultural resource management professional to carry out a survey for archaeological and above-ground cultural resources.
- Biomass Harvest on Sensitive Sites
  - Review General Guidelines and Timber Harvesting guidelines, especially those relating to checking for the presence of known endangered, threatened and special concern species, sensitive plant communities or cultural resources

- Forest certification systems often require protection of sites with historical, archeological, or cultural significance (ATFS, CSA, SFI, FSC).

European BMPs/Rules

- Framstad et al. 2009 (Fennoscandia)
  - Cultural heritage values include cultural remains, buildings and other monuments as well as cultural environments where sites and monuments form larger entities. Also cultural layers which are not visible above the ground are ascribed with cultural heritage values.
  - The present management of cultural heritage values is mainly based upon information from national registers and databases where many remains, monuments and sites are listed, but these only cover a minor area (~20%) of the forest lands.
  - The obligation to protect cultural heritage values is regulated by international agreements such as The Convention on the Value of Cultural Heritage for Society (CoE 2005), with its aim to "promote cultural heritage protection as a central factor in the mutually supporting objectives of sustainable development" (Article 5e) as well as by federal legislation which protects ancient monuments, sites, and remains.
  - Even though large parts of the cultural heritage have strict legal protection, investigations show that remains and monuments in forests are exposed to a rather high degree of obliteration and damage from heavy machinery used for logging, road construction, and scarification (up to 80% of remains). Increased biomass harvesting from forests and farmland aggravates the threats to cultural heritage values situated in affected areas.
  - Removal of logging residues result in more transport, an activity that represents almost 50% of damages done to cultural remains and monuments (Risbøl 2006).
  - Removal of logging residues is a positive initiative in that hidden remains and monuments become visible to the forest workers. But still the question remains if this compensates for the damages resulting from increased transport.
  - The removal of the stumps interferes with the soil on rather large areas and to a considerable depth, representing a severe threat to cultural remains and monuments as well as cultural layers not visible above ground (Finland only).
  - A fundamental prerequisite for sustainable management of cultural remains and monuments is reliable records including a precise mapping of where the objects are situated in the landscape. This is a basic premise which together with good planning routines to a great extent makes it possible to increase biomass harvesting without

violating laws, conventions and general sustainability ambitions for cultural heritage values.

- UK Forest Research 2009: stump harvesting guidance
  - Historic environment considerations focus on the need to protect archaeological sites, other above ground features of historical importance, including veteran trees, and any known or suspected below ground features.
  - The soil disturbance and mixing caused by stump harvesting is potentially damaging to biodiversity and the historic environment
  - Sensitive features should be protected by establishing a buffer area of appropriate width, e.g. a minimum of 5 m around archaeological sites.
- UK Forestry Commission 2011: Forests and historic environment guidelines
  - Surviving elements of the historic environment include ancient woodlands, veteran trees, earthworks, ruined structures and buried archaeological features.
  - Archaeological heritage and other aspects of the historic environment are protected mostly by legislation and by planning controls. Many of the most significant heritage assets are given specific protection through national systems of listing, scheduling, designation and registration.
  - As a guide, a margin of at least 20 m should be identified and maintained around Scheduled Monuments or other identified features of importance, but this will depend on the site itself. Linear features such as ancient rides, walls, banks and hedgerows, and woodland features such as veteran trees, may not justify as much as 20 m; they can be identified for protection in the forest management plan and operational plans.
  - Woodland features such as veteran trees, old coppice and pollards also need to be protected and it is important to select and manage suitable replacement trees that will eventually take their place.
  - Avoid disturbing the ground on or near sites of historical significance.
  - Identify relevant historic environment features in the operational plan and identify them on the ground; ensure they are excluded from the operational area and that the plan is communicated to all those working on the site.
  - Avoid using areas of historical importance for storing material, stacking timber or as a parking area for machinery.
  - Where operations are a necessity near vulnerable historical features, take precautions to avoid damage and take particular care with felling and extraction.

Summary

- Potential for additional ground disturbance with biomass harvest
- Consult with inventories, conduct surveys, minimize ground disturbance, and buffer known or discovered cultural sites from activities.

Discussion Questions

Wildlife

- Is a "public resource"
- To what extent is CWD being collected as biomass?
  - Downed snags
  - Preexisting CWD
  - Non-merchantable trees
- To what extent are shrubs being collected as biomass?
- Impacts of spraying for control of understory shrub and herbaceous layers
  - What proportion of stands are sprayed for vegetation control?
  - How many times is each stand sprayed?
  - How long does it take the understory to recover?
- Need to complete Landscape Level Wildlife Assessment models
  - to identify species/guilds dependent on CWD and FWD
  - to identify gaps in the Rules

Biodiversity

- Any FPR?
  - Need to follow general principles for managing forest biodiversity at landscape and stand levels (Lindenmayer et al. 2006)
- Green-up requirements should apply to biomass harvest to minimize cumulative effects across forested landscapes (Stewart et al. 2010)

Forest Practices Rules: WRT, GRT, logs

- Management standards for numbers of snags and down wood in forests of the Pacific Northwest have been far too low as compared with unharvested reference conditions (Ohmann and Waddell 2002).
- FPR emphasize the protection of aquatic habitats/species
- No protection for duff/litter, understory shrubs/herbs, non-merchantable trees, or slash
- Are current requirements sufficient for upland wildlife species?
  - How were they determined?

- 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.

- 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.

Cultural Resources

- Are current FPR requirements sufficient?
- Concern about firewood as a cultural resource?
- Other ways biomass harvest may affect cultural resources differently than traditional timber harvest?

Other

- Are short-rotation woody crops being grown/utilized for biomass in WA?
  - Likelihood of future use?
- Are short-rotation woody crops governed by the FPR?
- Are herbaceous plant species being intercropped between crop tree rows in WA?
  - Likelihood of future use?