Feller-buncher White Paper Outline

1. Introduction/Purpose/Goals

a. Need to implement riparian vegetation changes that reduce fire severity, which can include ground-based fuel reduction treatments in WLPZs
b. Promote the concept that, in site-specific locations and under appropriate conditions, certain heavy equipment can operate within the WLPZs without significant adverse impacts
c. Conditions present and factors resulting in the Board's support of feller-buncher use in WLPZs
    i. Historic Fire Return Intervals
        1. (van de Water & North, 2010)
        2. (Kilgore & Taylor, 1979)
    ii. High Stand Density and Resulting Fire Regimes in Riparian Areas
        3. (van de Water & North, 2011)
        4. (Pettit & Naiman, 2007)
        5. (Jurgensen et al., 1997)
        6. (van de Water & North, 2010)
    iii. Resulting Impacts of High-severity Fire on Water Quality and Site Productivity
        1. (Pettit & Naiman, 2007)
        2. (Dahm, Candelaria-Ley, Reale, Reale, & Van Horn, 2015)
        3. (van Mantgem et al., 2013)
        4. (van Mantgem et al., 2009)
        5. (Ice, Neary, & Adams, 2004)
    ii. Restoring Pre-Colonization Fire Regimes and Stand Structures
        1. (Kilgore & Taylor, 1979)
        2. (Messier, Shatford, & Hibbs, 2012)
        3. (North, 2012)
        4. (Keane et al., 2002)
    iv. Potentially improved aquatic habitat conditions from appropriate species composition/terrestrial nutrient input/light conditions
        1. (Dwire, Meyer, Riegel, & Burton, 2016)
        2. (Scott, James, & Ralph, 2012)
        3. (Messier, Shatford, & Hibbs, 2012)
d. Case Study: Ponderosa Fire, 2012

2. Concerns

a. Address common concerns associated with heavy equipment in WLPZs

i. Soil compaction, Runoff and changes in site productivity
    1. (B. Poff et al., 2011)
    2. (Grigal, 2000)
    3. (Froehlich & McNabb, 1983)
ii. Surface erosion and stream sedimentation
    1. (B. Poff, Koestner, Neary, & Henderson, 2011)
    2. (Sidle, Sasaki, Otsuki, Noguchi, & Abdul Rahim, 2004)
    3. (McCashion & Rice, 1983)
    4. (Lewis, 1998)
    5. (Rice, Rothacher, & Megahan, 1972)
    6. (Nitschke, 2005)
iii. Mass wasting and stream sedimentation
    1. (Swanson et al., 1987)
    2. (B. Poff et al., 2011)
    3. (Rice et al., 1972)
    4. (Dhakal & Sidle, 2003)
iv. Nutrient input and cycling
    1. (Dahlgren, 1998)
    2. (Feller, Lehmann, & Olanski, 2000)
    3. (Nitschke, 2005)
    4. (Jurgensen et al., 1997)
v. Summer stream flows
    1. (Nitschke, 2005)
vi. Stream temperature increases
    1. (B. Poff et al., 2011)
    2. (Moore, Spittlehouse, & Story, 2005)
    3. (Davies & Nelson, 1994)
    4. (Nitschke, 2005)
vii. Canopy cover/Light availability
    1. (Warren et al., 2016)
    2. (Kaylor, Warren, & Kiffney, 2016)
viii. Residual stand damage
    1. (Akay, Yilmaz, & Tonguc, 2006)
    2. (Han & Kellogg, 2000)
    3. (Limbeck-lilienau, 2003)
ix. Adequate slash disposal/reduction/fuel loading
    1. (Pettit & Naiman, 2007)
    2. (Cafferata et al., 2005)
    3. (Stone, Hudak, & Morgan, 2004)
x. Appropriate post-treatment species composition/structure results from work

1. (Ferry Slik, Verburg, & Kebler, 2002)
2. (Hall, Harris, Medjibe, & Ashton, 2003)
3. (Saiful & Latiff, 2014)

xi. Exotic invasive species introduced by equipment
1. (B. Poff et al., 2011)
2. (Ledoux & Martin, 2013)

xii. Sensitive riparian wildlife species impacted
1. (Fredericksen & Fredericksen, 2004)
2. (Braithwaite & Mallik, 2012)
3. (Pottier, 2002)
4. (Burns, 1972)
5. (Ernest, 2006)
6. (Kreutzweiser, Capell, & Good, 2005)
7. (Fuchs, Hinch, & Mellina, 2003)

3. Approaches for Riparian Stand Management

a. Management approaches possible with feller-buncher logging
   i. Thin from below; improve spacing, vigor, tree size; ladder and surface fuel treatment; possible gap creation
      1. (York, Battles, Wenk, & Saah, 2012)
      2. (Agee & Skinner, 2005)
      3. (Bolding, Lanford, & Kellogg, 2003)
      4. (Christopherson, 1992)
      5. (Resources, 2010)

4. Best management practices (BMPs) identified in the literature

a. Maintain adequate canopy cover, particularly on south side of stream for stream shading
   i. (R. J. Poff, 1996)
b. Do not store or use chemicals in riparian zones; no refueling or servicing equipment in WLPZs.
   i. (Broadmeadow & Nisbet, 2004)
c. Employ directional felling away from the watercourse channel
   i. (Akay et al., 2006)
   ii. (Kreutzweiser & Capell, 2002)
d. Minimize equipment passes on a single track
   i. (Contreras, Parrott, & Chung, 2015)
   ii. (Broadmeadow & Nisbet, 2004)
e. Utilize zero-swing equipment and skid trails without severe turns to minimize residual stand damage

i. (Resources, 2003)
ii. (Akay et al., 2006)
iii. (Broadmeadow & Nisbet, 2004)

f. Equipment exclusion on areas that are unnecessarily steep (>35%), on unstable areas, or where saturated conditions are present; pre-flag boundaries
    i. (Resources, 2003)
    ii. (R. J. Poff, 1996)
    iii. (Sidle et al., 2004)
g. Log yarding should not alter natural drainage or flow patterns; no connectivity between the site disturbance and the watercourse
    i. (Kreutzweiser & Capell, 2002)
    ii. (Sidle et al., 2004)
    iii. (Lewis, 1998)
h. Place slash on the equipment pathway to reduce soil compaction; when possible utilize mechanized harvesting equipment which delimb harvested trees on the pathway over which equipment will travel
    i. (Rone, 2011)
    ii. (R. J. Poff, 1996)
    iii. (Akay et al., 2006)
i. Do not place slash into the watercourse or in areas where it is likely to enter the watercourse; treat logging slash appropriately (e.g., pile burning)
    i. (Resources, 2003)
    ii. (Broadmeadow & Nisbet, 2004)
j. Avoid disturbance to flood prone areas
    i. (Cafferata et al., 2005)
k. Create a planned skid route with attention to minimizing soil impacts, clearly flag the skid route, and include the operator in the planning process to ensure understanding of management objectives
    i. (Kreutzweiser & Capell, 2002)
    ii. (Contreras et al., 2015)
    iii. (Mattson, Baumgras, Blinn, & Thompson, n.d.)
    iv. (Sidle et al., 2004)
    v. (Lewis, 1998)
    vi. (Nitschke, 2005)
    vii. (Froehlich & McNabb, 1983)
l. Conduct operations only in dry soil conditions
    i. (Resources, 2003)
    ii. (R. J. Poff, 1996)
m. Use tracked feller-bunchers as they exert less pressure on soil, or alternatively using high-flotation rubber tire designs
    i. (Mattson et al., n.d.)

ii. (Akay et al., 2006)
iii. (R. J. Poff, 1996)

n. Prevent residual stand damage by using a cut-to-length harvester and forwarder system or straight skid trails when possible
   i. (Mattson et al., n.d.)
   ii. (Akay et al., 2006)

5. Discussion of how utilization of these BMPs addresses the concerns with utilization of feller-bunchers in WLPZs

6. Case study: York study on Blodgett Forest Research Station and preliminary results

7. Conclusion

a. Reiteration of the Board's support for this use in appropriate site-specific locations, provided that BMPs are followed and appropriate analysis pursuant to the FPA and CA FPRs are completed.

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