Invasive Species

Key Points

- The risk of introducing and spreading invasive plant species would be lowest under Alternative D and highest under Alternative C.
- The risk of introducing and spreading invasive aquatic species would be lowest under Alternative A and highest under Alternative C.
- The No Action alternative, Alternatives C and D, and the Proposed RMP would result in the smallest increase in sudden oak death infestation, because the BLM would treat all detected infestations. Alternative A would result in the largest increase in sudden oak death infestation.

Summary of Notable Changes from the Draft RMP/EIS

The BLM replaced the discussion of long-term effects on introduction and spread of invasive plant species and invasive aquatic species with a qualitative summary of the overall risks for each alternative and the Proposed RMP. As described in the Draft RMP/EIS, the uncertainties associated with the effectiveness of future prevention and treatment measures, as well as uncertainties related to future invasive species introductions, render discussion of long-term trends speculative. To the extent it is possible to forecast future introduction and spread of invasive plant species and invasive aquatic species, it is reasonably foreseeable that the alternatives and the Proposed RMP would have the same relative effects in the first decade as in future decades.

Issue 1

How would the alternatives affect the risk of invasive plant introduction and spread?

Summary of Analytical Methods

The BLM compared the relative risk of introducing and spreading invasive species resulting from the land use allocations and planned management activity levels under the alternatives and the Proposed RMP, taking into consideration the collective distribution of a representative set of invasive plant species. Invasive species are non-native species whose introduction does, or is likely to, cause economic or environmental harm or harm to human health. The species selected for this analysis characterize the general distribution and condition of invasive species occurrences on BLM-administered lands in western Oregon. They represent a variety of strategies for introduction, spread, and resistance to certain treatment methods. The alternatives’ and Proposed RMP’s differing approaches to land use allocations (including designations for public motorized access), timber harvest levels, harvest methods, Riparian Reserve widths and management direction, new road construction, and livestock grazing drives the variation in the effects on invasive species.

In this analysis, the BLM measured the effects of management actions on the introduction and spread of invasive plant species in terms of susceptibility and risk. Susceptibility is the extent to which an area is vulnerable to the introduction and spread of invasive species. Risk accounts for both susceptibility to introduction and the existing distribution and abundance of invasive species in a given area. The higher the susceptibility and the higher the distribution and abundance of invasive species in a particular area, the higher the risk is of introducing and spreading invasive species.
The BLM measured the effects of timber harvest, road management activities, and public motorized access designations on the introduction and spread of invasive plant species at the scale of HUC 1075 watersheds (formerly known as 5th field watersheds). The BLM measured the effects of livestock grazing on the introduction and spread of invasive plant species at the scale of the district or field office. In this analysis, the BLM reports effects using the watershed or the district/field office as the basic analytical unit in much the same way as a site-specific analysis may report effects in terms of acres, rather than the smaller increments representing the extent of the infestations. Even though BLM-administered lands constitute a small percentage of many watersheds, BLM management actions could still affect susceptibility and risk for the introduction and spread of invasive plant species. Therefore, the BLM included all watersheds within the decision area in this analysis.

The BLM used the following factors to assess the relative levels of risk for the inadvertent introduction of invasive plant species on the BLM-administered lands:

- Distribution and abundance of invasive plant species
- Types of timber harvest and logging methods
- Proximity of harvest activity to streams
- Intensity and distribution of management activities
- Designations for public motorized access
- Availability for livestock grazing

The analysis assumed that actions on other ownerships and BLM management actions other than timber harvest, road management activities, public motorized access designations, and livestock grazing on BLM-administered lands would continue to contribute to invasive plant species introduction and spread at current levels. These actions include BLM management of special forest products, rights-of-way agreements, road maintenance, and fuels reduction treatments. Any future changes in the contribution from these other activities to the risk of introduction and spread of invasive plant species would be speculative and depend largely on site-specific factors that are inappropriate to analyze at this scale. There is no basis for speculating that such changes would vary among the alternatives and the Proposed RMP. Therefore, information on the contribution of these other management actions to the risk of introduction and spread of invasive plant species is not necessary for a reasoned choice among the alternatives and the Proposed RMP.

Illegal public motorized travel activities could potentially contribute to the introduction and spread of invasive plant species. Although the BLM has some site-specific and anecdotal information about illegal public motorized travel activities, the BLM does not have a basis for predicting the location or effects of any widespread or systematic illegal public motorized travel activities. In addition, much of the decision area has physical limitations to potential illegal public motorized travel activities, including dense vegetation, steep slopes, and locked gates. Terrain, vegetation, and a greater amount of open spaces in most of the interior/south can lead to degradation and erosion in a greater proportion than most of the coastal/north where vegetation is denser and terrain is steeper. However, the BLM lacks a basis for characterizing current illegal public motorized travel activities or forecasting such potential illegal public motorized travel activities in the future under any of the alternatives or the Proposed RMP at this scale of analysis. Therefore, in this analysis, the BLM assumed that members of the public participating in motorized travel recreation would operate vehicles consistent with BLM decisions about public motorized travel opportunities (see the Trails and Travel Management section of this chapter).

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75 Hydrologic Unit Codes (HUCs) are a U.S. Geological Survey classification based on a hierarchy of nested watersheds.
The Planning Criteria provides detailed information on the invasive plant analysis and assumptions, including the representative invasive plant species selected for this analysis, which is incorporated here by reference (USDI BLM 2014, pp. 90–98).

**Determining Species Distribution Categories**

The BLM pooled representative invasive plant species occurrence data from BLM corporate datasets and iMapInvasives (ORBIC 2013). **Figure 3-97** displays reported infestations of representative invasive plant species within the planning area. The BLM evaluated the collective pool of reported sites to determine representative invasive plant presence for each square mile in a grid applied to the planning area. Invasive plant species distribution categories of Abundant, Limited, and Low are based on the known representative species’ distribution in watersheds:

- **Abundant** – the representative invasive species reported from more than 25 percent of the square miles within the watershed
- **Limited** – the representative invasive species reported from more than 1 percent and less than 25 percent of the square miles within the watershed
- **Low** – the representative invasive species reported in no more than 1 percent of the square miles within the watershed

Watersheds in the Abundant species distribution category are more likely to have invasive species introduction and spread associated with management and human activities than those in the Limited and Low species distribution categories, because there are already relatively more infestations within them.
Assessing Risk of Introduction and Spread of Invasive Plant Species Associated with Timber Harvest

The risk of introducing invasive plant species over the next 10 years as a result of timber harvest activities would vary by alternative and the Proposed RMP. The BLM used the invasive plant distribution categories, the acres of the different timber harvest types (thinning, regeneration harvest, and uneven-aged management), and the methods of logging to determine the relative risk of introducing invasive plant species in each alternative and the Proposed RMP. For the purposes of this analysis, the BLM assumed:

- Regeneration harvests would create higher light levels than commercial thinning and uneven-aged management. Lower or no retention levels in regeneration harvests would create higher light levels after harvest than regeneration harvests with higher retention levels.

- Ground-based logging methods would disturb more soil, cable skyline systems would disturb less soil, and aerial logging systems would disturb the least amount of soil. Although the BLM does not generally prescribe specific logging methods in the alternatives or the Proposed RMP, the BLM...
The BLM determined the susceptibility of watersheds to invasive species introduction associated with timber harvest by analyzing estimates of timber harvest volumes under the alternatives and the Proposed RMP from the Woodstock vegetation model and the timber harvest type and harvest method coefficients developed for the 10-year scenarios in the 2008 FEIS (Appendix C). The geographic arrangement of timber harvests is a modeling product used solely for the purpose of this analysis and is not a product of actual site-specific project planning or decision-making.

For each alternative and the Proposed RMP, the BLM estimated the acres of timber harvest activities for watersheds in the planning area for the next 10 years using the generated harvest volumes. Each timber harvest type received a relative weight of 1 or 5, based on its respective post-harvest light levels (5 having a higher light level than 1). Each logging method received a relative weight of 1, 3, or 5, based on its respective levels of soil disturbance. The BLM assumed the non-commercial thinnings in the moist forest reserves would neither increase the light levels nor disturb the soil enough to create susceptibility for invasive species introduction and spread. Multiplying the weighted values by the watersheds’ estimated acres for the timber harvest types and methods over the next 10 years allowed the BLM to generate a combined timber harvest activity weighted value for each watershed.

Dividing these combined timber harvest values into three groups (Low, Moderate, and High) allowed the BLM to assign each watershed to one of these three susceptibility categories for introduction of invasive plant species from timber harvest activities.

The BLM determined the risk for invasive species introduction associated with timber harvest by considering both the susceptibility category and the presence of invasive plant species. Watersheds with a low distribution of invasive plant species and that are in the Low susceptibility category would have the lowest risk of invasion. The greatest risk of invasion would be in watersheds that are both in the High susceptibility category and where invasive plant species are abundant. Watersheds with no reported sites for the representative sample set of invasive plant species in the analysis, no BLM-administered lands, or no timber harvest activity susceptibility in the first 10 years do not have an assigned risk category.

Assessing Risk of Introduction and Spread of Invasive Plant Species in Riparian Habitats Associated with Timber Harvest

The BLM assessed the susceptibility of invasive plant species introduction into riparian habitats associated with each alternative and the Proposed RMP by considering the relative impact of the widths of the Riparian Reserve, management direction within the Riparian Reserve, and levels of timber harvest activity within the Riparian Reserve. These factors affect the light levels in riparian habitats; the higher the light levels, the higher the risk for the introduction of invasive plant species. As described in the Planning Criteria, the BLM assumed for the purpose of invasive plant species analysis that the light levels of areas within 100 feet of timber harvest would increase and that the light levels 100 feet or more from timber harvest would remain unaffected.

The BLM analyzed the effects of thinning within the Riparian Reserve over the next 10 years using spatial analysis to determine susceptibility of invasive plant species introduction into riparian habitats. In this analysis, the BLM used the modeled thinning acres in the Riparian Reserve from the Woodstock vegetation model to compare the susceptibility of introducing invasive plant species into riparian habitats through such thinning across the alternatives and the Proposed RMP over the next 10 years for each office. As noted above, the geographic arrangement of thinning is a modeling product used solely for the
Purpose of this analysis and is not a product of actual site-specific project planning or decision-making. For the purposes of this analysis, the risk of introducing invasive plants into riparian habitats from thinning activities matches the level of susceptibility.

The BLM also analyzed the effects of timber harvest activity adjacent to the Riparian Reserve over the next 10 years using spatial analysis to determine susceptibility of invasive plant species introduction into riparian habitats. The BLM considered the effects of timber harvest activities occurring outside of and adjacent to the Riparian Reserve with widths less than 100 feet on either side of streams. Multiplying Riparian Reserve acres susceptible to effects from the alternatives’ timber harvest activities by weights accounting for the relative differences in the combination of factors below provides a range of watershed riparian susceptibility values and subsequent susceptibility categories of Low, Moderate, and High:

- Light generated by timber harvest types
- Soil disturbance from different timber harvest methods
- Shade reduction in stands adjacent to timber harvest activities

The BLM used riparian susceptibility and species distribution categories to determine the risk by alternative and the Proposed RMP of introducing invasive plant species into riparian habitats over the next 10 years.

As described in the Fisheries section of this chapter, there is an element of uncertainty related to riparian thinning under the No Action alternative compared to the action alternatives and the Proposed RMP. Riparian thinning under the No Action alternative is allowed anywhere in the Riparian Reserve with no specific retention requirements. However, activities must meet the Aquatic Conservation Strategy objectives, which are often difficult to interpret at the site scale. Nevertheless, the 1995 RMPs do not define an inner zone with management direction prohibiting thinning, which makes the specific location and implementation of riparian thinning less certain than under the action alternatives or the Proposed RMP.

Assessing Risk of Introduction and Spread of Invasive Plant Species Associated with New Road Construction

Road construction and associated road management activities involving disturbance to soil and increased light levels contribute to the introduction of new infestations and the spread of existing invasive plant infestations. Road construction equipment can inadvertently transport invasive plant species seed or vegetation, creating new infestations. Soil disturbance and increased light created by road construction activities provide opportunities for invasive plants already present in a project area to thrive. Light and disturbed soils provide favorable conditions for invasive plant seed germination and plant establishment.

The BLM determined the susceptibility of watersheds to invasive species introduction associated with new road construction (temporary or permanent) by prorating each watershed with the road construction estimates for each alternative and the Proposed RMP produced in the Trails and Travel Management section in this chapter. Susceptibility values fall into relative susceptibility categories, allowing the BLM to compare the susceptibility of the watersheds to invasive plant species introduction and spread. As noted above, the geographic arrangement of timber harvest is a modeling product used solely for the purpose of this analysis, as is the modeled location of associated new road construction, and is not a product of actual site-specific project planning or decision-making.

The BLM used the susceptibility categories and species distribution categories for the watersheds to determine each alternative and the Proposed RMP’s relative risk of invasive plant introduction associated with road construction.
Assessing Risk of Introduction and Spread of Invasive Plant Species Associated with Public Motorized Vehicle Use

Motorized vehicles can inadvertently transport invasive plant species seed or vegetation, creating new infestations. Infestations associated with public motorized vehicle travel tend to spread along road and trail corridors. Public motorized vehicle travel along roads and trails disturb soil, especially along new trails. The combination of disturbed soil conditions from public motorized vehicle travel and vehicles inadvertently transporting invasive plant parts create susceptibility.

The BLM assessed the susceptibility of BLM-administered lands in the planning area to invasive species introduction associated with public motorized travel activities by comparing each alternative and the Proposed RMP’s acres of open, closed, and limited for public motorized access designations. The BLM assumed that areas designated as open would be more susceptible to having new introductions of invasive plant species and infestation spread than areas designated as limited or closed. The BLM assumed that areas designated as closed would not be susceptible to new introductions and spread of invasive plant species associated with public motorized travel activities. As noted above, the BLM assumed that members of the public participating in motorized travel recreation would operate vehicles consistent with BLM decisions about public motorized travel opportunities.

The BLM assigned public motorized access designation weights to each part of the watershed having a different public motorized access designation under each alternative or the Proposed RMP. Public motorized access designation susceptibility weights are the following:

- Closed = 0
- Limited = 3
- Open = 5

For each alternative and the Proposed RMP, the BLM multiplied the susceptibility weights by total acres per watershed for each of the three designations to generate a set of susceptibility values for the watersheds and then divided them into three categories: Low, Medium, and High.

The BLM used the susceptibility weights and species distribution categories for the watersheds to determine each alternative and the Proposed RMP’s relative risk of invasive plant introduction associated with public motorized access designations.

Assessing Risk of Introduction and Spread of Invasive Plant Species Associated with Livestock Grazing

The BLM assessed the risk of invasive species introduction associated with livestock grazing by comparing the relative amount of land available for livestock grazing under each alternative and the Proposed RMP. Livestock grazing creates ground disturbance, which creates susceptibility for the introduction and spread of invasive plants. The BLM assumed invasive plants would occur in the areas available for livestock grazing. Livestock movement and associated activities, such as the transport of contaminated hay, can introduce invasive plants into new locations. Therefore, areas that the BLM determined would be susceptible for introduction and spread of invasive plants associated with livestock grazing would be at risk. Only the Coos Bay District, Klamath Falls Field Office, and Medford District administer livestock grazing in the decision area. Comparing the acreage available for livestock grazing in the Coos Bay District, Klamath Falls Field Office, and Medford District provides a relative assessment for the introduction and spread of invasive plants across the alternatives and the Proposed RMP.
Affected Environment

While the affected environment section from the 2008 planning effort is still pertinent, data sharing among land managers has led to a more robust understanding of the distribution of invasive plant species than was available in 2008. The distribution of invasive plant species is available at iMapInvasives (www.imapinvasives.org). While this data is more robust than that available in 2008, the data is still limited because there is no requirement for county, private, or corporate landowners to report invasive plant information.

Figure 3-97, Figure 3-98, and Table 3-70 show the relative density of the reported infestations, which demonstrate that the representative invasive plant species are common throughout the planning area. Although reported infestations of the representative invasive plant species are less than the total amount of all invasive plant species infestations, these reported infestations provide a sense of how invasive species are distributed within the planning area. Almost all of the watersheds currently fit the Limited or Abundant species distribution categories. Only one watershed fits the Low species distribution category, and only one watershed has no reported sites. Neither of these watersheds contains BLM-administered lands.
Figure 3-98. Distribution categories of invasive plant species for the watersheds within the planning area

Table 3-70. Number of watersheds per district in each species distribution category

<table>
<thead>
<tr>
<th>District/Field Office</th>
<th>Species Distribution Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
</tr>
<tr>
<td>Coos Bay</td>
<td>-</td>
</tr>
<tr>
<td>Eugene</td>
<td>-</td>
</tr>
<tr>
<td>Klamath Falls</td>
<td>1</td>
</tr>
<tr>
<td>Medford</td>
<td>-</td>
</tr>
<tr>
<td>Roseburg</td>
<td>-</td>
</tr>
<tr>
<td>Salem</td>
<td>-</td>
</tr>
<tr>
<td>Total Watersheds</td>
<td>1</td>
</tr>
</tbody>
</table>
Environmental Consequences
This analysis examines timber harvest, road management activities, and public motorized access
designations for the potential to introduce and spread invasive plant species that would result from the
alternatives.

Risk of Introduction and Spread of Invasive Plant Species Associated with
Timber Harvest
Susceptibility to the introduction and spread of invasive plant species due to timber harvest would be
greatest under Alternative B, which would have 157 watersheds that have some level of susceptibility
associated with timber harvest activities over the next 10 years. Alternative A would have the least
watersheds with some level of susceptibility from timber harvest activities, with 136 susceptible
watersheds. The No Action alternative, Alternatives C and D, and the Proposed RMP would be
intermediate in susceptibility, with 143, 144, 146, and 155 susceptible watersheds, respectively.

The watersheds in the high susceptibility category occur evenly throughout the planning area under all
alternatives and the Proposed RMP, with Alternative C having the most watersheds in this category and
Alternative D having the fewest, at 67 and 35 watersheds, respectively. The No Action alternative,
Alternatives A and B, and the Proposed RMP would have an intermediate number of High susceptibility
category watersheds at 44, 40, 39, and 45 respectively. Watersheds with the potential for the most area
with timber harvest activities that would generate soil disturbance and reduced shade over the next 10
years fall into the highest susceptibility categories.

Categories for the distribution of invasive plant species and the categories for the susceptibility of
introduction from timber harvest activities determine the relative risk categories for the introduction of
invasive plant species. For example, watersheds with both a high density of representative invasive
species and a high level of susceptibility would be in the Highest risk category.

Table 3-71 contains the relative risk for the introduction and spread of invasive plant species that are
associated with timber harvest activities over the next 10 years.

<table>
<thead>
<tr>
<th>Risk Category</th>
<th>No Action (Number of Watersheds)</th>
<th>Alt. A (Number of Watersheds)</th>
<th>Alt. B (Number of Watersheds)</th>
<th>Alt. C (Number of Watersheds)</th>
<th>Alt. D (Number of Watersheds)</th>
<th>PRMP (Number of Watersheds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highest</td>
<td>42</td>
<td>30</td>
<td>30</td>
<td>52</td>
<td>26</td>
<td>32</td>
</tr>
<tr>
<td>High</td>
<td>33</td>
<td>43</td>
<td>56</td>
<td>46</td>
<td>57</td>
<td>53</td>
</tr>
<tr>
<td>Moderately High</td>
<td>11</td>
<td>12</td>
<td>16</td>
<td>11</td>
<td>11</td>
<td>10</td>
</tr>
<tr>
<td>Moderate</td>
<td>24</td>
<td>32</td>
<td>28</td>
<td>16</td>
<td>26</td>
<td>31</td>
</tr>
<tr>
<td>Moderately Low</td>
<td>33</td>
<td>19</td>
<td>27</td>
<td>19</td>
<td>26</td>
<td>29</td>
</tr>
<tr>
<td>Low</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total at Risk</td>
<td>143</td>
<td>136</td>
<td>157</td>
<td>144</td>
<td>146</td>
<td>155</td>
</tr>
<tr>
<td>Total Not at Risk</td>
<td>124</td>
<td>131</td>
<td>110</td>
<td>123</td>
<td>121</td>
<td>112</td>
</tr>
<tr>
<td>Total Watersheds</td>
<td>267</td>
<td>267</td>
<td>267</td>
<td>267</td>
<td>267</td>
<td>267</td>
</tr>
</tbody>
</table>
Over the next 10 years, Alternative B would have the most watersheds at some level of risk (157), and Alternative A would have the least watersheds at some level of risk (136). Under all alternatives and the Proposed RMP, slightly more than half of the watersheds in the planning area would experience some level of risk of introduction of invasive plant species associated with timber harvest activities over the next 10 years. The highest degree of risk would occur under Alternative C, and the lowest would occur under Alternative A, with 98 and 73 watersheds in the High and Highest risk categories, respectively. Moderate levels of risk intensity associated with timber harvest in the watersheds over the next 10 years would occur under the No Action alternative, Alternatives B and D, and the Proposed RMP as shown in Table 3-71. Under all alternatives and the Proposed RMP, less than one-quarter of the watersheds would experience Moderate to Moderately Low risk of invasive plant species introduction associated with timber harvest activities over the next 10 years.

Risk of Introduction and Spread of Invasive Plant Species into Riparian Habitats Associated with Timber Harvest Adjacent to the Riparian Reserve
The Riparian Reserve would be wide enough (i.e., at least 100 feet) to avoid effects on light levels in riparian habitats from adjacent timber harvest activities (including regeneration harvest where the Riparian Reserve is adjacent to Harvest Land Base, and thinning where the Riparian Reserve is adjacent to Late-Successional Reserve) under the following alternatives and the Proposed RMP and stream types:

- No Action alternative, Alternatives A and D, and the Proposed RMP Class I and Class II subwatersheds – all streams
- Alternative B – fish-bearing and perennial streams and intermittent, debris-flow-prone, non-fish-bearing streams
- Alternative C and the Proposed RMP Class III subwatersheds – fish-bearing and perennial streams

However, riparian habitats would be susceptible to increases in light levels associated with adjacent timber harvests, because the Riparian Reserve would be less than 100 feet in width on either side of streams under the following alternatives and the Proposed RMP and stream types:

- Alternative B – intermittent, non-debris-flow-prone, non-fish-bearing streams
- Alternative C and the Proposed RMP Class III subwatersheds – intermittent, non-fish-bearing streams

Figure 3-99 shows the susceptibility to the introduction and spread of invasive plant species into riparian habitats associated with timber harvest adjacent to the Riparian Reserve over the next 10 years.
Under the No Action alternative and Alternatives A and D, there would be no susceptibility for invasive plant introductions into riparian habitats associated with timber harvest activities adjacent to the Riparian Reserve. Under Alternative B, 150 watersheds would have a Low susceptibility, and no watersheds would have Moderate to High susceptibility. Under Alternative C, 136 of the 267 watersheds in the planning area would be susceptible to invasive plant introduction into riparian habitats associated with timber harvest activities adjacent to the Riparian Reserve over the next 10 years. Eight watersheds would have Moderate to High susceptibility. Under the Proposed RMP, 22 watersheds would be susceptible to invasive plant introduction into riparian habitats associated with timber harvest activities adjacent to the Riparian Reserve over the next 10 years, and 10 of those watersheds would have Moderate susceptibility.

Under the No Action alternative and Alternatives A and D, no watersheds would be at risk of the introduction of invasive plant species into riparian habitats associated with timber harvest activities adjacent to the Riparian Reserve over the next 10 years. The highest overall risk would occur under Alternatives B and C. More of the watersheds (56 and 51 percent, respectively) would be at risk under Alternatives B and C, compared to the eight percent of the watersheds at risk under the Proposed RMP. Table 3-72 displays the risk of introduction and spread of invasive plant species into riparian habitats associated with timber harvest adjacent to the Riparian Reserve over the next 10 years.
Table 3-72. Risk of introduction and spread of invasive plant species into riparian habitats associated with timber harvest adjacent to the Riparian Reserve over the next 10 years

<table>
<thead>
<tr>
<th>Risk Category</th>
<th>No Action (Number of Watersheds)</th>
<th>Alt. A (Number of Watersheds)</th>
<th>Alt. B (Number of Watersheds)</th>
<th>Alt. C (Number of Watersheds)</th>
<th>Alt. D (Number of Watersheds)</th>
<th>PRMP (Number of Watersheds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highest</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>High</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>5</td>
<td>-</td>
<td>8</td>
</tr>
<tr>
<td>Moderately High</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Moderate</td>
<td>-</td>
<td>-</td>
<td>102</td>
<td>88</td>
<td>-</td>
<td>8</td>
</tr>
<tr>
<td>Moderately Low</td>
<td>-</td>
<td>-</td>
<td>48</td>
<td>40</td>
<td>-</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total at Risk</strong></td>
<td>-</td>
<td>-</td>
<td>150</td>
<td>136</td>
<td>-</td>
<td><strong>22</strong></td>
</tr>
<tr>
<td><strong>Total Not at Risk</strong></td>
<td><strong>267</strong></td>
<td><strong>267</strong></td>
<td><strong>117</strong></td>
<td><strong>131</strong></td>
<td><strong>267</strong></td>
<td><strong>245</strong></td>
</tr>
<tr>
<td><strong>Total Watersheds</strong></td>
<td><strong>267</strong></td>
<td><strong>267</strong></td>
<td><strong>267</strong></td>
<td><strong>267</strong></td>
<td><strong>267</strong></td>
<td><strong>267</strong></td>
</tr>
</tbody>
</table>

Risk of Introduction and Spread of Invasive Plant Species in Riparian Habitats Associated with Thinning within the Riparian Reserve

Under all alternatives and the Proposed RMP, thinning activities would occur within the Riparian Reserve at varying levels in the next 10 years. Thinning would be limited to outside of the inner zone of the Riparian Reserve under all action alternatives and the Proposed RMP and could occur anywhere in the Riparian Reserve under the No Action alternative.

Under the No Action alternative, there is no defined area excluding thinning activities within the Riparian Reserve, which leaves all riparian habitats susceptible to invasive plant introductions associated with thinning activities. Under the No Action alternative, 31,407 acres of thinning in the Riparian Reserve would occur over the next 10 years, and a proportion of those acres could be within 100 feet of streams (see the Fisheries section of this chapter). Therefore, the No Action alternative would have the highest risk of introducing and spreading invasive plants into riparian habitats from thinning within the Riparian Reserve of all alternatives and the Proposed RMP.

Under Alternative A, the inner zone of the Riparian Reserve would be wider than 100 feet from fish-bearing streams and perennial streams and are therefore wide enough to prevent thinning activities in the outer zone from reducing shade levels in riparian habitats. On intermittent, non-fish-bearing streams, thinning could occur within 100 feet of streams. In moist forests, thinning would be limited to snag and down woody debris creation (i.e., no commercial thinning). These activities would not change shade levels enough to increase the susceptibility of the treatment areas to the introduction and spread of invasive plant infestations. In dry forests, thinning to reduce fire hazards would reduce shade levels and disturb the soil within 50 feet of streams, making the riparian habitats more susceptible to the introduction and spread of invasive plants. Under Alternative A, 7,219 acres of thinning in Riparian Reserve would occur over the next 10 years, but the fuel treatments in the dry forest of the Riparian Reserve would be the only thinning within the Riparian Reserve under Alternative A that would result in susceptibility for invasive plant introductions and spread into riparian habitats. As a result, Alternative A would have the second lowest level of susceptibility for introducing invasive plants into riparian habitats.

Under Alternative B, the inner zone of the Riparian Reserve would be less than 100 feet on either side of fish-bearing streams and perennial streams. The inner zone would also be less than 100 feet on either side of intermittent, debris-flow-prone, non-fish-bearing streams. Riparian Reserve thinning outside of the
inner zone would create susceptibility for the introduction of invasive plant species into riparian habitats over the next 10 years. No thinning would occur within Riparian Reserve along intermittent, non-debris-flow-prone, non-fish-bearing streams. Under Alternative B, 15,958 acres of thinning in the Riparian Reserve would occur over the next 10 years. Alternative B would have the second highest level of risk for introducing invasive plants into riparian habitats associated with thinning within the Riparian Reserve.

Under Alternative C, the width of the inner zone of the Riparian Reserve would be less than 100 feet on either side of fish-bearing streams and perennial streams, similar to Alternative B. No thinning would occur within Riparian Reserve along intermittent, non-fish-bearing streams under Alternative C. The Riparian Reserve thinning activities along fish-bearing streams and perennial streams would create susceptibility for the introduction of invasive plant species into riparian habitats over the next 10 years. Under Alternative C, 7,146 acres of thinning in the Riparian Reserve would occur over the next 10 years. Alternative C would have a Moderate level of risk for introducing invasive plants into riparian habitats associated with thinning within the Riparian Reserve.

Under Alternative D, there would be no susceptibility for invasive plant introductions and spread into riparian habitats associated with thinning within the Riparian Reserve. Under Alternative D, the inner zone of the Riparian Reserve would be wider than 100 feet from all streams and are therefore wide enough to prevent thinning activities in the outer zone from reducing shade levels in riparian habitats. Therefore, there would be no risk of introducing and spreading invasive plants into riparian habitats from thinning within the Riparian Reserve under Alternative D.

Under the Proposed RMP, the effects of thinning along fish-bearing streams and perennial streams in all subwatersheds would the same as Alternatives A and D; there would be no risk of introducing and spreading invasive plants into riparian habitats from thinning within the Riparian Reserve because the inner zone would be wider than 100 feet from streams. In Class I subwatersheds, thinning along intermittent, non-fish-bearing streams would be the same as Alternative A; there would be no risk in moist forests, but some limited risk associated with fuels treatments in dry forests. In Class II subwatersheds, the width of the inner zone of the Riparian Reserve would be less than 100 feet on either side intermittent, non-fish-bearing streams, which would create susceptibility for the introduction of invasive plant species into riparian habitats over the next 10 years. In Class III subwatersheds, no thinning would occur within Riparian Reserve along intermittent, non-fish-bearing streams. In total, 10,561 acres of Riparian Reserve thinning would occur under the Proposed RMP over the next 10 years. The Proposed RMP would have a Moderately Low level of risk of introducing and spreading invasive plants into riparian habitats from thinning within the Riparian Reserve.

**Risk of Introduction and Spread of Invasive Plant Species Associated with New Road Construction**

The BLM determined the susceptibility of watersheds to invasive species introduction associated with new road construction (temporary or permanent) by prorating each watershed with the road construction estimates for each alternative and the Proposed RMP produced in the Trails and Travel Management section in this chapter. Susceptibility values fall into relative susceptibility categories, allowing the BLM to compare the susceptibility of the watersheds to invasive plant species introduction and spread. As noted above, the geographic arrangement of timber harvest is a modeling product used solely for the purpose of this analysis, as is the modeled location of associated new road construction, and is not a product of actual site-specific project planning or decision-making.

The BLM used the susceptibility categories and species distribution categories for the watersheds to determine each alternative and the Proposed RMP’s relative risk of invasive plant introduction associated with road construction. See Table 3-73 for the risk comparison for the introduction and spread of invasive
plant species resulting from new road construction activities among the alternatives and the Proposed RMP.

**Table 3-73. Risk of introduction and spread of invasive plant species associated with new road construction over the next 10 years**

<table>
<thead>
<tr>
<th>Risk Category</th>
<th>No Action (Number of Watersheds)</th>
<th>Alt. A (Number of Watersheds)</th>
<th>Alt. B (Number of Watersheds)</th>
<th>Alt. C (Number of Watersheds)</th>
<th>Alt. D (Number of Watersheds)</th>
<th>PRMP (Number of Watersheds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highest</td>
<td>36</td>
<td>14</td>
<td>34</td>
<td>55</td>
<td>12</td>
<td>26</td>
</tr>
<tr>
<td>High</td>
<td>41</td>
<td>45</td>
<td>42</td>
<td>47</td>
<td>44</td>
<td>46</td>
</tr>
<tr>
<td>Moderately High</td>
<td>16</td>
<td>13</td>
<td>16</td>
<td>8</td>
<td>12</td>
<td>15</td>
</tr>
<tr>
<td>Moderate</td>
<td>22</td>
<td>44</td>
<td>30</td>
<td>17</td>
<td>45</td>
<td>33</td>
</tr>
<tr>
<td>Moderately Low</td>
<td>28</td>
<td>29</td>
<td>35</td>
<td>18</td>
<td>33</td>
<td>35</td>
</tr>
<tr>
<td>Low</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total at Risk</strong></td>
<td><strong>143</strong></td>
<td><strong>145</strong></td>
<td><strong>157</strong></td>
<td><strong>145</strong></td>
<td><strong>146</strong></td>
<td><strong>155</strong></td>
</tr>
<tr>
<td><strong>Total Not at Risk</strong></td>
<td><strong>132</strong></td>
<td><strong>130</strong></td>
<td><strong>118</strong></td>
<td><strong>130</strong></td>
<td><strong>129</strong></td>
<td><strong>120</strong></td>
</tr>
<tr>
<td><strong>Total Watersheds</strong></td>
<td><strong>275</strong></td>
<td><strong>275</strong></td>
<td><strong>275</strong></td>
<td><strong>275</strong></td>
<td><strong>275</strong></td>
<td><strong>275</strong></td>
</tr>
</tbody>
</table>

Under Alternative B and the Proposed RMP, 157 and 155 watersheds, respectively, would be at risk of introduction of invasive plant species associated with new road construction in the next 10 years. The other alternatives would have between 143 and 146 watersheds at risk of introduction of invasive plant species associated with new road construction in the next 10 years. Alternative C would have 102 watersheds in the High to Highest relative risk rankings, more than any other alternative or the Proposed RMP. The No Action alternative, Alternative B, and the Proposed RMP would have an intermediate number of watersheds in the High to Highest risk categories, 77, 76, and 72 watersheds, respectively. Alternatives A and D would have the fewest watersheds in the High to Highest risk categories, 59 and 56 watersheds, respectively.

Overall, the greatest relative risk of invasive plant species introduction associated with new road construction would occur under Alternative C, because it would have the most watersheds in the High to Highest risk categories. The lowest risk would occur under the Alternatives A and D. However, all alternatives and the Proposed RMP have management objectives to prevent the introduction of invasive species and the spread of existing invasive species infestations and the BLM would implement measures to prevent, detect, and rapidly control new invasive species infestations based on management direction. Because of this management direction, all alternatives and the Proposed RMP would be expected to continue to apply mitigation against introduction and spread of invasive plant species equally across all risk-level HUC 10 watersheds within the planning area in response to new road construction.

**Risk of Introduction and Spread of Invasive Plant Species Associated with Public Motorized Vehicle Use**

The action alternatives and the Proposed RMP would have similar susceptibility to invasive plant introduction and spread associated with public motorized access designations because none would designate any areas as open to public motorized vehicle use. The BLM would only designate open for public motorized access under the No Action alternative. Furthermore, all alternatives and the Proposed RMP would have similar susceptibility to invasive plant introduction and spread associated with public motorized access designations over the portions of the decision area where the topography and vegetation inhibit cross-country vehicle travel.
The designation of open areas in the No Action alternative, and the number and distribution of areas with public motorized vehicle use restrictions (e.g., ACECs and District-Designated Reserve – Lands Managed for their Wilderness Characteristics) would result in the slight differences among the alternatives and the Proposed RMP in the risk results. Table 3-74 shows a relative risk comparison for introduction and spread of invasive plant species associated with public motorized access designations between the alternatives and the Proposed RMP.

Table 3-74. Risk of introduction and spread of invasive plant species associated with public motorized access designations

<table>
<thead>
<tr>
<th>Risk Category</th>
<th>No Action (Number of Watersheds)</th>
<th>Alt. A (Number of Watersheds)</th>
<th>Alt. B (Number of Watersheds)</th>
<th>Alt. C (Number of Watersheds)</th>
<th>Alt. D (Number of Watersheds)</th>
<th>PRMP (Number of Watersheds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highest</td>
<td>38</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>High</td>
<td>100</td>
<td>86</td>
<td>80</td>
<td>68</td>
<td>64</td>
<td>111</td>
</tr>
<tr>
<td>Moderately High</td>
<td>40</td>
<td>63</td>
<td>62</td>
<td>57</td>
<td>55</td>
<td>68</td>
</tr>
<tr>
<td>Moderate</td>
<td>5</td>
<td>30</td>
<td>35</td>
<td>47</td>
<td>52</td>
<td>5</td>
</tr>
<tr>
<td>Moderately Low</td>
<td>3</td>
<td>6</td>
<td>7</td>
<td>12</td>
<td>14</td>
<td>1</td>
</tr>
<tr>
<td>Low</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total at Risk</td>
<td>186</td>
<td>185</td>
<td>184</td>
<td>184</td>
<td>184</td>
<td>185</td>
</tr>
<tr>
<td>Total Not at Risk</td>
<td>81</td>
<td>82</td>
<td>83</td>
<td>83</td>
<td>83</td>
<td>82</td>
</tr>
<tr>
<td>Total Watersheds</td>
<td>267</td>
<td>267</td>
<td>267</td>
<td>267</td>
<td>267</td>
<td>267</td>
</tr>
</tbody>
</table>

Almost 70 percent of the watersheds would be at risk for invasive plant species introductions associated with public motorized travel under all of the alternatives and the Proposed RMP. The No Action alternative would have higher risk levels than the action alternatives and the Proposed RMP, because it is the only alternative with areas designated as open for public motorized access. The No Action alternative is the only alternative that would have any watersheds in the Highest risk category for invasive plant species introduction and spread associated with public motorized travel. The No Action alternative would have more watersheds in the High to Highest risk categories than any action alternative or the Proposed RMP. Although the Proposed RMP would have no watersheds in the Highest risk category, it would have the most watersheds in the High risk category, 111 watersheds. Alternatives A and B would have an intermediate number of watersheds in the High risk category, 86 and 80 watersheds, respectively. Alternatives C and D would have the fewest watersheds in the High risk category, 68 and 64 watersheds, respectively.

**Risk of Introduction and Spread of Invasive Plant Species Associated with Livestock Grazing**

The BLM assessed the risk of invasive species introduction associated with livestock grazing by comparing the relative amount of land available for livestock grazing under each alternative and the Proposed RMP. Livestock grazing creates ground disturbance, which creates susceptibility for the introduction and spread of invasive plants. The BLM assumed invasive plants would occur in the areas available for livestock grazing. Livestock movement and associated activities, such as the transport of contaminated hay, can introduce invasive plants into new locations. Therefore, areas that the BLM determined would be susceptible for introduction and spread of invasive plants associated with livestock grazing would be at risk. The Livestock Grazing section of this chapter lists the acres of BLM-administered lands in the Coos Bay District, Klamath Falls Field Office, and Medford District available...
for livestock grazing by alternative and the Proposed RMP.

In the Coos Bay District, the No Action alternative would have 544 acres available for livestock grazing, resulting in the greatest risk of invasive plant introduction and spread. Under all action alternatives and the Proposed RMP, no lands would be available for livestock grazing in the Coos Bay District, and there would therefore be no risk of invasive plant introduction and spread associated with livestock grazing.

In the Klamath Falls Field Office, the No Action alternative would result in the greatest risk of introduction and spread, with 203,582 acres available for livestock grazing. Alternatives A, B, and C and the Proposed RMP would have 203,377 acres available for livestock grazing, resulting in slightly less risk of introduction and spread than the No Action alternative. Alternative D would have no acres available for livestock grazing and would therefore result in no risk of invasive plant introduction and spread associated with livestock grazing.

In the Medford District, the No Action alternative would result in the greatest risk of introduction and spread, with 285,920 acres available for livestock grazing. Alternatives A, B, and C would have 162,854 acres available for livestock grazing, resulting in less risk of introduction and spread than the No Action alternative. The Proposed RMP would have 156,926 acres available for livestock grazing, resulting in less risk of introduction and spread than the No Action alternative and Alternative A, B, and C. Alternative D would have no acres available for livestock grazing and would therefore result in no risk of invasive plant introduction and spread associated with livestock grazing.

**Summary**

The risk of introduction and spread of invasive plant species would vary by the various management activities, as described above. It is not possible to combine the risks associated with various management activities quantitatively to provide a total cumulative risk from all management activities for each alternative or the Proposed RMP because of the different metrics used for measuring the risk associated with different management activities and the differing geographic scope of management activities (see ‘Determining Species Distribution Categories’ in the Summary of Analytical Methods above). Additionally, the risk of introduction and spread of different invasive plant species and different management activities are not quantitatively comparable. For example, timber harvest adjacent to the Riparian Reserve would have indirect effects on the introduction and spread of invasive plant species in riparian habitats by increasing light levels in riparian habitats, whereas road construction would have more direct effects on the introduction and spread of invasive plant species by transporting invasive plant seeds or vegetation.

It is possible to summarize qualitatively the relative cumulative risk of introduction and spread of invasive plant species for each alternative and the Proposed RMP. **Table 3-75** ranks the alternatives and Proposed RMP in terms of the relative risk of introduction and spread of invasive plant species by analysis factor and overall.

The No Action alternative would result in a moderate overall risk of introduction and spread of invasive plant species. Under the No Action alternative, the risk associated with timber harvest and new road construction would be moderately low and moderate, respectively. The No Action alternative would have no risk of introduction and spread of invasive plant species in riparian habitats from timber harvest outside of the Riparian Reserve, but the highest risk associated with thinning within the Riparian Reserve. The No Action alternative would have the highest risk associated with public motorized vehicle use and livestock grazing, but the effect of these management activities on introduction and spread of invasive plant species would be geographically limited within the decision area.
Alternative A would result in a low overall risk of introduction and spread of invasive plant species. Under Alternative A, timber harvest activities and new road construction would result in a Low risk of introduction and spread of invasive plant species relative to the other alternatives and the Proposed RMP. Alternative A would result in a Moderate risk associated with public motorized vehicle use and livestock grazing, but the effect of these management activities on introduction and spread of invasive plant species would be geographically limited within the decision area.

Alternative B would result in a Moderately High overall risk of introduction and spread of invasive plant species, the second highest of all alternatives and the Proposed RMP. Under Alternative B, timber harvest activities and new road construction would result in a Moderate risk of introduction and spread of invasive plant species relative to the other alternatives and the Proposed RMP. Alternative B would result in a High risk of introduction and spread of invasive plant species in riparian habitats, both from timber harvest outside of the Riparian Reserve and thinning within the Riparian Reserve. Alternative B would result in a Moderate risk associated with public motorized vehicle use and livestock grazing, but the effect of these management activities on introduction and spread of invasive plant species would be geographically limited within the decision area.

Alternative C would result in the highest overall risk of introduction and spread of invasive plant species of all alternatives and the Proposed RMP. Under Alternative C, timber harvest activities and new road construction would result in the Highest risk of introduction and spread of invasive plant species. Alternative C would result in a Low risk associated with public motorized vehicle use and a Moderate risk associated with livestock grazing, but the effect of these management activities on introduction and spread of invasive plant species would be geographically limited within the decision area.

Alternative D would result in the lowest overall risk of introduction and spread of invasive plant species of all alternatives and the Proposed RMP. Under Alternative D, timber harvest activities would result in a Moderate risk and new road construction would result in the Lowest risk of introduction and spread of invasive plant species. Alternative D would have no risk of introduction and spread of invasive plant species in riparian habitats from either timber harvest outside of the Riparian Reserve or thinning within the Riparian Reserve. Alternative D would result in the Lowest risk associated with public motorized vehicle use. Alternative D would have no risk of introduction and spread of invasive plant species associated with livestock grazing.

The Proposed RMP would result in a moderate overall risk of introduction and spread of invasive plant species. Under the Proposed RMP, the risk associated with timber harvest and new road construction would be moderate relative to the alternatives. The Proposed RMP would result in a Low risk of introduction and spread of invasive plant species in riparian habitats from timber harvest outside of the Riparian Reserve, and a Moderately Low risk associated with thinning within the Riparian Reserve, but this risk would be limited to Class III subwatersheds. The Proposed RMP would result in a Moderately High risk associated with public motorized vehicle use and a Moderate risk associated with livestock grazing, but the effect of these management activities on introduction and spread of invasive plant species would be geographically limited within the decision area.

These qualitative rankings of risk are simply evaluations of susceptibility based on current conditions of invasive plant species populations, coupled with management actions proposed under the alternatives and the Proposed RMP. That is, an alternative’s overall rating describes the level of risk of introduction and spread of invasive plant species rather than an analysis of actual introduction and spread of invasive plant species in any specific watershed. Whether an alternative would result in actual introduction and spread of invasive plant species in any specific watershed would depend on a variety of project-specific, watershed-specific, and species-specific factors that cannot be analyzed at this scale of analysis. All alternatives and the Proposed RMP have management objectives to prevent the introduction of invasive species and the
spread of existing invasive species infestations and the BLM would implement measures to prevent, detect, and rapidly control new invasive species infestations based on management direction. Because of this management direction, all alternatives and the Proposed RMP would be expected to continue to apply mitigation against introduction and spread of invasive plant species equally across all risk-level HUC 10 watersheds within the planning area in response to management activities.
<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Timber harvest activities</td>
<td>Moderately Low</td>
<td>Lowest</td>
<td>Moderate</td>
<td>Highest</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>Timber harvest activities adjacent to Riparian Reserve</td>
<td>None</td>
<td>None</td>
<td>High</td>
<td>Highest</td>
<td>None</td>
<td>Low</td>
</tr>
<tr>
<td>Riparian Reserve (invasive plant species in riparian habitats)</td>
<td>Highest</td>
<td>Low</td>
<td>High</td>
<td>Moderate</td>
<td>None</td>
<td>Moderately Low</td>
</tr>
<tr>
<td>Thinning activities within Riparian Reserve</td>
<td>Moderate</td>
<td>Low</td>
<td>Moderate</td>
<td>Highest</td>
<td>Lowest</td>
<td>Moderate</td>
</tr>
<tr>
<td>(invasive plant species in riparian habitats)</td>
<td>Highest</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Low</td>
<td>Lowest</td>
<td>Moderately High</td>
</tr>
<tr>
<td>New road construction</td>
<td>Highest</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
<td>None</td>
<td>Moderate</td>
</tr>
<tr>
<td>Public motorized vehicle use</td>
<td>Highest</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Low</td>
<td>Lowest</td>
<td>Moderately High</td>
</tr>
<tr>
<td>Livestock grazing</td>
<td>Highest</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
<td>None</td>
<td>Moderate</td>
</tr>
<tr>
<td>Overall Risk of Introduction and Spread of Invasive Plant Species</td>
<td>Moderately High</td>
<td>Low</td>
<td>Moderately High</td>
<td>Highest</td>
<td>Lowest</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

Table 3-75. Relative risk of introduction and spread of invasive plant species by analysis factor and overall
Issue 2
How would the alternatives affect the risk of invasive aquatic species introduction and spread?

Summary of Analytical Methods
The BLM compared the relative risk of introducing and spreading invasive aquatic species resulting from the land use allocations and planned management activity levels under the alternatives and the Proposed RMP, taking into consideration the collective distribution of a representative set of invasive aquatic species. Variation in the effects among the alternatives and the Proposed RMP would result from differences in Recreation Management Area designations, the area available to livestock grazing, and the mileage of new road construction over the next 10 years. The Planning Criteria provides detailed information on the invasive species analysis and assumptions, which is incorporated here by reference (USDI BLM 2014, pp. 90–98).

In this analysis, the BLM measured effects associated with new road construction and RMA designations using subbasins (HUC 8) as the basic analytical unit, in much the same way as a site-specific analysis may report infestation effects in terms of acres, rather than in smaller increments representing the extent of the infestations. Even though BLM-administered lands constitutes a small percentage of many subbasins, BLM management actions could still affect susceptibility and risk for the introduction and spread of invasive plant species. Therefore, the BLM included all subbasins within the decision area in this analysis. The BLM measured the effects of livestock grazing on the introduction and spread of invasive aquatic species at the scale of the district or field office.

Representative Species
The BLM selected the following invasive aquatic species to characterize the general condition of invasive aquatic species in the decision area:

- American bullfrog (*Rana catesbeiana*)
- Asiatic clam (*Corbicula fluminea*)
- New Zealand mudsnail (*Potamopyrgus antipodarum*)
- Nutria (*Myocastor coypus*)
- Yellow flag iris (*Iris pseudacorus*)

Each of these species has a unique distribution and strategy for spreading and resisting different control methods. Although each species is unique, this sample of invasive aquatic species represents a range of life histories and methods of introduction and spread sufficient to describe the condition of invasive aquatic species in the decision area. The BLM considered these dispersal strategies when developing its assumptions around how management activities would affect invasive aquatic species introduction and spread. **Figure 3-100** illustrates the reported presence of the representative invasive aquatic species in the planning area.

A complete accounting of the distribution of invasive aquatic species is unavailable, because there is no requirement for county, private, or corporate landowners to report occurrences of invasive aquatic species. Despite the limited reporting, a sufficient picture of the distribution of invasive aquatic species is available on a species-by-species basis on the NAS – Nonindigenous Aquatic species database managed by the U.S. Geological Survey (http://nas.er.usgs.gov/) and iMapInvasives (www imapinvasives.org). Baseline occurrence data in iMapInvasives and the NAS – Nonindigenous Aquatic species database allow for an analysis of invasive aquatic species among alternatives and the Proposed RMP using the subbasins as the basic analysis unit.
Determining Species Distribution Categories

The BLM pooled representative invasive aquatic species occurrence data from BLM corporate datasets and iMapInvasives (ORBIC 2013). The BLM evaluated the collective pool of reported sites to determine representative invasive plant presence for each square mile in a grid applied to the planning area. The BLM based the invasive aquatic species distribution categories of Abundant, Limited, and Low on the known representative species’ distribution in the subbasins:

- **Abundant**—the representative invasive species reported from more than 25 percent of the square miles within the subbasin
- **Limited**—the representative invasive species reported from more than 1 percent and less than 25 percent of the square miles within the subbasin

Figure 3-100. Reported infestations of representative invasive aquatic species within the planning area
• **Low**—the representative invasive species reported in no more than 1 percent of the square miles within the subbasin

Subbasins fitting the Abundant species distribution category are more likely to have invasive species introduction and spread associated with management and human activities than those fitting the Limited and Low species distribution categories because there are already more infestations within them.

**Risk of Introduction and Spread of Invasive Aquatic Species**

The BLM considered the following factors in the analysis of the relative levels of risk of the introduction and spread of invasive aquatic species in the decision area:

- Distribution and abundance of invasive aquatic species
- Levels of new road construction over the next 10 years
- Designations for Recreation Management Areas
- Proximity of Recreation Management Area designations to streams and water bodies
- Area available to livestock grazing

The relative risk of introducing and spreading invasive aquatic species would vary by alternative and the Proposed RMP. This analysis compares the effects road construction, recreation use, and livestock grazing would have on the introduction and spread of invasive aquatic species, in terms of susceptibility and risk (see Issue 1 above for the discussion of susceptibility and risk).

As in Issue 1 above, the analysis assumed that actions on other ownerships and BLM management actions other than those listed above would continue to contribute to invasive aquatic species introduction and spread at current levels.

All alternatives and the Proposed RMP include management direction to “prevent, detect, and rapidly control new invasive aquatic species infestations” (Appendix B). This management direction is general, as is appropriate to the scope and scale of this action. Under the alternatives and the Proposed RMP, the BLM would mitigate some of the effects by incorporating prevention measures in the planning and design of implementation-level actions, to prevent the introduction of new infestations. These specific measures would include, but are not limited to, the following:

- Clean road construction, restoration, and livestock grazing management equipment that would operate off roads. In infested areas, where the transport of invasive species seeds, propagules, or individuals on equipment is likely, clean the equipment before leaving the project site
- Use sterile road construction materials and weed-free straw and mulch
- Use native plant species to promote competitive exclusion of invasive plant species
- Retain native plant communities in and around riparian and aquatic habitats and minimize soil disturbance, consistent with project objectives

Although implementation of these measures under all alternatives and the Proposed RMP would mitigate the effects of management activities on the introduction and spread of invasive aquatic species, it is not possible to forecast the effectiveness of prevention or treatment measures in avoiding or reducing the introduction and spread of specific invasive aquatic species. Thus, it is not possible to incorporate a quantitative analysis of the effect of such prevention and treatment measures into this analysis.

**Assessing Risk of Invasive Aquatic Species Introduction Associated with New Road Construction**

Road construction activities contribute to the introduction of new infestations and the spread of existing invasive aquatic species infestations. Road construction equipment can inadvertently transport invasive
aquatic species from one contaminated aquatic system to another. In addition, the disturbance and modification of riparian and aquatic habitats by road construction can create better habitat conditions for some invasive aquatic species.

This analysis used levels of new road construction over the next 10 years to compare the relative risk of invasive aquatic species introduction associated with road construction across the alternatives and the Proposed RMP.

The BLM determined the susceptibility of subbasins to invasive species introduction associated with new road construction by analyzing the alternatives and the Proposed RMPs estimates of road construction from the Woodstock vegetation model and the coefficients developed for the 10-year scenarios in the 2008 FEIS (Appendix C). See Issue 1 above for discussion of the analytical assumptions regarding new road construction.

The BLM prorated the road construction estimates for the subbasins in the planning area for each alternative and the Proposed RMP. The BLM used levels of new road construction under each alternative and the Proposed RMP over the next 10 years to generate susceptibility values for each subbasin. The BLM used these susceptibility values to compare the susceptibility of the subbasins to invasive aquatic species introduction and spread.

This analysis considers both the susceptibility of a subbasin to invasion due to new road construction and the presence of invasive aquatic species to determine the risk of invasion and spread of invasive aquatic species. Subbasins with a low distribution of invasive aquatic species and low susceptibility for the introduction of invasive aquatic species would have the lowest risk of invasion. The greatest risk of invasion would be in subbasins where both invasive aquatic species are more abundant and susceptibility would be higher. Subbasins without a risk category either have no reported sites for the representative sample set of invasive aquatic species or have no BLM-administered lands in the subbasin.

Assessing Risk of Introduction and Spread of Invasive Aquatic Species Associated with Recreation Management Area Designations

Visitors to recreation areas could introduce invasive aquatic species to new locations in a number of different ways. Recreational vehicles and equipment can inadvertently transport invasive aquatic species into new habitats, resulting in new introductions. In addition, visitors sometimes deliberately release aquatic pets they no longer want in areas with easy access to water.

The levels of human activity in the different Recreation Management Area (RMA) designations would create varying levels of opportunity for introducing and spreading invasive aquatic species. Visitor use and concentration would be highest in Special Recreation Management Areas (SRMAs), intermediate in Extensive Recreation Management Areas (ERMAs), and lowest in areas outside of designated RMAs. In this analysis, the BLM assumed that, with increased visitor use and activity, there would be a corresponding increase in the susceptibility of introduction and spread of invasive aquatic species. That is, this analysis assumed that SRMAs would be most susceptible, ERMAs would be moderately susceptible, and areas with no RMA designation would be least susceptible to introduction and spread of invasive aquatic species.

New guidance on applying RMA allocations on BLM-administered lands creates a marked difference in how RMA designations are defined under the No Action alternative, compared to all action alternatives and the Proposed RMP. Under the No Action alternative, all lands in the decision area would be designated to either SRMAs or ERMAs, but these designations have different meaning than under the
action alternatives or the Proposed RMP (see the Recreation section of this chapter). Because the RMA designation definitions differ for the No Action alternative, the relative ranking analysis can only compare the action alternatives and the Proposed RMP.

The BLM assessed susceptibility to invasive aquatic species introduction and spread by using subbasins as the basic unit of analysis. SRMAs received the highest weight (i.e., the highest susceptibility) and areas with no RMA designation received the lowest weight (i.e., the lowest susceptibility). Susceptibility values for each subbasin result from multiplying the acres of each type of RMA by the relative weight for each alternative and the Proposed RMP. The BLM organized the susceptibility categories into relative susceptibility categories of High, Medium, and Low.

This analysis considers both the susceptibility of a subbasin to invasion due to RMA designations and the presence of invasive aquatic species to determine the risk of invasion and spread of invasive aquatic species. Subbasins with a low distribution of invasive aquatic species and low susceptibility for the introduction of invasive aquatic species would have the lowest risk of invasion. The greatest risk of invasion would be in subbasins where both invasive aquatic species are more abundant and susceptibility would be higher. Subbasins without a risk category either have no reported sites for the representative sample set of invasive aquatic species or have no BLM-administered lands in the subbasin.

Assessing Risk of Introduction and Spread of Invasive Aquatic Species Associated with Livestock Grazing
The BLM assessed the risk of invasive aquatic species introduction and spread associated with livestock grazing by comparing the amount of land available for livestock grazing in each alternative and the Proposed RMP by BLM district. Livestock grazing creates opportunities for livestock and equipment to move through streams and other aquatic environments, which creates susceptibility for the introduction and spread of invasive aquatic species. Therefore, areas that the BLM determined would be susceptible for introduction and spread of invasive aquatic species associated with livestock grazing would be at risk. Only the Coos Bay District, Klamath Falls Field Office, and Medford District administer livestock grazing in the decision area. Comparing the acreage available for livestock grazing in the Coos Bay District, Klamath Falls Field Office, and Medford District provides a relative assessment for the introduction and spread of invasive aquatic species across the alternatives and the Proposed RMP.

Background
Invasive aquatic species include non-native species in all taxa groups whose introduction causes economic or environmental harm, or harm to human health. Numerous invasive species identified in the Oregon Conservation Strategy (ODFW 2006) occur in the planning area. Some of these invasive species include New Zealand mudsnails, ringed crayfish, bullfrogs, and bluegill. Other priority invasive aquatic species with documented sightings in western Oregon that have the potential to be introduced and documented in the planning area include quagga mussels, Eastern snapping turtle, and Louisiana swamp crawfish. In this analysis, the BLM is specifically considering the following representative species, all of which occur within the planning area.

American Bullfrog
American bullfrogs (Rana catesbeiana) inhabit river and stream segments with slow moving waters, ponds, lakes, and boggy areas and prefer simplified, modified aquatic habitats (Fuller et al. 2011). Tadpoles require moisture year round to mature. American bullfrogs move to new sites by a variety of mechanisms including: aquaculture and garden water feature escapes, translocation into private wetlands
from pet store purchases, and release of bullfrog pets into the wild (Crayon et al. 2009). Bullfrogs disperse from ponds into natural water bodies up to two miles away during periods of seasonally high water (Adams et al. 2003).

Habitat modifications that make better conditions for American bullfrog establishment include simplifying the plant community and altering seasonally wet habitats to those with permanent water. Simplification of the plant community allows for easier hunting and increased water temperatures (Crayon et al. 2009). Warmer water temperatures generally provide better habitat conditions for American bullfrog in the planning area.

American bullfrogs occur on BLM-administered lands in the Roseburg District (USDI BLM 2013) and in numerous widespread locations across western Oregon.

**Asiatic Clam**
The Asiatic clam (*Corbicula fluminea*) is a filter feeder inhabiting the surface and top layer of sediment in rivers and reservoirs. This species can reproduce rapidly under warm conditions and can persist in cool temperatures. Simply one Asiatic clam introduced into a new location can multiply into a new population because the species is capable of self-fertilization and cloning. Asiatic clam are successful invasive species because they have multiple reproductive strategies, reproduce rapidly, easily relocate in aquatic systems, and tolerate a wide range of environmental conditions. The species’ life history requirements limit its ability to spread in high temperature, low pH, and low calcium environments (Kramer-Wilt 2008).

People introduce Asiatic clam to new locations by way of contaminated sand and gravel for construction projects, bait buckets, and imported aquaculture purchases (Weidemer and Chan 2008). They also move to new areas in water currents, on contaminated sporting and construction equipment, and through the transfer of infested water (Foster et al. 2014).

Asiatic clam occur within the administrative boundaries of the Coos Bay, Eugene, Roseburg, and Salem Districts.

**New Zealand Mudsnaile**
The New Zealand mudsnail (*Potamopyrgus antipodarum*) is a clonal mollusk species that thrives in disturbed fresh and brackish waters. This habitat generalist spreads very easily, likes to burrow in sediment, and grows large populations under high nutrient flows. New Zealand mudsnails live equally well on organic matter or silt in lakes and in slow-moving streams, or burrowed in sediment in fast-moving streams.

New Zealand mudsnails are spread into new locations by passage through fish digestive tracts, contaminated fishing, sporting, and construction equipment, and contaminated water from game fish relocations (Oregon Sea Grant 2010). Once introduced into an aquatic system, New Zealand mudsnails spread within aquatic environments as hitchhikers on fish and aquatic plants. This species has the potential to interfere with the operations of facilities drawing infested waters. New Zealand mudsnail populations can become very dense and outcompete native snails for habitat and food (Benson et al. 2014).

New Zealand mudsnail are reported across the planning area, on BLM-administered lands in the Coos Bay District, and within the administrative boundaries of the Eugene, Medford, Roseburg, and Salem Districts.
**Nutria**
Humans intentionally introduced nutria (*Myocastor coypus*), a large rodent, to Oregon and Washington in the 1930s for two purposes: fur trade and undesirable aquatic plant control. Within a decade, nutria escaped captivity and became feral (Washington Department of Fish and Wildlife 2006). Nutria is now well established throughout the planning area. Nutria travel long distances over land to find new habitat as their populations expand (Washington State Lake Protection Association 2011). They inhabit burrows in riparian areas near still or slow-moving water bodies, including marshes, wetlands, ponds, and rivers. Dense populations of nutria modify riparian ecosystems by overgrazing riparian vegetation and building numerous burrows. The burrows also weaken fabricated structures, such as roadbeds and dikes. Intolerance to freezing temperatures is the primary factor limiting the spread of nutria in Oregon (ODFW 2014).

Nutria is reported in all parts of the planning area.

**Yellow Flag Iris**
Yellow flag iris (*Iris pseudacorus*) is a tall and showy invasive perennial wetland plant species introduced to North America for multiple purposes, including gardening, erosion control, and bioremediation (specifically, to remove metals from wastewater in sewage treatment plants). Yellow flag iris reproduces sexually by seed and vegetatively by rhizomes. The species tolerates a broad array of habitat conditions, including high soil acidity, high salinity, low soil oxygen, and periods of drought. However, yellow flag iris does not tolerate long periods of freezing temperatures (Ramey 2001).

Similar to other invasive aquatic plants, yellow flag iris can be introduced to new locations when it is inadvertently transported on construction equipment and vehicles. Once introduced, yellow flag iris spreads to form thickets in mud and shallow water. Seeds can float long distances and start new colonies downstream. Any disturbance to yellow flag iris infestations provides an opportunity for the species to spread via rhizome fragments. Yellow flag iris thickets crowd out most other vegetation, including native aquatic plants such as cattails (Ramey 2001).

Yellow flag iris has limited to widespread distribution in western Oregon and occupies BLM-administered lands in the Coos Bay, Eugene, and Medford Districts.

**Affected Environment**
The representative invasive aquatic species generally have the following distribution in the planning area:
- American bullfrog occurs in numerous widespread locations across western Oregon.
- Asiatic clam occurs within the administrative boundaries of the Coos Bay, Eugene, Roseburg, and Salem Districts.
- New Zealand mudsnail infestations are reported across the planning area.
- Nutria are well established throughout the planning area.
- Yellow flag iris has limited to widespread distribution in western Oregon and occupies BLM-administered lands in the Coos Bay, Eugene, and Medford Districts.

Figure 3-101 shows the distribution of representative invasive aquatic species throughout the planning area by subbasin.
Of the 41 subbasins completely or mostly within the planning area, none have enough reported infestations of the representative invasive aquatic species to fall into the Abundant species distribution category. Thirteen subbasins are in the Limited distribution category, and 21 subbasins are in the Low distribution category for invasive aquatic species. In total, 83 percent of the subbasins have some reported representative invasive aquatic species infestations. Seven subbasins (17 percent) fall in the Null distribution category (i.e., they currently have no reported representative invasive aquatic species infestations).
Environmental Consequences

**Risk of Introduction and Spread of Invasive Aquatic Species Associated with New Road Construction**

The No Action alternative and Alternative C would have the greatest susceptibility because they have the most subbasins in the highest susceptibility ranking. Alternatives B and C, and the Proposed RMP would each have 36 subbasins with some level of susceptibility that is associated with new road construction over the next 10 years. Alternative D would have the least susceptibility to the introduction and spread of invasive aquatic species, with all of the susceptible subbasins with Moderate to Low relative categories. Alternative B would be the second highest in susceptibility; Alternative A would be intermediate, and the Proposed RMP second to the least susceptible.

See Table 3-76 for the risk of the introduction and spread of invasive aquatic species resulting from new road construction activities among the alternatives and the Proposed RMP.

Under all alternatives and the Proposed RMP, no subbasins would have a High risk of introduction and spread of invasive aquatic species resulting from new road construction over the next 10 years. Alternative A would have the most number of subbasins with some level of risk of introduction and spread of invasive aquatic species resulting from new road construction, and Alternative D would have the fewest. However, the No Action alternative and Alternative C would have the highest relative risk of introduction and spread of invasive aquatic species resulting from new road construction, because they would have the most subbasins in the Moderately High risk category. Alternative B and the Proposed RMP would have an intermediate number of subbasins in the Moderately High risk category. Alternatives D and A would have the lowest relative risk of introduction and spread of invasive aquatic species resulting from new road construction, because they would have the least number of subbasins in the Moderately High risk category.

**Table 3-76. Risk of introduction and spread of invasive aquatic species associated with new road construction by subbasins over the next 10 years.**

<table>
<thead>
<tr>
<th>Risk Category</th>
<th>No Action (Number of Subbasins)</th>
<th>Alt. A (Number of Subbasins)</th>
<th>Alt. B (Number of Subbasins)</th>
<th>Alt. C (Number of Subbasins)</th>
<th>Alt. D (Number of Subbasins)</th>
<th>PRMP (Number of Subbasins)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Moderately High</td>
<td>8</td>
<td>3</td>
<td>7</td>
<td>8</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Moderate</td>
<td>1</td>
<td>-</td>
<td>4</td>
<td>5</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>Moderately Low</td>
<td>15</td>
<td>14</td>
<td>14</td>
<td>12</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>Low</td>
<td>6</td>
<td>15</td>
<td>6</td>
<td>6</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>Total at Risk</td>
<td>30</td>
<td>37</td>
<td>31</td>
<td>31</td>
<td>29</td>
<td>31</td>
</tr>
</tbody>
</table>

**Risk of Introduction and Spread of Invasive Aquatic Species Associated with Recreation Management Area Designations**

See Table 3-77 for the risk of introduction and spread of invasive aquatic species associated with the RMA designations.

All of the alternatives and the Proposed RMP would have 32 total subbasins with some level of risk of introduction and spread of invasive aquatic species associated with RMA designations and 9 subbasins with no risk of introduction and spread of invasive aquatic species associated with RMA designations.
The Proposed RMP would have 7 subbasins in the Moderately High to High risk categories, and would therefore result in the most risk of introduction and spread of invasive aquatic species associated with RMA designations, Alternative C and D would have 6 subbasins in the Moderately High to High risk categories, and Alternative B and A would have 4 and 3 subbasins, respectively, in the Moderately High to High risk categories, and would therefore have the least risk of introduction and spread of invasive aquatic species associated with RMA designations.

Table 3-77. Risk of introduction and spread of invasive aquatic species associated with RMA designations

<table>
<thead>
<tr>
<th>Risk Ranking</th>
<th>Alt. A (Number of Subbasins)</th>
<th>Alt. B (Number of Subbasins)</th>
<th>Alt. C (Number of Subbasins)</th>
<th>Alt. D (Number of Subbasins)</th>
<th>PRMP (Number of Subbasins)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Moderately High</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Moderate</td>
<td>-</td>
<td>1</td>
<td>4</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Moderately Low</td>
<td>14</td>
<td>23</td>
<td>20</td>
<td>20</td>
<td>17</td>
</tr>
<tr>
<td>Low</td>
<td>15</td>
<td>4</td>
<td>2</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total at Risk</strong></td>
<td><strong>32</strong></td>
<td><strong>32</strong></td>
<td><strong>32</strong></td>
<td><strong>32</strong></td>
<td><strong>32</strong></td>
</tr>
<tr>
<td><strong>Total Watersheds</strong></td>
<td><strong>41</strong></td>
<td><strong>41</strong></td>
<td><strong>41</strong></td>
<td><strong>41</strong></td>
<td><strong>41</strong></td>
</tr>
</tbody>
</table>

Risk of Introduction and Spread of Invasive Aquatic Species Associated with Livestock Grazing

The Livestock Grazing section in this chapter lists acres of the BLM-administered lands available for livestock grazing by alternative and the Proposed RMP.

In the Coos Bay District, the No Action alternative would have 544 acres available for livestock grazing, resulting in the greatest risk of invasive aquatic species introduction and spread. Under all action alternatives and the Proposed RMP, no lands would be available for livestock grazing in the Coos Bay District, and there would therefore be no risk of invasive aquatic species introduction and spread associated with livestock grazing.

In the Klamath Falls Field Office, the No Action alternative would result in the greatest risk of introduction and spread, with 203,582 acres available for livestock grazing. Alternatives A, B, and C and the Proposed RMP would have 203,377 acres available for livestock grazing, resulting in slightly less risk of introduction and spread of invasive aquatic species than the No Action alternative. Alternative D would have no acres available for livestock grazing and would therefore result in no risk of invasive aquatic species introduction and spread associated with livestock grazing.

In the Medford District, the No Action alternative would result in the greatest risk of introduction and spread of invasive aquatic species, with 285,920 acres available for livestock grazing. Alternatives A, B, and C would have 162,854 acres available for livestock grazing, resulting in less risk of introduction and spread than the No Action alternative. The Proposed RMP would have 156,926 acres available for livestock grazing, resulting in less risk of introduction and spread than the No Action alternative and Alternative A, B, and C. Alternative D would have no acres available for livestock grazing and would therefore result in no risk of invasive aquatic species introduction and spread associated with livestock grazing.
Summary
The risk of introduction and spread of invasive aquatic species would vary by the various management activities, as described above. As with the discussion of invasive plant species in Issue 1 above, it is not possible to combine the risks associated with various management activities quantitatively to provide a total cumulative risk from all management activities for each alternative or the Proposed RMP because of the different metrics used for measuring the risk associated with different management activities and the differing geographic scope of management activities. Additionally, the risk of introduction and spread of different invasive aquatic species and different management activities are not quantitatively comparable. Table 3-78 shows the relative risk of the alternatives and the Proposed RMP, by analysis factor and overall, of introduction and spread of invasive aquatic species.

Table 3-78. Relative risk of introduction and spread of invasive aquatic species by analysis factor and overall

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>New road construction</td>
<td>High</td>
<td>Lowest</td>
<td>Moderately High</td>
<td>Highest</td>
<td>Low</td>
<td>Moderate</td>
</tr>
<tr>
<td>RMA designations</td>
<td>--</td>
<td>Lowest</td>
<td>Low</td>
<td>High</td>
<td>High</td>
<td>Highest</td>
</tr>
<tr>
<td>Livestock grazing</td>
<td>Highest</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
<td>None</td>
<td>Moderate</td>
</tr>
<tr>
<td>Overall relative risk for the introduction and spread of invasive aquatic species</td>
<td>High</td>
<td>Lowest</td>
<td>Moderate</td>
<td>Highest</td>
<td>Low</td>
<td>Moderately High</td>
</tr>
</tbody>
</table>

The No Action alternative would result in a high overall risk of introduction and spread of invasive aquatic species. Under the No Action alternative, the risk associated with new road construction would be high. As noted above, the RMA designations under the No Action alternative cannot be directly compared to the RMA designations under the action alternatives and the Proposed RMP. However, the overall recreation management approach under Alternative B best reflects the recreation management approach of the No Action alternative, updated with RMA designations consistent with current BLM policy. Thus, the effect of recreation management on risk of introduction and spread of invasive aquatic species under the No Action alternative can best be approximated as Low relative to the other alternatives and the Proposed RMP, similar to Alternative B. The No Action alternative would have the Highest risk associated with livestock grazing, but the effect of livestock grazing on introduction and spread of invasive aquatic species would be geographically limited within the decision area.

Alternative A would result in the lowest overall risk of introduction and spread of invasive aquatic species. Under Alternative A, new road construction and RMA designations would result in the Lowest risk of introduction and spread of invasive aquatic species relative to the other alternatives and the Proposed RMP. Alternative A would result in a Moderate risk associated with livestock grazing, but the effect of livestock grazing on introduction and spread of invasive aquatic species would be geographically limited within the decision area.

Alternative B would result in a moderate overall risk of introduction and spread of invasive aquatic species. Under Alternative B, new road construction would result in a Moderately High risk of introduction and spread of invasive aquatic species relative to the other alternatives and the Proposed RMP. RMA designations would result in a Low risk relative to the other alternatives and the Proposed RMP. Alternative B would result in a Moderate risk associated with livestock grazing, but the effect of livestock grazing on introduction and spread of invasive aquatic species would be geographically limited...
within the decision area.

Alternative C would result in the highest overall risk of introduction and spread of invasive aquatic species. Under Alternative C, new road construction would result in the highest risk of introduction and spread of invasive aquatic species relative to the other alternatives and the Proposed RMP. RMA designations would result in a High risk relative to the other alternatives and the Proposed RMP. Alternative C would result in a Moderate risk associated with livestock grazing, but the effect of livestock grazing on introduction and spread of invasive aquatic species would be geographically limited within the decision area.

Alternative D would result in a low overall risk of introduction and spread of invasive aquatic species. Under Alternative D, new road construction would result in a Low risk of introduction and spread of invasive aquatic species relative to the other alternatives and the Proposed RMP. RMA designations would result in a High risk relative to the other alternatives and the Proposed RMP. Alternative D would have no risk of introduction and spread of invasive aquatic species associated with livestock grazing.

The Proposed RMP would result in a moderately high overall risk of introduction and spread of invasive aquatic species. Under the Proposed RMP, new road construction would result in a Moderate risk of introduction and spread of invasive aquatic species relative to the alternatives. RMA designations would result in the Highest risk relative to the alternatives. The Proposed RMP would result in a Moderate risk associated with livestock grazing, but the effect of livestock grazing on introduction and spread of invasive aquatic species would be geographically limited within the decision area.

**Issue 3**

*How would the alternatives affect the risk of sudden oak death introduction and spread?*

**Summary of Analytical Methods**

The BLM designed the analysis to project the rate of sudden oak death (*Phytophthora ramorum*) infestation expansion for the periods of 2013–2023 and 2023–2033. The analysis shows the relative differences in the expected rate of sudden oak death infestation expansion resulting from different sudden oak death treatments strategies under the alternatives and the Proposed RMP. The Planning Criteria provides detailed information on the sudden oak death analysis and assumptions, which is incorporated here by reference (USDI BLM 2014, pp. 101–104).

The BLM measured the effects of where sudden oak death treatments would occur in the decision area in terms of the location and amount of area projected to become infested in the sudden oak death expansion zones over the next 10–20 years. Zone 1 covers infestation area for the period between 2001 and 2013; Zone 2 shows the expected extent of the infested area by 2023, and Zone 3 by 2033.

The BLM considered the following factors in the analysis relative to the projected sudden oak death infestation levels and spread over the next 10–20 years:

- Sudden oak death treatment strategy by alternative and the Proposed RMP:
  - Treat all infestations under the No Action alternative, Alternatives C and D, and the Proposed RMP
  - No treatments under Alternative A
  - Treat all infestations outside of the Riparian Reserve under Alternative B

- Sudden oak death projected infestation zones for the next 10–20 years
The rate of the sudden oak death expansion realized from the date of first detection in 2001 through 2013 defines the boundaries of the infestation zones for the next 10–20 years. Under the status quo, technical experts anticipate the infestation area would expand by approximately 1 mile to the south, 5 miles to the east and 17 miles to the north every 10 years for the next 20 years, as it has done in the previous 10 years (Frankel and Palmieri 2014).

A team of technical experts including Ellen Goheen (U.S. Forest Service), Alan Kanaskie (Oregon Department of Forestry), and Everett M. Hansen (Department of Botany and Plant Pathology, Oregon State University) worked with the BLM to project the rate of disease expansion and infestation zones for the next 10–20 years under the alternatives and the Proposed RMP. The experts used their professional opinions, the proportion of infestation acres on BLM-administered lands in the Riparian Reserve (as described under Alternative B) compared to total infestation area on BLM-administered lands, and the principles within a sudden oak death distribution model to arrive at the projected rates of expansion and infestation levels on BLM-administered lands.

The technical experts added assumptions to facilitate the analysis after the Planning Criteria was developed. These assumptions include:

- The acres treated on BLM-administered lands in the period 2001–2013 represent the infested area for the same period.
- The area treated would expand at the same rate on BLM-administered lands in the second and third decades as it did between 2001 and 2013.
- Disease management practices on nearby non-Federal land will influence amount of disease on BLM-administered lands; sudden oak death will spread and intensify when left untreated resulting in disease intensification and spread from infected trees for several years and accelerated mortality in untreated areas.
- All infestations on other ownerships would be treated.

The analysis does not account for the following:

- Regrowth of vegetation on sites that were treated and replanted or naturally re-vegetated
- Variation in abundance of tanoak across the landscape
- Treatments that remove tanoak but leave overstory conifer and non-host hardwoods intact

**Background**

Non-native forest pathogens, whose introduction causes economic or environmental harm, or harm to human health, are invasive species. Sudden oak death, caused by the invasive pathogen *Phytophthora ramorum*, threatens Oregon’s forest and nursery industries.

*Phytophthora ramorum*, a water mold (oomycete), caused high levels of tanoak and live oak mortality in California for several years before its presence in Curry County, Oregon became evident in 2001. *Phytophthora ramorum* also infects nursery stock of a wide range of host species in Europe, California, Oregon, and Washington. The European and North American mating types are not the same, which indicates that the source population for the North American infestations is not from Europe. In 2001, Oregon had several infection centers in close proximity to one another on private residential, industrial forestland, and BLM-administered lands. The original quarantine area covered 9 square miles (Goheen et al. 2006). By 2013, the quarantine area expanded to 264 square miles, despite aggressive coordinated education, prevention, and early detection and treatment efforts.

*Phytophthora ramorum* travels long distances via nursery stock and in the infected wood of some host species. For that reason, the pathogen is subject to both State (ORS 603-052-1230) and Federal (7 CFR
quarantine regulations that restrict the movement of host material from infested areas into disease-free areas. *Phytophthora ramorum* infects more than 46 host species and more than 90 associated species (USDA APHIS 2013). Regulated material includes host nursery stock and wood, logs, and lumber of identified host species. Many host species are native trees and shrubs found in forests in the decision area, including tanoak and canyon live oak. *Phytophthora ramorum* causes mortality in susceptible oak, tanoak, rhododendron, viburnum, evergreen huckleberry, and other plant species.

*Phytophthora ramorum* affects the stem, twigs and leaves of its host. The species spreads by both resting (chlamydospores) and swimming (zoospores) spores. Sporangia released from the canopies of infected trees travel to new host trees or the ground through the air assisted by wind and rain. Zoospores can move through water along the stems, twigs, and leaves of host plants, and some spores ultimately penetrate and infect new hosts. The spores travel in water, splash onto new susceptible host plants, and start new infections. Irrigation water from infested drainages or water sources also carries spores to new sites. Chlamydospores, which can survive periods of warmth and drought, move to new locations on infested soil, leaf, and twig litter (Goheen *et al.* 2006).

Outside of nurseries, pathologists have not detected *Phytophthora ramorum* infections on conifer species in Oregon. Pathologists believe the aggressive treatments in Oregon’s forests have kept the spore levels down to a level where understory conifer species growing in infestation areas have escaped inoculation. However, in California, infestation levels are relatively high, and several species of conifers in the understory of infected oaks have become infected. The list of susceptible conifers in California includes Douglas-fir, several fir species, coast redwood, and Pacific yew. When left untreated, the disease intensifies as the infected hosts produce more spores for several years. In Oregon, where the disease has been aggressively treated since 2001, the spore loads have not reached high levels.

Early in 2013, the State of Oregon revised the quarantine rule to establish a Generally Infested Area where landowners are no longer required to try to eradicate infestations. The BLM and other Federal agencies have continued aggressive treatments within the Generally Infested Area (Frankel and Palmieri 2014). Pathologists do not know if higher spore levels in untreated areas in Oregon will lead to infections on understory conifers, such as in California, but pathologists do know the spore loads will increase. With higher spore loads come more opportunities for the spores to infect more hosts and to move off site to new locations.

The Coos Bay District has been coordinating treatment activities with adjoining landowners, the Oregon Department of Forestry, and the U.S. Forest Service to control sudden oak death infection sites in the state-designated quarantine area since 2001. After pathologists found new infestations north of the established quarantine area in 2013, the Animal and Plant Health Inspection Service (APHIS) and the State of Oregon expanded the quarantine area in Curry County to 264 square miles (USDA APHIS 2013). Pathologists have found no new infestations from the movement of nursery stock outside of Oregon’s quarantine area, which suggests the quarantine program established in 2002 has been effective (USDA APHIS 2014).

The Coos Bay District has been using an integrated pest management approach to control all detected sudden oak death infestations. Treatments have included cutting, piling, and applying herbicides to host species within 300 feet of infected trees. Treatments have typically included broadcast or pile burning of cut material. Pathologists from the Oregon Department of Forestry and the U.S. Forest Service have performed follow-up surveys until the area has been determined to be disease-free for two successive years. If the disease is still present, the area has been retreated. The Coos Bay District has been planting treatment areas with Douglas-fir within two years of treatment.
**Affected Environment**

In 2001, Oregon had several infection centers in close proximity to one another on private residential, industrial forestland and on BLM-administered lands within the planning area. All of the western Oregon districts are at risk for sudden oak death infestations (Václavík *et al.* 2010), but Coos Bay District is the only one currently with known sites.

Sudden oak death infestation Zone 1 represents the broader infested area over the period of 2001 through 2013 (*Figure 3-102*). The Coos Bay District manages over 10,000 acres (almost 15 percent) of the total area within Zone 1. *Phytophthora ramorum* infests almost 1,000 acres (10 percent) of the Coos Bay District administered lands in Zone 1. Because the pathogen thrives in wet environments, trees closer to streams have a higher infection rate than those in upland habitats. More than 25 percent of the infested area is either within one site-potential tree height of perennial and fish-bearing streams or within 50 feet on non-fish-bearing intermittent streams, or both.

*Figure 3-102.* Sudden oak death infestation zones as of 2013 and expected expansion zones by 2023 and 2033
Between 2001 and 2013, the BLM implemented integrated pest management treatments to control sudden oak death on 959 acres. Most areas were treated using more than one method. In 2013, the Coos Bay District treated 46 acres by cutting and piling, over 160 acres by pile burning, and 24 acres by herbicide treatments. No retreatments occurred in 2013. The BLM’s cumulative treatments between 2001 and 2013 include more than 830 acres of cutting and piling, almost 700 acres of pile burning, 17 acres of broadcast burns, and almost 80 acres of retreatments.

**Environmental Consequences**

The intensity and area of sudden oak death infestations would vary under the different treatment strategies over time. See Table 3-10 for sudden oak death infestations levels by infestation zone over the next 10 and 20 years for each of the alternatives and the Proposed RMP.

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<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Zone 1 (2014–2023)</td>
<td>10,013</td>
<td>4,440</td>
<td>1,918</td>
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<td>Zone 2 (2014–2023)</td>
<td>4,893</td>
<td>2,111</td>
<td>780</td>
<td>780</td>
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<td>Zone 3 (2014–2023)</td>
<td>305</td>
<td>39</td>
<td>-</td>
<td>-</td>
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<tr>
<td><strong>Total all zones (2014–2023)</strong></td>
<td><strong>15,211</strong></td>
<td><strong>6,590</strong></td>
<td><strong>2,698</strong></td>
<td><strong>2,698</strong></td>
</tr>
<tr>
<td>Zone 1 (2024–2033)</td>
<td>10,013</td>
<td>5,874</td>
<td>2,877</td>
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<td>Zone 2 (2024–2033)</td>
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<td>1,560</td>
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<td>Zone 3 (2024–2033)</td>
<td>3,050</td>
<td>1,429</td>
<td>584</td>
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<tr>
<td><strong>Total all zones (2024–2033)</strong></td>
<td><strong>21,206</strong></td>
<td><strong>11,281</strong></td>
<td><strong>5,021</strong></td>
<td><strong>5,021</strong></td>
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</table>

Under Alternative A, the BLM would not treat sudden oak death infestations, which would result in the most intense and largest levels of infestations on BLM-administered lands. Left untreated, infected trees would produce and release spores over several years, allowing rapid and uncontrolled infestation on BLM-administered lands. The highest levels of tanoak mortality would occur under Alternative A. In this alternative, by the end of the first decade, sudden oak death infestations would occupy all BLM-administered lands in Zone 1 (10,013 acres). Infestations would occupy all of the BLM-administered lands within the quarantine area and a quarter of the remaining BLM-administered lands within Zone 2. Sudden oak death infestations would occupy 1 percent (305 acres) of the BLM-administered lands in Zone 3 within the first 10 years. Sudden oak death would infest 87 percent (21,206 acres) of BLM-administered lands in the cumulative three-zone area by the end of the second decade under Alternative A.

Under Alternative B, the BLM would not implement treatments within the Riparian Reserve, but would treat all detected infestations outside of the Riparian Reserve. Sudden oak death would spread and intensify from the untreated areas in the Riparian Reserve, but Alternative B would result in a smaller increase in infected acres than Alternative A. Spores produced within the Riparian Reserve from untreated trees would spread to both additional hosts within and outside of the Riparian Reserve for several years. Ultimately, more tanoak would die from this intermediate treatment strategy under Alternative B than would die under the aggressive strategy prescribed under the No Action, Alternatives C and D, and the Proposed RMP. By the end of the first decade, the infestation would have increased in Zone 1 and entered
Zones 2 and 3. Cumulatively, the infestation would cover almost 6,590 acres. By the end of the second decade, the infestation would have increased in all zones, with a cumulative total infestation covering 11,281 acres or 47 percent of BLM-administered lands in the cumulative three-zone area.

Under Alternatives A and B, sudden oak death infestations would occupy 100 percent of the Riparian Reserve area in Zone 2 and almost 90 percent in the cumulative three-zone area by 2033.

The lowest amount of sudden oak death infestation intensification and increase in infested acres would occur under the No Action alternative, Alternatives C and D, and the Proposed RMP, because the BLM would treat all detected infestations. The infestation would still increase under this treatment strategy, as it has over the past 10 years. Spore loads would have less opportunity than under Alternatives A and B to increase and spread to new hosts due to rapid response treatments. By the end of the first decade, the infestation would increase in both Zones 1 and 2 and would total 2,698 acres. By the end of the second decade, the infestation would enter Zone 3 and the cumulative total for all zones would be 5,021 acres or 21 percent of BLM-administered lands in cumulative three-zone area. Under the No Action alternative, Alternatives C and D, and the Proposed RMP, 25 percent of the Riparian Reserve area in Zone 2 and 27 percent of the Riparian Reserve area in the cumulative three-zone area would have sudden oak death infestations. Under the No Action alternative, Alternatives C and D, and the Proposed RMP, the Riparian Reserve in Zone 3 would still be free of infestations by 2023.

The acreage of sudden oak death treatments under Alternative B would be substantially greater than under the No Action alternative, Alternatives C and D, and the Proposed RMP. Even though Alternative B would not apply treatments within the Riparian Reserve, the greater acreage of infestation under Alternative B would result in more acres of treatment than under the No Action alternative, Alternatives C and D, and the Proposed RMP. Decadal initial sudden oak death treatments under Alternative B would be almost two times higher than the expected treatment levels under the No Action alternative, Alternatives C and D, and the Proposed RMP over the next 10 years, and one and a half times greater in the second 10 years (Table 3-80).

### Table 3-80. Initial sudden oak death treatment levels over the next 10 and 20 years

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<tbody>
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<td>Initial treatments for 2014–2023</td>
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<tr>
<td>Cumulative Treatments</td>
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<td>7,146</td>
<td>4,313</td>
<td>4,313</td>
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</tbody>
</table>
References


Oregon Biodiversity Information Center (OBIC). 2013. Cooperative data sharing agreement, iMapInvasives data, between the Oregon Biodiversity Information Center and USDA BLM, Oregon State Office. Portland State University. 4 pp. [http://www.dfw.state.or.us/wildlife/living_with/nutria.asp.]


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