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Visual-quality impacts of forest pest activity at the landscape level: A synthesis of published knowledge and research needs

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Abstract

Given the growing importance of forest-management strategies which seek to emulate natural disturbance patterns, and the increased incidence of pest epidemics in some parts of North America, there is surprisingly little published research on perceived visual quality of pest infestations, especially, at the landscape level (middleground viewing distance). Much of the literature that does exist focuses on the visual impact of beetles (*Dendroctonus* spp.) or gypsy moth (*Lymantria dispar*). This paper reviews the work published to date and distills key points and research priorities emerging from it.

Visual-quality ratings generally decrease significantly as pest damage increases in the middleground landscape. Some studies have identified quite low thresholds (in terms of the area of the visible landscape affected by pest activity), below which perceived visual quality drops significantly with increasing visible pest damage, and beyond which, additional negative visual impacts of increasing damage appear to be modest. However, reductions in visual quality due to pest attack may be outweighed by high visual quality of the overall scene. Low levels of beetle damage may even enhance the visual quality of a landscape temporarily. Results are not clear on the effect of information about pest infestations on respondents' visual-quality ratings. Some studies show that informed respondents consider visual quality of affected scenes to be lower than do uninformed respondents, but this may reflect the way in which the information was delivered.

A conceptual framework is suggested which relates the existing research to knowledge gaps and future research priorities, not only on visual-quality effects of pest infestations but also on related public perceptual responses and other disturbance types.

Keywords: Public perceptions; Visual impact; Forest pest infestations; Aesthetics; Visual-resource management; Social acceptability; Mountain pine beetle

1. Introduction

In light of the current trend towards sustainable forest management and more ecosystem-based forestry, practices that emulate natural disturbances are

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increasingly considered as a viable option (Canadian Institute of Forestry, 2003). In order to assess whether practices emulating natural disturbances such as insect attacks and forest fires will be socially acceptable, we need to consider the public perceptions of those natural disturbances. Also, given the recent epidemics of mountain pine beetle (MPB), *Dendroctonus ponderosae,* in places, such as Western Canada (Natural Resources Canada, 2003), public perception of forest health is increasingly a major issue. This paper reviews current knowledge of visual impacts of forest pest activity and identifies key knowledge gaps. More specifically, the present paper focuses on studies addressing the perceived visual-quality impacts of forest pest infestations and damage in North America, as seen from a middleground viewing distance. We conclude with recommendations on future research priorities.

Some definitions are in order. Pests are defined here as insects or other invertebrates and their related effects causing damage to forests; diseases and other forms of natural disturbance are not treated here. The terms "pest", "infestations", and "pest damage" as descriptors of disturbance are somewhat pejorative with regard to their role in the ecosystem, as discussed below in the context of potentially biased responses in human subject perception testing. However, these terms are used here in view of their predominance in the literature being reviewed, and the term "damage" is particularly useful in that it applies more precisely to the physical (and visible) extent of symptoms in forest stands than do more neutral but general terms, such as "activities" or "attack".

In terms of public perceptions, this paper primarily addresses effects of forest pests on visual quality or scenic quality (and related preferences) as perceived by the public, as opposed to expert judgements by landscape- or visual-assessment professionals. Studies directed primarily toward broader perceptions of other values and forest conditions are not the focus here, though there are important relationships between visual quality and other perceived values, which should be examined.

The terms "visual quality", "scenic quality", and "scenic beauty" are considered to be synonymous here in describing the visual aesthetic qualities of the overall landscape or scene; the term "visual quality" will be generally used, with the specific terms from individual studies used in describing their results. The term "visual effect" is used here to mean the objective description of visual characteristics associated with pest activities, such as colour values, scale, and pattern, which contribute to the stimulus for visual-quality ratings. The terms "visual-quality impacts" and "scenic preferences" are used to describe changes in visual quality perceived by the public or surrogates for them in human subject research experiments, as distinct from expert ratings of visual impact by professionals trained in conventional visual-resource analysis methods (e.g. Blair, 1986); such expert ratings may integrate both visual effect analysis and assumptions on public perception based on research and design theory.

It is important to differentiate between: (1) the observed change in perceived visual quality of the overall landscape from one measured state to another (as a result of pest activity over time) and (2) the direct rating of visual impact of the pest attack itself, in contrast with its landscape setting at a given point in time. It is possible that a visual impact of a pest attack rated as severe (by experts or lay-people) may have a moderate impact on overall perceived scenic quality of the landscape. Several of the studies reviewed below compare independent ratings of two or more landscape states to arrive at a quantification of what we call visual-quality impact (e.g. a drop in scenic quality), rather than a direct rating by subjects of the visual effect of a pest attack on the landscape.

The middleground viewing distance (defined here as ranging from approximately 500 m–5 km) is considered by many to be the most critical and sensitive distance for scenic landscape assessments (Litton, 1979; Hull and Buhyoff, 1983[2]; McCool et al., 1986; Pâquet, 1993; Picard, 2002). The importance of the middleground viewing distance lies in the fact that it is the distance at which it is the hardest to achieve harmonization among the different cuts (or disturbances) affecting the landscape (Litton, 1979). At these viewing distances, which correspond most closely to the landscape level of planning becoming important in modern forestry, emphasis is placed on texture, form, and line compatibility of a disturbance within the adjacent natural appearing landscape, rather than on stumps and slash features which are prominent only in limited foreground views

[2] Hull and Buhyoff (1983) found that the worst scenic impact occurred at a distance of approximately 1 km, which falls within the middleground viewing distance range used in the present paper.