I included three overlays for the weighting of the pixels: fuel-type, topography, and creeks. The fuel-type weighting assignment was based on the rate-of-spread (ROS) figures given for the Canadian Forest Fire Behaviour Prediction (FBP) System fuel-type designations (Taylor and Pike 1995). An Initial Spread Index (ISI) of 15, and Build Up Index (BUI) of 50 were used in the tables to represent "average" fire weather conditions in the Prince George area (Forestry Canada Fire Danger Group 1992).

Age and composition information in each pixel were used to assign broad fuel-types closely matching those from the FBP system. Where gaps occurred, I used interpolation (between two existing forest fuel-types) or the closest possible category in the case of non-forested classes, such as non-productive brush and non-productive black spruce.

There is currently no mechanism that considers increasing rates of spread in older stands within the FBP fuel-type ROS's that form the basis of how and where fires will spread across the landscape. In other words, the FBP system assumes age invariance. Although the results of Section 2.4.1 were ambiguous, there is reason to believe that a limited degree of age selection is in operation on the SBSmk1 landscape[[1]](#footnote-1).

To allow for age selection, the model adopted the FBP ROS values as they exist below 140 years, and increased them by 50% thereafter. This underplays the tendency of age selection according to the disturbance rates for the Weibull in Table 2.1 in Section 2.4.1, which is reasonable considering the evidence on which the adoption of the Weibull model was made. It also allowed for the possibility of more frequent reburning (which has been observed). The final fourteen fuel-types and their respective ROS values used in the model are given in Table 3.2.

The ROS weights given in Table 3.2 are valid only for flat ground. Slope and aspect information combined to form the second data overlay. From the target pixel, the direction (uphill, downhill, or sideslope) was found, and used in conjunction with the slope to adjust the ROS accordingly. The adjustments were taken directly from the Relative Spread factors used for the FBP system (Alexander *et al*. 1984). The factors by which the fuel-type ROS's were adjusted are given in Table 3.3. The ROS multipliers were applied directly when the fire is moving uphill, and inversely when moving downhill. Note that for slopes less than 10%, no correction was applied.

Although there was some indication that south and west facing slopes may be more susceptible to fire than north and east slopes (Section 2.4.5.2), the evidence was not considered strong enough to warrant complicating the model further. Furthermore, although there was fairly strong evidence that forest stands on very dry, well drained soils burn more often than stands on other

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| Table 3.2. Fuel-types and rate-of-spread (ROS) values for the landscape model. |  |
| FUEL-TYPE (age-class) | ROS (m/min) |
| Water | 5 |
| Young mixedwood (<= 120 years) | 6 \* |
| Non-productive brush | 7 |
| Non-productive black spruce | 8 |
| Mature hardwood (> 120 years) | 9 |
| Young mixedwood (<= 120 years) | 12 \* |
| Immature pine (41 - 120 years) | 14 \* |
| Mature mixedwood (> 120 years) | 17 |
| Young softwood (<= 120 years) | 18 \* |
| Young spruce (<= 120 years) | 20 \* |
| Mature pine (> 120 years) | 21 |
| Young pine (<= 40 years) | 22 \* |
| Mature softwood (> 120 years) | 27 |
| Mature spruce (> 120 years) | 30 |

\* values derived directly from Taylor and Pike (1995).

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| Table 3.3. Rate-of-spread (ROS) slope correction factors for the landscape model fuel-types. |  |
| SLOPE RANGE | ROS MULTIPLIER |
| 0-9% | 1.0 |
| 10-19% | 1.4 |
| 20-39% | 2.3 |
| > 40% | 6.5 |

soils (Section 2.4.4.1), none of these soils were found within the small 28,730 hectare area. No adjustment for multiple fire regimes was made.

The only other ROS adjustment necessary was for water. The model mechanics were such that for pixels that are classified as water, fires will always stop at this edge unless they are assigned a positive ROS value. Forest fires can jump water bodies quite easily in some cases, but, as analysis showed, even very small creeks can influence edge formation (Section 2.4.5.1). For those pixels that are classified as water larger than a creek, an arbitrary ROS value of five was assigned. Subsequent model testing revealed that fires could cross even the largest water bodies using this value, but they had to be persistent to do so. If a fire could not "jump" water, it could always burn around it if the fire was large enough.

For smaller water bodies such as creeks, a different solution was developed. Section 2.4.5.1 showed that most fires burn across creeks, although creeks can influence fire behaviour. Based on this conclusion, the ROS of a forest pixel with a creek running through it was multiplied by an arbitrary factor of 0.6. Subsequent model testing showed that this had little influence on the formation of edges in most cases.

1. As stated in Chapter 2 of this thesis, the observed age selection may not be due, in whole or part, to fire, but nonetheless exists as a landscape feature that I have chosen to incorporate. [↑](#footnote-ref-1)