Mills cutting high-value, clear Douglas-fir lumber, which usually includes some sapwood, for export may incur painful losses because of degrade caused by staining. The common blue stains and molds on sapwood can be prevented by proper use of fungicidal dips or sprays, and a great deal of technology on the subject now exists.

Another kind of stain, not caused by fungi and not controllable by fungicides causes brownish discolorations on fresh sapwood of Douglas-fir soon after the log is opened up. This stain seems to develop from substances already in the sap of some living trees which, although initially colorless, later darkens when exposed to air (oxygen). The appearance of the stain is similar to that of hemlock brown stain; its color ranges from pale yellow-tan, through shades of brown and dark reddish brown to brick red. It occurs only on sapwood where it may develop within a few hours, or sometimes not until a week or two after sawing. It's likely that this stain has always been more or less with us, but it may not be very troublesome until periods of severe staining and soft market conditions happen to coincide.

The concerns with this stain are that it degrades a very high-value product, and that there is no easy or practical control at this time.

WHAT WE (THINK WE) KNOW ABOUT THE STAIN

The brown color is not caused by wood-staining fungi, and it cannot be controlled by the usual dip treatments used for blue stain and mold. However, alkaline dip solutions commonly used for controlling blue stain do not seem to intensify this brown stain as they may with similar brown staining of hemlock. An azide solution formulated to control brown stain in white and sugar pines had no similarly beneficial effect on Douglas-fir.

Naturally occurring substances in the sap of stainable, but still bright, sapwood of affected trees soon darken in the presence of air. Darkening is slowed if available oxygen is limited although very little O₂ is needed by color to develop. In piled lumber, stain appears first on well exposed outside surfaces. Light is not necessary for stain development.

Log age does not seem to have a marked effect on development of this brown stain, as it does in sugar pine. Sawing fresh Douglas-fir logs less than 3 months off the stump, as compared with logs at least 5 months old, provided no relief from staining during a memorably bad period during the spring of 1981. Indeed, brown stain appeared on sapwood of fresh stumps within a couple of weeks after the trees were felled.
The stain has been reported over the range of coast-type Douglas-fir in Oregon and is known to occur northward in British Columbia where it is regarded as less of a problem than staining in hemlock, a major species there. During recent outbreaks over the years 1981-84, there was no clear relationship to any particular locality, climate, or seasonal abnormalities. Staining at mill yards has been reported to us most often in the spring and rarely in summer, and in Oregon it was alleged to be more severe at coastal than at inland sites. Small-scale tests indicating that slow drying under damp, warm conditions intensified the stain support that opinion.

Depth of staining is usually shallow, but it does not reliably surface off—particularly if the board is very darkly stained. Among a small sample of ten darkly stained pieces, half were stained deeper than 1/8 inch, and once piece deeper than 3/8 inch. Opinions differ, sometimes within the same plant, as to whether the stain worsens during kiln drying. I've heard no claims that kiln schedules recommended for controlling brown stain in pine and hemlock will also control brown stain in Douglas-fir.

More than one kind of brown-staining system may possibly occur in Douglas-fir sapwood. Typically the yellowish-tan to dark brown colors develop after fresh sapwood is exposed to air, particularly so on the fully exposed, faster-drying ends of stacked lumber. A less common, dark reddish color, some operators describe it as purple, can develop on constantly wet (sprinkled) sapwood where no drying occurs. This dark stain is soluble in water and may bleed over nearby heartwood, thus creating a false impression of heart stain. Surface growths of slime spreading over wet, stained sapwoods suggest that this stain may stem from a biological source, possibly bacteria.

CONTROLS

Presently there are no generally available materials or methods being used for treating or processing Douglas-fir to control brown stain. Some mills will saw to avoid sapwood in export lumber. Steaming at 212°F before stain can develop has been an effective preventive, but requires special equipment.

An ongoing study at OSU will look at the chemistry of this type of stain with the hope for developing some practical means of control.