

## Technical Tip

# The Angular Canopy Densiometer

Robin Pike

An innovative instrument to measure the amount of summertime shade over streams has recently been developed. Its inventor, **Patrick Teti**, Research Hydrologist with the Ministry of Forests, is using this instrument in combination with data on Biogeoclimatic zone, seral stage, and stream width to develop a predictive model for shade.

"The Angular Canopy Densiometer, or ACD meter for short, can be used to help us understand how shade varies over the width and length of a stream, how it varies over a watershed, and how it is affected by riparian management practices. We are currently using it to survey stream shade in the Horsefly watershed in order to help develop a model for shade as a function of stream width and the seral stage of riparian vegetation," explained Teti. "Our ACD meter was inspired by the absence of a suitable instrument for measuring summertime shade over streams. While other instruments exist, none of them has the right combination of low cost, convenience, and accuracy."

Being able to measure the amount of summertime stream shade is important in many watersheds where stream temperature is an issue. Forest management is often associated with

increasing summer stream temperatures through the removal of shading vegetation. There is much debate, however, over the importance of shade as a primary controlling mechanism of stream temperature. This is because, in many watersheds, stream temperature is not influenced by shade (solar radiation) alone. Watershed characteristics such as channel geometry, streambed composition, topographic shading, air temperature, water source, and flow paths can also influence

stream temperature. While the research continues, it is clear that in watersheds where summer stream temperatures are an issue, shade is important. Therefore, a logical approach to managing potential temperature changes through forest management is to manage riparian shade.

In approaching the issue, Teti said it was important to be able to define shade and be able to measure it accurately.

"In the 1980s several scientists recognized the importance of solar radiation in relation to stream heating," he added. "They defined Angular Canopy Density as the portion of the sky shaded along the sun's path between 10 a.m. and 2

p.m. For many temperature-sensitive streams, this is the time of day when shade is most important. However, nobody else picked up on the idea that a new tool was needed, so we designed one."

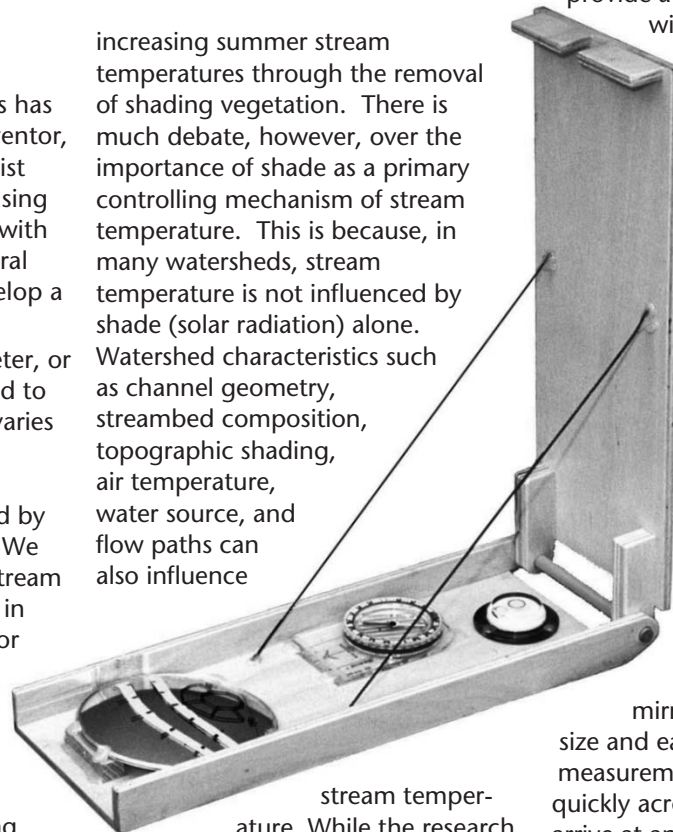
The ACD meter is light, compact, easy to use, and has been demonstrated to provide a high degree of accuracy,

with adequate practice. It consists of a hinged case, 4-inch convex mirror, bubble level, compass, and a fixed eye-sight. On the convex mirror, the sun's path between 10 a.m. and 2 p.m. (solar time) is delineated into four quadrants for mid-summer. With the instrument held level near the water surface, the operator points the instrument south, and looks through the eye-sight at the reflected imaged on the convex mirror. Ocular estimates of canopy density are then made for each of four quadrants on the

mirror. Because of its small size and ease of use, a series of measurements can be made very quickly across a stream segment to arrive at an average value for a stream reach.

When asked how he plots the sun's path onto the mirror Teti explained: "We get the inclination of the sun's path relative to the earth's equator at different dates from astronomical tables. Then, we plot sun positions at different times and dates on the walls and ceiling of a room using an instrument that is like a planetarium, except that it projects the sun instead of stars. Finally, we place the blank ACD meter at the centre of the 'planetarium' and draw lines on the mirror while viewing the marks on the ceiling through the instrument."

To assess the accuracy of his instrument, Teti has been comparing canopy densities estimated using the



### Editor's Note

This article is reprinted from our sister publication LINK (Volume 4, Issue 2, Fall 2002). LINK—Linking Innovations and Networking Knowledge is produced by FORREX four times a year to promote and encourage the sharing of natural resource management information. Subscriptions are free on-line, and back issues are available. To join the mailing list for LINK please visit the Web site: <http://www.forrex.org>

## Watershed Management

# A Living Rivers Strategy for British Columbia

Jamie Alley

In "A New Era for British Columbia" (2001) the British Columbia government committed to "pass a Living Rivers Act to protect and improve British Columbia's river systems with scientifically based standards for watershed management, enhancements to fish habitat, and a 10-year program to correct past damage." The British Columbia Strategic Plan (2002/03–2004/05) also commits the government to "implement a Living Rivers Strategy." The Service Plan of the BC Ministry of Water, Land and Air Protection indicates that the Living Rivers Strategy will be fully operational by 2004.

## The Living Rivers Concept

Living rivers are healthy freshwater ecosystems, essential to a healthy society and a prosperous, sustainable economy (Figure 1). The term "living rivers" recognizes that river systems are complex ecosystems involving

ACD meter with those calculated using a commercial fisheye camera and software system. His results show that the ACD meter can provide numbers within a few percent of the fisheye system, but that the percentage varies between users. Further evaluation of the accuracy of ocular estimates under a wide range of canopy conditions, and with different operators, is currently underway. The advantage of the

physical, biological, and chemical processes and interrelationships, and that people and society are part of this dynamic interaction. The essence of the Living Rivers concept is that the conservation and restoration of rivers and watershed systems should be centred on an ecological, science-based management model



Andrew Wilson

Figure 1. Stellako River: the Living Rivers Strategy supports healthy watersheds where physical and biological processes function effectively to support sustainable aquatic ecosystems and human communities.

and the engagement of the public, private, and voluntary sectors in active stewardship roles.

## Progress to Date

In the January 2002 reorganization of the BC Ministry of Water, Land and Air Protection, a Living Rivers Section was established in the new Biodiversity Branch to lead this initiative and to begin building a strategy.

instrument is that it is faster, easier, and cheaper to use than a fisheye system.

The ACD meter shows promise for a variety of hydrologic and silvicultural applications. With a slight modification, the instrument has been used to measure overhead canopy related to snow interception and snowmelt. Researchers, consultants, and other government agencies are

The Ministry completed a review of river-based conservation activities in selected jurisdictions in North America, Europe, and Oceania to identify exemplary practices and new program ideas applicable to British Columbia. The report is available from the Ministry and will be posted on its web site shortly.

A Living Rivers Trust Fund has been established at the Vancouver Foundation to act as a catalyst by providing seed funding for river-conservation

## Draft Vision

*The draft vision is healthy watersheds, where physical and biological processes function effectively to support sustainable aquatic ecosystems and human communities.*

activities. A draft discussion paper, to be released in 2003, will outline concepts and program proposals from interested stakeholders.

## For further information, contact:

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using the instrument to quantify winter cover for moose, for fish habitat surveys, and for stream temperature studies.

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