



# CALIFORNIA FORESTRY NOTE

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## **CONVERTING SALVAGE TIMBER TO LUMBER ON SENSITIVE SITES USING THE CHICO MOSS ON LATOUR DEMONSTRATION STATE FOREST**

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### **ABSTRACT**

The Chico Milled-On-Site System (Chico MOSS) is a combination of a highly portable sawmill and "Zig Zag" yarder. Using the Chico MOSS, logs can be milled into lumber at the location where the tree is felled, without having to skid the logs or move in heavy equipment. The milled lumber, which can be fully suspended, is yarded to a landing 1000 feet or more from the felled tree. With the Chico MOSS no new roads or skid trails need to be constructed to access felled timber.

Minimal soil disturbance or damage to the residual stand is created, making the Chico MOSS an option for highly selective commercial thinning and harvesting of stands on sensitive sites. The Chico MOSS may be used in riparian areas, on archaeological sites, steep slopes, erodible soils, and in densely populated wildland-urban intermix



Using the portable mill to saw cents from logs at the stump.

neighborhoods where fire hazard reduction, hazard tree removal, or insect infestation control is vital for community safety.

The Chico MOSS is an alternative that should also be considered on less sensitive sites, such as when seasonally saturated soils deny access to heavy equipment or in stands of insect damaged trees where total available

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Cables ready to yard using the Zig Zag yarder. Note cables above cables.

volume is insufficient to justify conventional harvesting. The Chico MOSS is available for use in conjunction with traditional harvesting operations to access islands of timber that may be unavailable to other harvesting equipment due to unfavorable topography, or other obstructions.

This study demonstrated that it is technically feasible for the Chico MOSS to mill and yard lumber on site. The authors identified several potential modifications to the equipment that would make it more efficient and easier to use. Additional studies of the Chico MOSS will be needed to determine its economic feasibility.

## INTRODUCTION

California has many wildland-urban intermix (I-Zone) communities located in timber stands characterized by closed canopy, dense highly

flammable suppressed understory, accumulations of dead woody material, and/or a species mix atypical of the native forest. Current conditions make these stands highly susceptible to insect attack, disease, drought, and wildfire. These threats may be mitigated through vegetation management practices designed to restore stands to a sustainable and non-catastrophic fire composition and structure. Perceived costs may deter many I-Zone property owners from implementing effective fire hazard mitigation on their lands or on the common lands within subdivisions. One of the methods to reduce the cost of fire hazard mitigation is the salvage of valuable commercial wood products.

In many areas of the wildland-urban intermix, the current available commercial approaches to fire hazard reduction are unacceptable to the public because of aesthetics, noise, traffic, environmental, and safety concerns. Lumber produced by the Chico MOSS from salvaged trees, when sold to a sawmill or manufacturer, can provide income that will defray the cost of fire hazard reduction practices to I-Zone property owners. Salvage projects may not pay the full cost of fire hazard reduction, but they may reduce the out-of-pocket costs to the landowner.

## OBJECTIVES

In this study the Fire and Ecosystem Management project of the California State University, Chico Research Foundation was seeking to find and test methods that will increase the cost-effectiveness of fire and forest health hazard mitigation in the I-Zone. One of these methods, the Chico MOSS, was tested on the California Department of Forestry and Fire Protection's LaTour Demonstration State Forest.

## FOREST DESCRIPTION

LaTour Demonstration State Forest is a 9,033 acre mixed conifer and true fir timber type property located at the southern end of the Cascade Range, approximately 50 miles northeast of Redding, California. Elevation ranges from 3,800 feet to 6,740 feet.

## MATERIAL AND METHODS

### THE CHICO MOSS

The Chico MOSS combines two successful technologies that have been adapted to operate effectively in the wildland-urban intermix. The first is a portable saw mill designed to be disassembled for easy transportation to remote locations that are inaccessible to most other mills. The second is a continuous-loop monocable yarder, also referred to as a "Zig Zag" yarder. When used together, it is possible to fall one or more trees, move the mill using the "Zig Zag" yarder to the felled trees, mill them into lumber, and then yard the lumber to a landing where it is loaded directly onto trailers. Slash and mill waste may also be yarded to the landing where it can be chipped or used for firewood. The processing of slash and mill

waste will reduce net revenues unless these products can be sold.

After a log is milled into lumber, the portable mill can then be easily moved to the next log or tree. Once milling is completed at a particular site, the mill is yarded back to the landing, loaded into a pick-up truck, and hauled to the next site. This harvesting/milling method is **extremely** light on the land. In the entire process, it is unnecessary to skid logs or to **build new** haul or tractor roads. Soil disturbance is almost nonexistent. Milled boards can be fully suspended above the ground by the "Zig Zag" yarder to protect both the wood and the site.

After a log is milled into lumber, the portable mill can then be easily moved to the next log or tree.

### THE SAW MILL

The portable sawmill is composed of a frame that is set up either directly over a log, or a log can be rolled into place for milling. A gasoline fueled powerhead rides on two rails that are adjusted up or down to precisely determine one of the two dimensions of the lumber being produced. The second dimension is determined by settings on the powerhead that determine the precise horizontal location of the blade.



Loading cants on to a trailer at the landing. The yarder is mounted on the pickup in the background.

The power head contains a circular blade that has five carbide cutters. The kerf is 3/16 inches. The blade can be sharpened in five minutes using a sharpener that comes with the purchase of the mill. The blade does not need to be removed from the powerhead to be sharpened, and because the new models are "electric start", the 12-volt battery can power the sharpener. A wheel attaches to the powerhead allowing it to be pushed to most sites. If this is not feasible, the various components can be arranged to enable processing flexibility. For example, ropes can be attached to the powerhead frame, which is then attached to the "Zig Zag" yarder cable, and transported to the log. The saw mill frame and rails were attached to the cable with twine chokers. The "Zig Zag" yarder transported the mill to the site of the felled tree. Once the saw mill pieces reached the site they were cut from the cable and then the mill was assembled over the log to be cut.

To mill lumber the saw mill operator engages the powerhead which rides on tracks that are set up around the log being milled, making either a vertical or horizontal cut. When the powerhead reaches the end of the log being milled the blade is shifted and the second cut is completed as the powerhead is pulled back to the opposite end of the log. The operator, or a second worker, pulls the board that has just been milled and stacks it. The mill is then reset for the next cut and the process is repeated.

The saw mill tested can manufacture cants up to 6.25 inches by 12.5 inches, and other models are capable of manufacturing cants up to 8.5 inches by 17 inches. Slabbing bars can be purchased which allow the mill to manufacture slabs up to 6.25 inches by 50 inches from the Model 6 and 8.5 inches by 60 inches with the Model 8. These mills can manufacture lumber of any size that is less than the stated maximums. The standard

mills are able to cut logs that are 48 inches in diameter and 20 feet in length without moving the end frames. Much larger logs may be cut by the mill. Diameters of 8' or larger can be manufactured by resawing cants to smaller sizes. For logs longer than 20 feet contact the manufacturer to get instructions on methodology. Two or three small diameter logs can be placed under the frame and milled in a single setup. Extensions are available which permit longer logs to be milled.

#### THE "ZIG ZAG" YARDER

The "Zig Zag" is a continuous monocable yarding system, consisting of a series of blocks that are hung from trees or spars in a "Zig Zag" pattern. In the blocks are pulleys that have a toothed flange on the bottom. The blocks are hung from trees with straps, and cable tension and friction hold the blocks in place. The blocks do not cause damage to the trees.

The "Zig Zag" yarder was mounted in the back of a four-wheel drive, ¾ ton pickup truck that makes it easy to move. The power source for the yarding system is a 12 horsepower gasoline fueled engine that turns a drum around which the cable is wound. The cable is a continuous loop that is set at a constant speed. The speed of the cable is adjustable and direction can be reversed.

Lumber, brush, firewood, or other material is hung from the cable by a bailing-twine choker that is looped around the material and tied to the cable with a clove hitch. Experienced workers quickly tie the clove hitch with one hand. The twine passes through the blocks and when the material being yarded reaches the landing the twine is cut. When necessary to fully suspend the material being yarded, both ends of the items are tied to the cable with the twine. The weight the "Zig Zag" can

carry is effectively limited by what the workers can lift, not by the capacity of the machine.

Distances of up to 1,000 feet were reached, but greater distances are feasible. The "Zig Zag" yarder can be set up to operate on very steep ground, over wet areas, and uneven terrain. The yarder is quick to assemble and disassemble. One thousand (1,000) foot layouts can be rigged in two hours, depending on the terrain and density of the vegetation.

### RESULTS

The portable mill was easy to move with the "Zig Zag" yarder. Milling of logs on relatively flat, even ground proceeded without difficulty. Where logs were located on side-hills it was necessary to support the lower legs of the frame. Providing additional support to the lower legs was time consuming, resulting in decreased productivity. The frame is designed for level ground. Logs were milled into lumber on slopes ranging from 0 to 10 percent.

A professional faller is essential for productivity. Felling of trees to achieve the most favorable lie reduced time spent in preparing the log and setting up the mill. Production was most efficient when the lumber was cut, stacked, and then yarded. The yarding of lumber as it was milled required an additional employee at the landing, resulting in increased costs.

The "Zig Zag" yarder was capable of transporting over 250 pieces of lumber an hour. The highest production obtained during an eight hour shift by a crew of 3 was 2,000 board feet (2 MBF) of 4.75 inches by 5.25 inch cants. Production is defined as milling, yarding, loading on to a trailer, hauling to a staging area, and then re-stacking with stickers.

The largest log milled was a 42 inch diameter sugar pine, and the smallest was approximately 10 inches in diameter.

Two ways to improve productivity were identified. The first was to improve the saw mill frame to reduce the time required to level

Load of lumber milled with the MOSS system leaving the La Tour Demonstration State Forest.



it on steep slopes. The second would be to purchase a second frame and have it assembled by one crew person over the next log to be milled, reducing down time for set up.

#### LUMBER SALE

The lumber milled was sold to a commercial saw mill in Redding, California. 11.2 MBF of cants were sold for re-sawing and processing. The Redding sawmill produced a total of 9.5 MBF of lumber, and \$1,581 in revenue. Further studies are needed to determine the economic viability of the MOSS.

#### COSTS

The basic sawmill used in this study, the Lucas sawmill, comes with an 18 H.P. engine and it costs about \$6,695. The larger model has a 25 H.P. engine and it sells for about \$9,495. Both of these models have electric starts. The cost of a "Zig Zag" yarding system is approximately \$20,000, without the pickup to transport it. A single "Zig Zag" system could yard for several mills, in close proximity.

#### RECOMMENDED IMPROVEMENTS

During this study several ways to improve the efficiency of the operation were identified:

- 1) Use more than one saw mill to reduce down time.
- 2) Develop an efficient sorting, grading, and binding method for use at the staging area.
- 3) Develop a marketing plan for the product. Lumber milled will typically be mixed species and dimensions, in small volumes. A forest products cooperative serving a number of independent owner/operators may be the most appropriate marketing arrangement.

#### SUMMARY AND CONCLUSIONS

The sawmill and yarder combination used in this study, called the Chico Milled On Site System (Chico MOSS), was able to mill lumber at the stump and yard it to a landing 1,000 feet away without impacting the soil or the residual stand. It is technically feasible for the Chico MOSS to recover lumber from trees within the wildland-urban intermix, on residential properties and other sensitive sites. Further testing is needed to determine the financial feasibility for various settings.

*The term "Chico MOSS" was developed by Professor Ron Hodson of Chico State University and does not refer to any particular brand of sawmill or yarder, but to a combination of the two types of equipment.*

*While CDF chose to use the Lucas sawmill provided by Bailey's for this study there are several other companies that produce a similar product capable of the same work. Mighty Might Industries, Inc., Portland Oregon and Mobile Manufacturing Company, Troutdale, Oregon are two examples.*

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