Manual of Rural Wood Preservation

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PAPUA NEW GUINEA
FOREST PRODUCTS RESEARCH CENTRE
DEPARTMENT OF FORESTS

MANUAL OF RURAL WOOD PRESERVATION

2ND EDITION

JUNE, 1975

PREFACE

Preservative treatment of sawn timber by the Dip Diffusion process has been an integral part of the timber utilisation program in Papua New Guinea for more than ten years. This has mainly benefited the sophisticated urban dweller. This booklet, prepared by the Forest Products Research branch of my Department, describes methods for making traditional building materials such as poles, bamboo, etc., more durable. It is hoped that Local Government Councils, Government and private organisations and particularly the ordinary villager will find it useful.

The Honourable Bruce Jephcott
Minister for Natural Resources

FORWARD

This is the second edition of the Manual of Rural Wood Preservation and represents a revised and reduced version of the 1st edition. This manual is intended for use by people in rural areas of Papua New Guinea where sophisticated techniques for wood preservation are not available and/or not applicable.

In the 1st edition the process descriptions were written by Mr P. Lattey, a CUSO volunteer, in simple straight-forward English for the layman. Mr Lattey's style has been retained in this second edition, but certain sections have been revised or deleted in the light of our experience.

J. AUNA
Director
Department of Forests

MANUAL OF RURAL WOOD PRESERVATION

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1. INTRODUCTION

The people of Papua New Guinea have been using wood for their houses, fences, carvings and tools, ever since they arrived in the country. Wood has been, and still is, the most important building material in this country. However, there has always been a struggle to make things made out of wood last longer. In this country, there are many different agents that destroy wood. Termites eat it, beetles bore holes in it, and fungi rot it. Usually, the wood must be replaced every few years.

For many years now, nearly all of the sawn timber produced by sawmills has been treated with preservative by the "Dip Diffusion Method." This treatment has saved the Government and private people a lot of money. It has protected the sawn timber in their buildings from termites, beetles and rot. We would now like to help the people of Papua New Guinea who use bush materials for their homes, to protect these materials from termites, beetles and rot as well. This book is to tell the people in rural areas how they can treat the wood in their houses so that it will also be protected.

There are many different methods of treating building materials to protect them. Some methods use equipment that is only available in a few parts of the country. Some use very simple equipment. They do not all do an equally good job. Some are better than others. Wherever you are, you should pick the method that is the best from those available to you.

Wood that has been treated by the methods in this book should last many times longer than wood that has not been treated. Lots of trees that cannot be used now, because they are quickly destroyed by insects or rot, can be used after they have been treated. They will then last as long as the best kind of untreated trees.

Read on through the rest of the booklet. If you find something that you do not understand, or want help in choosing the best wood, then contact the Forestry Department. You can either contact the Forestry Officer near where you live, or write to us at:

Bush Preservation
Forest Products Research Centre
P.O. Box 1358
BOROKO P.N.G.

Telephone: Port Moresby 256555.

2. WOOD DESTROYING INSECTS AND FUNGI

A tree is like any other living thing. It is always being attacked by various insects and diseases. It is attacked while it is growing in the forest and after it has been cut down.

In this manual we are not concerned with the tree before it is cut down. We are concerned with the things that attack the tree after it has been cut down. Because the tree is usually attacked as soon as it is cut down, it is important that it is brought out of the forest as quickly as possible. The longer that the tree lies on the ground in the forest, then the more it will be eaten by insects, or rotted away.

WOOD ROT:

Wood rot or decay is caused by very small plants called fungi. Like all living things, fungi needs certain things to grow. They need food, air and water. If we can keep any of these things away from the wood-rotting fungi, they will not grow. Let us look at them.

Food

The food that the wood-rotting fungi live on is the wood itself. As it eats the wood, the wood gets weaker and weaker until finally it collapses. The way to stop this from happening is to poison the wood so that the fungi can not grow in it. You do this by putting a preservative into the wood - that is what this book is all about.

Air

The fungi need air to grow. There is no simple practical way to keep air away from the wood in a building.

Water

This is very important. If the wood is kept dry, fungi will not grow. In P.N.G. it is very difficult to keep wood dry because often there is enough water in the air to let the fungi grow.

There are three things you can do about this and it is best if you do all three.

1. Build your house so that all wood stays as dry as possible.

2. Build your house so that if the wood does get wet, it can dry out quickly.

3. Treat all the wood with a preservative.

This is explained more in the next section, Building Practice. Here, it is enough to say that the drier you can keep the wood in your building, the less chance there will be for rot.

INSECTS:

Termites or White Ants

In the coastal areas of Papua New Guinea and in areas up to 1000 m (3000 ft) above sea level, termites cause a lot of damage to wood.

There are two kinds of termites.

. Subterranean Termites

These termites usually build nests away from your houses. Often their nests will be a mound built around a stump, up a tree or on a piece of wood, or their nest will be hidden underneath the ground. Sometimes they will build a nest inside a wall. These termites cannot live long outside in the sun, so they build little tunnels of mud to get from their nests to the wood they are going to eat.

You will see these little tunnels going up house stumps, along pieces of wood, or along brick walls. It is important to look under your house from time to time to try and find these tunnels. Whenever you find them, break them open and you will see the termites inside. Destroy all the tunnels that you can find.

Subterranean termites often build their nest inside wooden house stumps so you will not see any sign of them until the stump collapses.

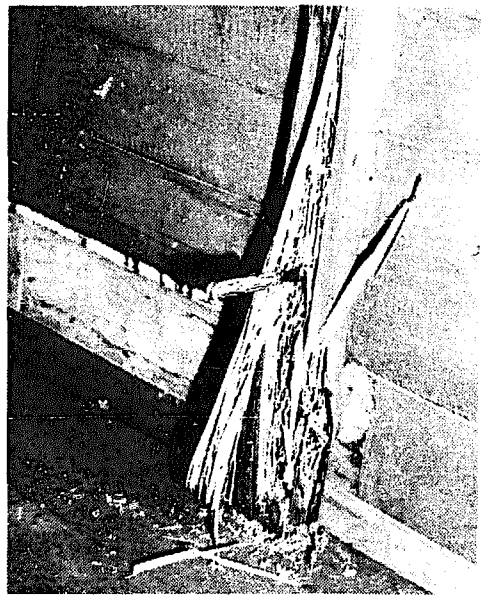
. Dry Wood Termites

These are termites that actually make their nests inside the wood they are eating. They do not build tunnels of mud and keep their nests well sealed, so you cannot see any holes on the outside of the wood. Often though, they will make a very small hole out of the wood at night. Through this hole they will push their waste (called frass). Before morning, they will close the hole again. This frass is made up of many small beads of "wood". If you see this on your floor or around your house, then you know that they are living in the house with you. Sometimes too you will be able to hear them in the wood.

FIGURE 1

Subterranean Termite tunnels running up a house stump

FIGURE 2



Drywood Termite damage in a stud.

There are two big differences between subterranean and drywood termites. The first is where they build their nests. The second is what preservative will stop them.

In this book we talk about two preservatives, C.C.A. and Octabor. C.C.A. will stop both kinds of termites, but for various reasons should not be used everywhere. Octabor will only stop drywood termites. You may be using a lot of Octabor, so it is important to keep on the lookout for subterranean termite tunnels.

. Sapwood-Eating Insects

There are two main types of sapwood eating insects or borers - Bostrychid or shot-hole borers and Lyctus or powder-post borers. Both types of borers attack only sapwood which contains starch. Most of the hardwoods have sapwood containing starch and will be attacked by these borers.

Hardwoods are trees with large leaves and which have flowers. The trees which never contain starch are conifers or cone bearing trees which have small leaves, often like needles. Wood from conifers is not attacked by these borers. Examples of conifers are Hoop and Klinkii pine.

Shot-hole borers will attack trees soon after they are felled. They seldom attack dry wood. These borers tunnel into the sapwood and lay their eggs in the tunnels. The holes they make are usually quite large and resemble holes made by shot-gun pellets - hence the name shot-hole borer.

Powder-post borers attack only seasoned (dry) timber. The adult bore[illegible] lays her eggs in small holes or pores in the wood. The larvae or small grubs which hatch out make tunnels along the length of the wood and pack these tunnels full of waste. Until the grub turns in[illegible] an adult there are no signs of any damage. The adult cuts its way out of the wood leaving a small round hole. This is usually the first sign you will see of powder-post borer attack and of course, by then, most of the damage has been done. The waste from both powder-post borers and shot-hole borers is a very fine powder, and not like the small beads produced by drywood termites.

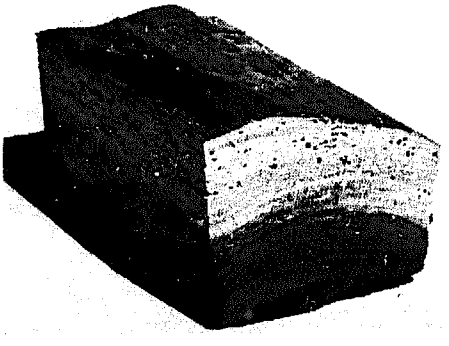
These borers eat only the sapwood and never eat the heartwood or true-wood. The sapwood, which is the outer part of a tree is usually lighter in colour than the heartwood.

All the preservatives talked about in this manual will stop these borers attacking wood.

Most of the damage to wood caused by insects in Papua New Guinea is caused by termites or these sapwood borers. The other insects are not so common and the treatment used against these will usually stop the other types of insects too.

FIGURE 3.

Damage Caused by
Sapwood Eating Beetles



3. BUILDING PRACTICE

There are many ways to make a building last longer. Wood preservatives will help a lot and this is what this booklet is mostly about, but it is also important to make the building last longer by good building practice. One of the most important parts of this is to keep the wood in the finished building as dry as possible. Some of the ways of doing this are:

. Use Wide Eaves (roof overhangs)

The wider the roof overhang is, the more it will protect the walls from getting wet. It will also keep the sun off of the walls so that the house will be cooler. An overhang should never be less than 600 mm (2'0") and is much better if it is 1000 mm (3'0") or 1300 mm (4'0").

. Protect Projecting Ends

Water gets into the end of a piece of wood much more easily than the side. So, any ends of bearers, joists, purlins, rafters or other pieces of wood that stick out and are exposed to the rain and sun, should be protected. You can do this by using a fascia or barge board nailed onto all of the ends, or you can simply project the roofing iron out over the ends of the rafters, or you can bring the wall siding down over joists. You can also make little caps of galvanised iron and nail them over the ends of the pieces of wood. A final method is to paint the ends with a water repellant preservative and paint or tar. Any of these methods will help to stop water from getting into the wood and making it rot.

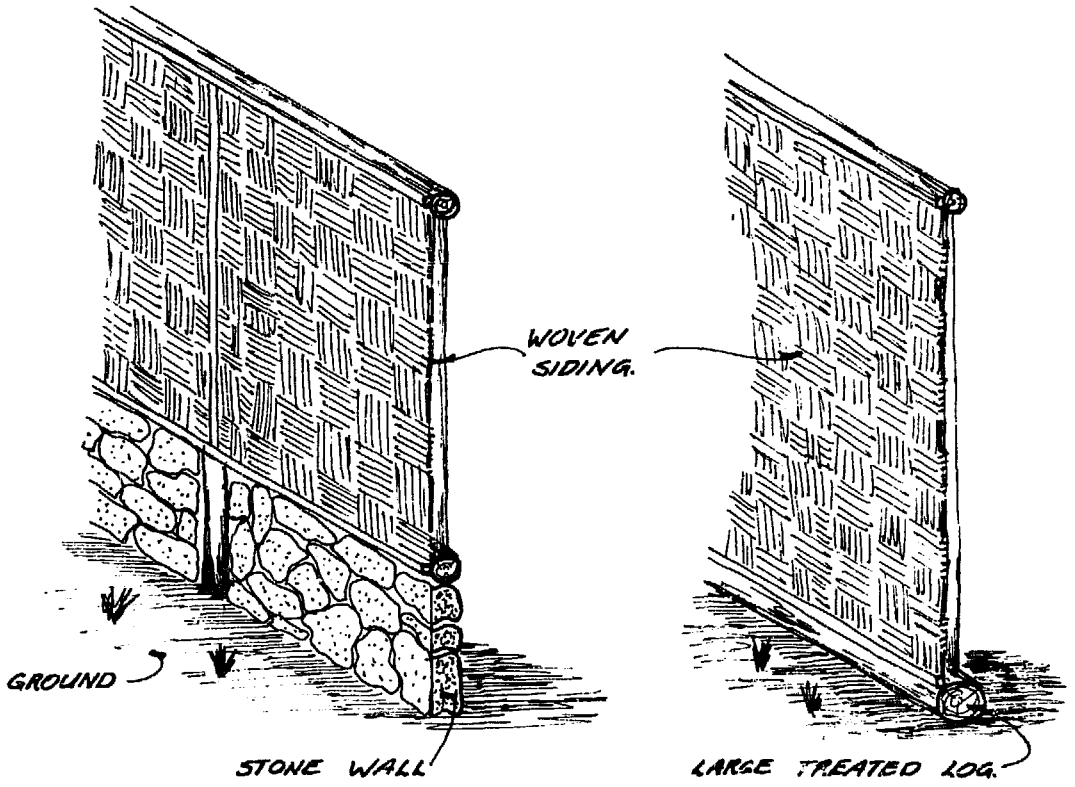
. Protect Pole Ends in the Ground

When you put a pole into the ground and the ground is wet, the pole also becomes wet. The chemical treatment will help the wood resist rotting, but if you can keep the wood dry as well it is even better. The best way to do this is to paint the part that is going into the ground with tar or bitumen. Use the same staff that is used on the roads. Just melt some and paint it on. You should do this to all poles going into the ground.

. Keep Wall Lining or Siding Clear of the Ground

Because lining is usually made of thin material like bamboo, pitpit or thin weatherboards, it rots more quickly than large pieces of wood. It is more important to keep it away from the ground, so that when it does get wet, it can dry off easily. If you are building a house on a concrete slab or with an earth floor, it is a good idea to build a wall of bricks or stone around the edge up to a height of 600 mm (2'0"). You can also lay a large log that has been treated by sap replacement, on the ground. Then start the bamboo, pitpit or weatherboard above this. This way the siding will not get as wet and can dry off better. The picture shows you how this can be done.

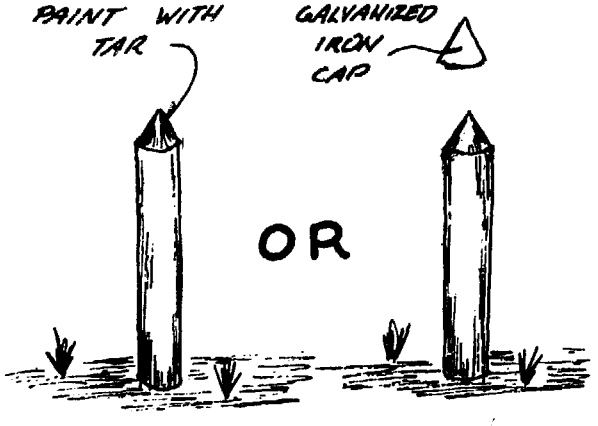
FIGURE 4



If you are building a house on stumps above the ground, the siding will already be above the ground so a wall of brick or stone will not be needed.

Cap Fence Posts and Outside Poles

The top end of a pole that is exposed to the rain, usually will let water into the wood. This is because there are usually small splits or cracks running in from the end, that the water can run into. If you want a fence post to last longer, it is a good idea to sharpen it to a point at the top. If you want to protect it even better then after you have sharpened it you can paint the end with tar, and/or nail a galvanised iron cap over it.



Choosing the Right Wood

Papua New Guinea has many many different kinds of trees. The wood from these trees is different too. Some will last a long time and some will not. If you are using a wood that is lasting a long time then do not bother treating it, just keep on using it the way you have been.

If you do not have any long lasting wood, then you should treat your wood. Some treatment methods will treat all kinds of wood, others will only treat some kinds. This is explained in the section of this book that describes all the treatment methods. It is important to choose the right wood, so read that before you choose your wood. Soaking or Diffusion will treat any wood, so you can use whatever you like. But for sap replacement the wood must have a wide ring of sapwood. This is explained later on under sap replacement.

Space Flooring

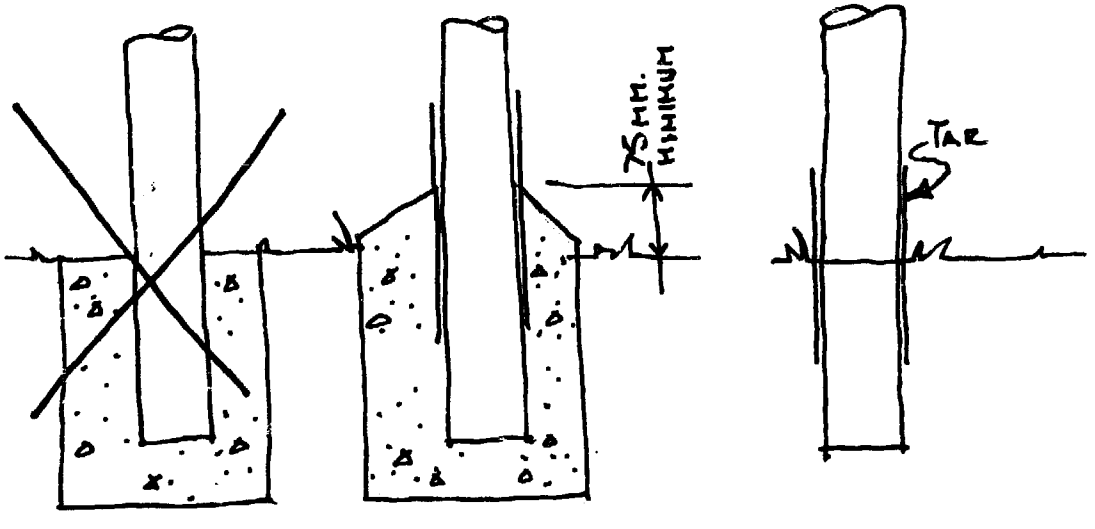
If the wood is wet all the time, it will rot quickly. For a floor that is going to get wet often it is very important to leave a small space between the boards to let the water run out. A space, 5 mm (¼") wide will do very well. You should do this on all verandahs. It is also a good idea in shower rooms. If you want to wash the floor in the rest of your house often, then you should leave spacings in the floor, everywhere in the house. When you put spaces between the boards, do not use tongue and groove flooring.

Protect Ground Line of Posts and Poles

Rot is worst at the ground line of a post or pole. The "ground line" is that part of the post or pole 150 mm (6") above and below the ground.

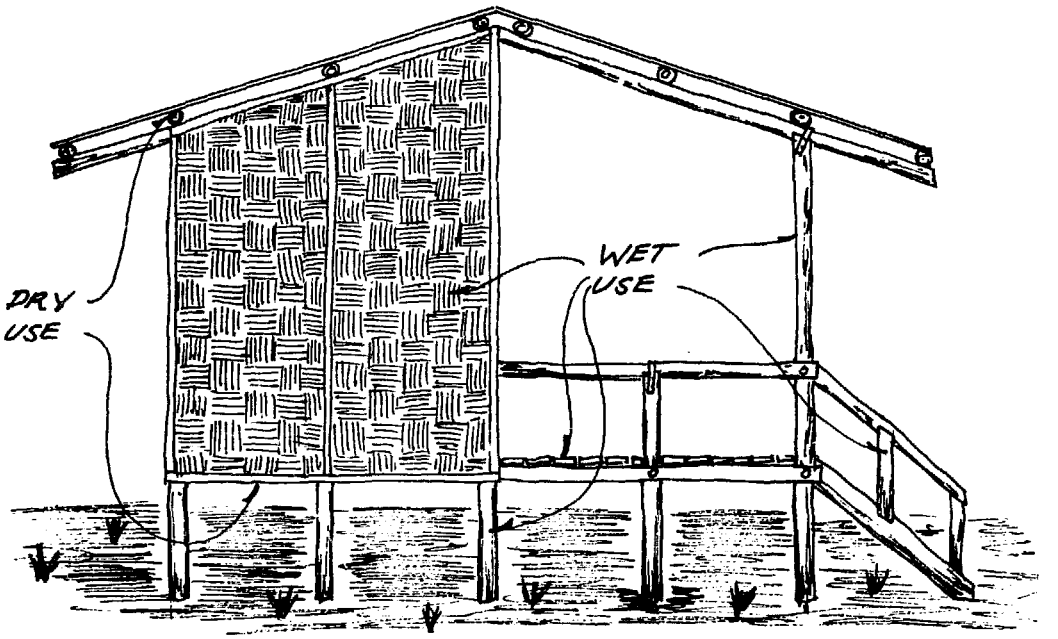
Whether the pole or post is treated or not, you should paint the ground line zone with hot coal-tar to protect it. If the pole or post is set in concrete you should bring the conrete to at least 75 mm (3") above the ground and shape it so that water will run away from and not towards the pole.

FIGURE 5



4. MATERIAL AND USES

FIGURE 6



When you are building something, you use wood in may different ways. Some is used in the ground where it gets wet, some is used inside walls where it stays dry and so on. Different uses need different ways of treatment. You must decide what method of treatment you need to use, to treat the wood you need. It is not difficult.

Firstly: Read the description below and decide what material you have and what use it is in.

Secondly: Look up the chart at the end of this section. The chart lists the different materials and uses. Find the one you want and then read across the chart. The numbers, show the best treatments. '1' is best, '2' is next best, '3' next and so on.

Thirdly: Look in the book in the next section on treatment methods and find out about the different methods that are recommended.

Fourthly: Decide which method to use. This will depend on what equipment is available where you live.

. Round Poles in Wet Use

This use is one where the pole normally gets wet, but not where it is actually standing in water. If a pole goes into the ground, or even touches the ground, it is in Wet Service. Some examples of Wet Use are house stumps, fence posts, verandah flooring, verandah joists and bearers, outside stairs and handrails.

. Round Poles in Dry Use

These are poles that do not usually get wet. They may sometimes get wet, but only by accident or by mistake. Some examples of Dry Use are, flooring, florr joists, wall framing, roof rafters and purlins.

. Marine Use

If you live on the coast then it is possible that your house is buitl over the sea on piles. Those piles and any other poles that are actually in salt water, are in Marine Use. It is very difficult to stop worms from eating wood that is in the water. Eventually they will eat almost any wood, no matter what it is. The method we recommend should make the piles last much longer. After you have treated the wood, the part that goes into the water must be painted with tar or bitumen. This will help the wood last longer.

. Cladding or Lining

The cladding is anything that covers the sides of the building. This includes inside walls, outside walls, ceiling and roof.

. Woven Bamboo

Woven bamboo is a wall cladding widely used in Papua New Guinea and is very good. To preserve this best, it should be treated before it is woven. Bamboo must be splot or flattened before treating. This is because the outside of the bamboo has skin that will not let the preservative in. Once you have split it, the preservative can get in from the inside, where there is no skin.

If you are going to put the bamboo on the oustide of a building, then it is in wet use. If it is only going on the inside of a house then it is in dry use. However, for a house where you will only need a small amount of each type, it would be easier to do it all one way. If you decide to do this, use the treatment for wet use as it is good in wet or dry use.

Summary of Treatment

Use this table to decide which treatment method you use.
For each material and use, the treatments are listed by preference.

Treatment Methods for Rural Areas

MATERIAL AND USE	TREATMENT		
	Sap Replacement	Octabor Diffusion	C.C.A. Soak
Poles in Wet Use	1	Not Suitable	Not Suitable
Poles in Dry Use	2	1	Not Suitable
Poles in Marine Use	1	Not Suitable	Not Suitable
Woven Bamboo in Wet Use	Not Suitable	2	1
Woven Bamboo in Dry Use	Not Suitable	1	1

Example.

. House Stumps

House stumps are in wet use. The best treatment method you can use is sap replacement. Other methods given here are not much use.

5. BUYING TREATED WOOD

Wood in the form of post, poles and sawn timber is treated by one of two processes by the Department of Forests, C.N.G.T. Bulolo and most sawmills. These processes are:

(a) Vacuum Pressure Impregnation, and

(b) Dip Diffusion.

Whenever you buy sawn timber you should make sure that it is treated properly by the sawmill by the Dip Diffusion Process. The Department of Forests and C.N.G.T. can sell you posts and poles treated with C.C.A. by vacuum/pressure. These two processes are briefly described below:

A. Vacuum/Pressure Treatment

This method can give very good results provided the timber is suitable. But, for three main reasons, it is not used very much in Papua New Guinea.

- The equipment is very expensive
- The person operating the equipment must be well trained. He must also be very careful or else the treatment will be no good.
- Many timbers in Papua New Guinea are difficult or impossible to treat by this method.

In this method the wood is put into a large cylinder and the door closed. Then, all of the air is pumped out of the cylinder and after a little while, the preservative is pumped in under pressure. The pressure forces the preservative into the wood.

At present there are only three pressure treatment plants operating in Papua New Guinea. If you live near one of these places, then you can buy treated wood from them. They are at the Forestry Station in Banz and at Forest Products Research Centre at Hohola, Port Moresby and at C.N.G.T. Bulolo.

B. Dip Diffusion

This is the method of preservation that is most widely used in Papua New Guinea. Almost all sawmills treat sawn timber by this method and the Government uses dip diffusion wood treated by this method in all its buildings.

In this method freshly sawn, still wet wood is dipped into the preservative. Then the wood is kept from drying out for 3 weeks so that the preservative can diffuse into the wood.

Wood treated this way will not last if it is put into the ground. However, it will last very well inside a building and when used as weatherboards, if they are painted or kept dry.

If you are buying sawn timber, you should make certain that you buy wood that has been treated by this method. Any wood treated by dip diffusion will have a brand mark on the end of it.

6. TREATMENT METHODS FOR RURAL AREAS

This part of the handbook will tell you exactly what to do to treat wood and bamboo by the different methods mentioned earlier. We have tried to make the instructions as simple and easy as possible. Please read them carefully. Before you actually start work, you should read the instructions at least twice. The preservative will only help the wood, if it is put into the wood in the right way. The instructions tell you the right way. Follow them. If you do think of a short cut, then tell us about it. If it is a good idea, we would like to know. If it is a bad idea, we would like to tell you, so that you do not make a mistake.

Some of you may have used Creosote before and you wonder why we do not talk about using it. We have thought about it, but at present in Papua New Guinea it is far more expensive than C.C.A. or Octabor. If you do want some information on using it, write to us and we will be happy to help you.

Just once last caution before you go ahead with treatments. The preservatives we are recommending - C.C.A. and Octabor - are deadly poisons to insects. They are also poisonous to people and animals. Please read the safety precautions carefully. Once you have read them, read them again. Then follow them!!!!!!! We do not want you to be poisoned.

. Safety Precautions in the Use of C.C.A. Wood Preservative

C.C.A. is very poisonous and should be kept out of reach of children, animals and anyone not connected with its use.

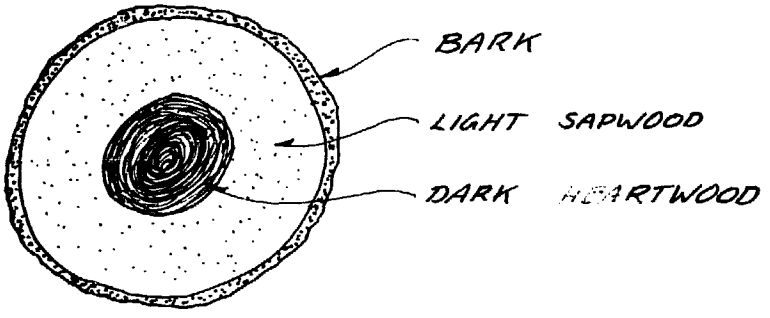
When C.C.A. is absorbed by wood it reacts chemically with the wood so that it is not washed out of the wood by rain. Because C.C.A. is held so strongly in wood, treated wood is not dangerous to people or animals and can be used for fencing and farm buildings and even animal feed troughs. However, certain precautions must be taken with C.C.A. preservative.

A. The Sap Replacement Method

When a freshly cut sapling is debarked and stood up in a bucket of preservative solution, the preservative is sucked up into it. This works because the green sapling is full of water and as the water evaporates out of the sides of the pole, the preservative is sucked in to replace it. It works the same way as a wick in a kerosene lamp which sucks up the kerosene as it is burnt in the lamp. Because this method of treating wood depends on the sap of the wood evaporating and because the sap is only in the sapwood and not in the heartwood, this method will only put preservative into the sapwood. This is important to remember for 2 reasons.

(1) This method will only work well for young trees - they are called saplings - that have a thick layer of sapwood, at least 25 mm (1"). If the sapwood is thinner than this, then the heartwood will not be well protected and may rot or be eaten by insects.

(2) Any cuts, or holes that are made in the poles may expose the heartwood that has not been treated. This can be attacked by rot and insects. To prevent this, all cuts into the wood and all holes must have some of the preservative painted onto them.



CROSS SECTION OF SMALL TREE

Sap replacement is used for round saplings which are put into the ground, or that are exposed to rain. This includes house stumps or posts, fence posts, bridge supports and flag poles. Because the wood will be getting wet, the preservative used must not be washed out by rain. The best preservative for this is a mixture of copper, chrome and arsenic salts, called C.C.A.

Materials Required

In order to treat poles, you will need certain materials. This is a list of these materials.

C.C.A. Salts

This is available as a powder, specially prepared for this and other treatment processes you can use. To estimate how much preservative you will need, use this table.

AMOUNT OF C.C.A. TO TREAT 10 POLES EACH 3 M (10') LONG

Diameter of pole	100 mm (4")	125 mm (5")	150 mm (6")	175 mm (7")	200 mm (8")
* Amount of C.C.A. for house poles	4.5 kg (10 lb)	7.5 kg (15 lb)	9 kg (20 lb)	13.5 kg (30 lb)	21 kg (35 lb)
* Amount of C.C.A. for bridge timbers	9 kg (20 lb)	15 kg (30 lb)	18 kg (40 lb)	27 kg (60 lb)	42 kg (70 lb)

* The minimum qunatity of C.C.A. which may be bought is 27 kg (60 lb) packed in a 20 litre (4 gallon) drum.

Remember: C.C.A. is a very poisonous chemical and must be used with great care. It especially must be kept away from children and animals. When not being used, it must be locked up, so that no one can accidentally get some.

Buckets, Tins

These should be about 600 mm (2ft) deep and 300 mm (1ft) in diameter. 18 litre (4 gal) kerosene or oil tins are ideal. Plastic buckets are also very good. As you can only treat one pole at a time in each tin, you will need a number of tins. For a house with 20 stumps, 10 would be a good number.

One, 200 litre (44 gal Drum)

The C.C.A. comes as a powder. Before you use it you must mix it with water. To do this you will need a large container. As long as it is waterproof, a 200 litre (44 gal drum will do very well.

Water

You will need water for two reasons. The first is to mix with the preservative, the second is to wash in. Because the preservative is very poisonous, everyone who is working with it must wash before eating or smoking and at the end of every day. A shower with plenty of soap or a both in a river with plenty of soap will do very well.

Plastic Sheet

There are many kinds of plastic that will do. "Visquene" building plastic, polyethylene and yellow coffee plastic all will do. This plastic is used to cover the containers of preservative to keep the rain out and to stop the preservative from drying out. If the rain gets in, it will dilute the preservative. The plastic will also help keep animals or small children from getting into the preservative. You will not need very much, a piece about 600 mm x 600 mm (2ft x 2ft) for each bucket will do.

Dip Sticks

These can be lengths of bamboo, pitpit or any straight branch. They should be about 1 metre (3ft) long. When you are treating the wood, they will be used to dip into the preservative solution to measure how much there is. You will need one for each bucket.

Saplings

This is what you are going to treat. Because they must be felled, debarked and put into the preservative solution the same day, do not cut them until everything else is ready.

Rubber Gloves

Because the preservative is poisonous and because it can burn the skin, you must wear rubber gloves when mixing it and when handling the newly treated poles.

When you have all the materials, you can start work. Please follow our instructions carefully. We will not tell you to do something without a good reason. We have made the process as simple and easy as possible. Any short-cuts will result in poor treatment so that the wood will not last as long or else be dangerous.

Prepare the Preservative Solution

This is done in the 44 gallon drum. The strength or concentration of the solution needed, will depend on what the poles will be used for. Use the table below to decide what strength you need.

USE	C.C.A. MIXING INSTRUCTIONS
House poles, fence posts, etc.	Dissolve one 9.1 kg (20 lb) bag of C.C.A. in 180 litres (40 gal) of water.
Bridge poles, marine service	Dissolve one 9.1 kg (20 lb) bag of C.C.A. in 90 litres (20 gal) of water.

The solution is made by simply putting the right amount of water into the drum and then slowly pouring the powder into it. When you are pouring the powder into the water, the mouth of the bag should be under water. This stops the dust from rising and being breathed in by you. Remember, the powder is poisonous and breathing the dust can hurt you.

You must then stir this until all the chemical has dissolved. There will probably be a little bit of muck that stays at the bottom; do not worry about this.

Cut the Trees

Select and fell only the number of posts which can be treated at one time. This will be no more than the number of buckets that you have. Cut the poles much longer than you need them and do not remove the bark until you have carried the poles to the place where the buckets are.

Carefully remove the bark from the saplings and cut 50 mm (2") from the large end of each sapling. Do not cut the surface of the saplings or damage it in other ways. If you require a post 3 metres (about 10 ft) long and the sapling is 5 metres (about 16½ ft) for example, do not cut the sapling to the required length yet.

Stand the sapling in the container (bucket or can etc.) with the large end down and fill the container nearly to the top with the preservative solution. The top of the sapling will have to rest against a tree or building. Make sure that the sapling cannot fall over and spill the preservative on the ground.

Turn the sapling halfway round in the container every day, so that all the surface gets even exposure to wind and sun.

FIGURE 7

FIGURE 8

Take a dip stick and dip it in the preservative solution in the container and mark the height of the preservative on the dip stick. Keep one dip stick for each container.

Tie a piece of plastic around the top of each bucket, as shown in the picture. The plastic sheeting will keep the rain out of the container, stop animals and children going near the preservative and will stop the preservative from evaporating. The treatment is now underway and the preservative is being sucked into the wood to replace the sap lost by evaporation.

Everyday, mark the height of the preservative left in the containers on the dip stick. When no more preservative is being sucked up by the saplings, the treatment is complete. This will be indicated when there is no change in the levels on the dip sticks. Make sure that there is always enough preservative in the container. If the preservative is sucked up quickly you will have to add more preservative to the container.

For small saplings, 120 mm (5") diameter and about 3 metres (10ft) long, treatment will take about 7 days. For posts greater than 120 mm (5") in diameter, treatment may take longer.

When no more preservative is taken up, remove the saplings and cut the top off so that the pole is the right length, then put the newly cut end back into the container and repeat the treatment.

This will give protection to the top end as well as the bottom end of the sapling.

When you cut the saplings to length, you may be able to see the preservative in the wood, if it has reached that height. If you can, the treatment has been very good. You should still reverse the sapling and treat the top end.

Before using in a building, both ends of the spaling should be coated with tar or bitumen, grease or paint. You should paint the part of the sapling which is to go into the ground with bitumen or coal tar, as this will give added protection.

If the poles are going to be used in salt water, then all of the pole that goes below the water line MUST be painted with the C.C.A. preservative and then with hot tar.

B. Octabor DIFFUSION OF POLES

This method is for treating poles in Dry Use, only. If the poles are going to get wet all the time, then you must use sap replacement with C.C.A. instead. Octabor diffusion is cheaper, safer and easier than sap replacement, so you should use it whenever you can. It stops insects and rot in dry use and is almost the same as the method used in most saw-mills in this country.

There are two important things to remember about this method.

(1) The wood must be kept dry after treating. If it gets wet, the preservative may wash out and the wood may rot.

(2) The treatment will only work on green wood. The poles must be cut and treated the next day. If you cut the poles and leave them for a few days, they may have dried out too much.

Materials: Before you can treat the poles, you will need certain things. This is a list of those things.

Octabor (Wood Preservative) - This comes in packages of 3.6 kg (8 lb). Each pack is enough to treat about 50 100 mm (4") diameter by 3 m (10ft) long poles. You must decide how many packages you need. The smallest amount you can usually buy, is 27 kg (60 lb).

A Small Mixing Drum or Can - You will be mixing up 18 litres (4 gal) of preservative at one time. A drum or can that will hold this much or a little bit more is just right. The drum must not leak and should not be rusty.

Plastic Sheet - This will be used to wrap up the pile of poles during the treatment. Because of this, you will need a big piece, big enough to completely cover all the poles, on top, underneath and on all sides. Take a look at the picture on the next page and then decide how big a piece to get. A piece 1.5 m x 20 m (8ft x 60ft) should do for most jobs.

A Paint Brush - This is for painting the preservative onto the poles. So that you can do it easily, you should get a big brush - 100 mm (4") wide. A home made brush is often just as good as one bought from a store.

Water - You will need water for mixing up the preservative and for washing after working.

When you have all these things, you will be ready to start. Please follow our instructions carefully.

INSTRUCTIONS:

Prepare the Octabor Solution - On the side of your mixing drum put a mark about where you think 13.5 litres (3 gal) of water comes to and another mark for 18 litre (4 gal). Then fill the drum up to the lower mark with hot water. (You can build a fire under the drum if you like). Now put in one 3.6 kg (8 lb) package of Octabor and stir until it is all dissolved. Finally add enough hot water to fill the drum up to the 18 litre (4 gal) mark.

Cut the poles - You must cut the poles and bring them to where you will treat them on the same day. The poles should be cut a little longer than you need.

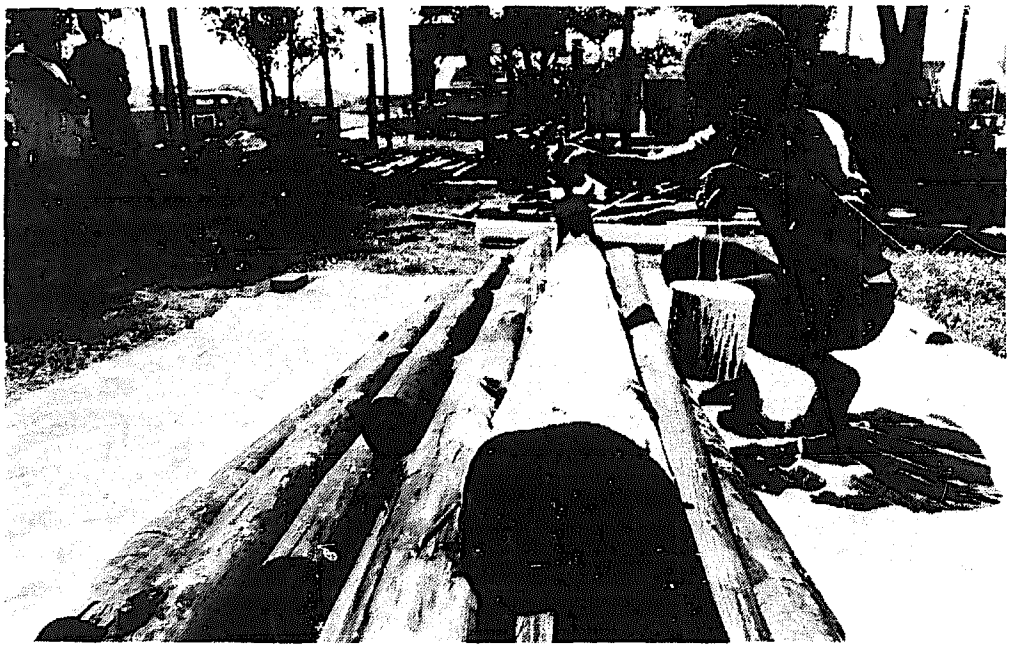
Remove the Bark - As the poles are brought in to the treatment site, they should be placed in a stack on bearers to keep them off the ground. When the bark is removed the debarked pole will often be sticky. Leave the poles (on the bearers) until the poles are no longer sticky, then paint on the Octabor solution.

Paint the Poles - Before painting, spread the plastic sheet on the ground near your debarked poles stack. Remember the plastic should be long and wide enough to stop your poles from touching the ground.

Now pick up one pole and as you transfer it to the plastic, paint it all over with the Octabor solution. Then pick up another and repeat until you have transferred all your poles to the plastic sheet.

It is a good idea to actually paint over the poles that are already on the plastic. This way, any preservative that drips, will just go on to the other poles. It is also a good thing if the preservative is still hot when you are painting.

FIGURE 9



Painting the Poles with Octabor Preservative

Build up a pile of poles, painting each one as you go. The poles should be piled as closely together as you can make them.

The whole surface of every pole must be painted. Make sure of this and put on a thick layer of preservative.

Cover with Plastic - Finally, when you have painted them all and they are all piled up, cover the pile with sheets of plastic. Put stones or pieces of wood on the plastic all around the edges so that no air can get into the pile.

FIGURE 10

Wait - Now the poles must be left alone so that the preservative can soak or diffuse into the wood. If the poles are 150 mm (6") or less diameter, leave them for at least two weeks.

If the poles are between 150 mm and 200 mm (6" to 8") in diameter, then they must be painted twice, once at the start and once again after one week. Just take the plastic off the top and spread it on the ground. Then restack and paint the poles on top of it. Then cover with plastic again and leave for another week.

If the poles are bigger than 200 mm (8") then they must be painted three times. Once at the start, again after one week and again after two weeks. After each painting they must be covered with plastic again and left for at least one week.

When the treatment is finished, the poles may have mould growing on them. This will brush off when the pole dries and will not damage it.

While the treated poles are waiting to be used, they must be kept dry to stop the rain from washing the preservative out. Leave the treated poles under the plastic sheeting if you do not need it any more.

C. C.C.A. SOAK OF BAMBOO

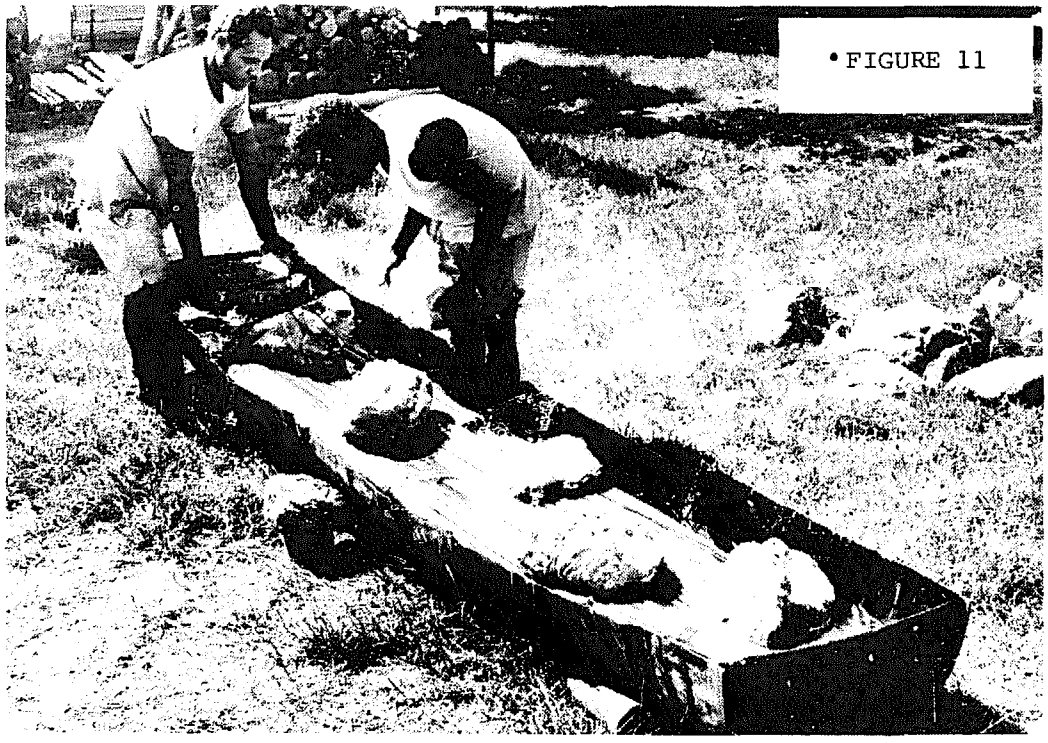
This method is for preserving woven bamboo that is going to be in Wet Use. That is, it will be on the outside of a building. If you are preserving bamboo for inside a house, you should use the Octabor Diffusion of Bamboo. It is simpler, cheaper method and will do a good job inside a house.

It is important when treating bamboo, to split it before treating it. Bamboo has a waxy coat on the outside and the preservative cannot go through this. When you split the bamboo, the preservative can soak into the wood from the inside. Remember this and do not try to treat the whole piece of bamboo.

Materials: Here is a list of the things you will need to get before you can treat bamboo.

C.C.A. Salts - This comes in 9.1 kg (20 lb) packages. One of these should make enough preservative to treat the bamboo needed to make a wall 15 metres (50ft) long by 3 metres (10ft) wide. You must decide how much to buy.

Soaking Trough - You will need a trough about 4 metres (13ft) long and big enough to hold plenty of bamboo. You can make a good trough by cutting 2, 200 litre (44 gal) drums in half lengthways and welding them together like a canoe as shown in the picture. You can cut the drums with a cold chisel and hammer, or with an axe. After you have cut the drums, you should flatten the edges with a hammer so that they are not so sharp.



• FIGURE 11

Putting Stones on the Bamboo to Hold it Under the Preservative

After you have welded the drums together, it is a good idea to paint the inside with tar or bitumen. If you do not do this, the preservative will make the drum rust very quickly.

A Mixing Drum - You will need a drum that can hold at least 180 litres (40 gal) of water. A 200 litre (44 gal) drum will do quite well. Put a mark on the side 760 mm (31") up from the bottom. When the drum is filled

to there, it will have 180 litres (40 gal) in it. You can also use a 18 litre (4 gal) drum to measure 180 litres (40 gal) into the drum and mark it that way.

Rubber Gloves - The C.C.A. Salts are very poisonous. Whenever you are touching the preservative, or bamboo that is still wet with preservative, you must wear these.

A Plastic Bucket - You will need a bucket to get the preservative from the mixing drum into the trough. One that holds 6 to 9 litres (1½ gal to 2 gal) will do very well.

INSTRUCTIONS:

Now you are ready to start. Please follow our instructions carefully.

Prepare the Chemical Preservative - Put about 140 litres (30 gal) of water in the mixing drum. Mix in one, 9.1 kg (20 lb) bag of C.C.A. preservative and stir until dissolved, add enough water to fill the drum up to 180 litre (40 gal) mark.

This gives you a 5% solution. That is , 10 litres contains ½ kilogram (1 gallon contains ½ lb) of preservative. For treatment of the bamboo, this concentrated preservative will be diluted with water to give a 2½% solution, containing 2½ kilograms of preservative in 100 litres (2½ lb in 10 gallons).

Split the Bamboo - As we said before, the bamboo must be split open before you treat it. You can do this in whatever way you usually do. After it is split, you may find it easier to handle if you tie the split bamboo into bundles before you treat it.

Fill the Trough - Put the bamboo into the trough. Only put enough in so that when you fill the trough up, all the bamboo will be completely covered with preservative. On top of the bamboo, put some big stones so that the bamboo does not float up.

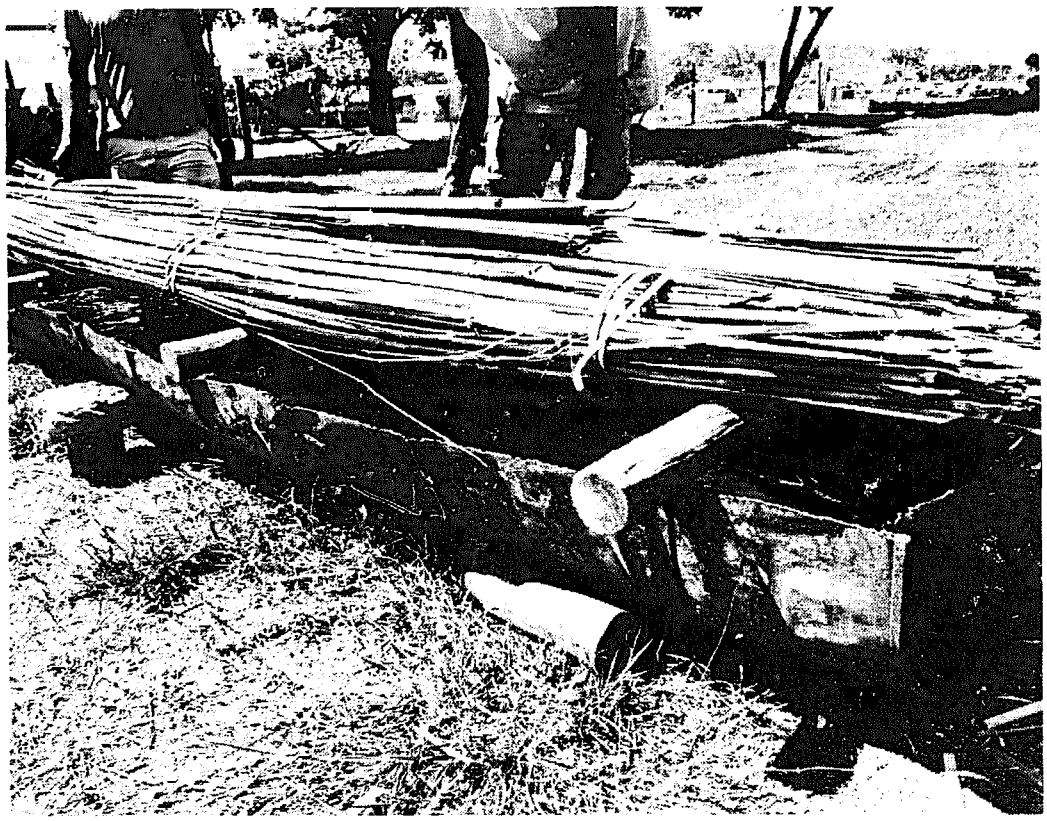
Now you must fill the trough up until the bamboo is all covered. Because the preservative you have mixed is concentrated, you must dilute it. So put one bucket of preservative into the trough and then add one bucket of water. Put another bucket of preservative and another bucket of water. Keep doing this until the bamboo is covered.

Wait 1 Week - The bamboo must soak for at least seven days, so that the preservative can soak in. During this time, you should cover the trough with plastic. This will keep the rain out and stop children or animals from poisoning themselves, with the preservative.

Remove the Bamboo - After 1 week or more, lift the bundles of bamboo up onto sticks laid across the trough and let them drain into the trough. By doing this you do not waste any preservative. After it has drained for a few hours, the bamboo should be set out to dry for a week or more. It is best to do this on a rack set up off the ground.

After the bamboo is dry, you can sue it in your house.

FIGURE 12



Bamboo Draining Over Trough After Soaking

There will always be bits and pieces of bamboo left over when you have finished weaving it. Do NOT burn these scraps. Bury them in the ground far away from wells and streams. A pit latrine is a good place to bury them.

D. Octabor DIFFUSION OF BAMBOO

This method is for preserving woven bamboo that is going to be in Dry Use, that is, it will not get wet. Bamboo for inside walls or for the inside lining of outside walls, can be treated this way. Bamboo that has been treated by Octabor Diffusion, can also be used on the outside of buildings, IF it is painted. If you want to use bamboo on the outside of buildings and are not going to paint it, the walls should be protected from the rain by wide eaves.

This method is almost the same as the C.C.A. soak. The biggest difference is that we use a different preservative. Octabor is much less expensive and not as poisonous as C.C.A.

You can put Octabor preservative into the bamboo by one or two ways. You can soak the bamboo in a trough of preservative. This is a good method, but you need a trough. The trough is the same as the soaking trough in C.C.A. Soak of Split Bamboo.

The other way is to paint the preservative on and let it soak into the bamboo. This is more work, but you do not need to make a big trough. The end result of both ways is much the same.

If you are only treating a little bit of bamboo, then painting is easier. If you are doing a lot, then it is worthwhile making a trough.

Materials: Here is a list of things that you will need before you can treat the bamboo.

Octabor Preservative - This comes in packages of 3.6 kg (8 lb). Each package is enough to treat about 500 lengths of 4 metre (12ft) long by 50 mm (2") diameter pieces of bamboo. If you are using a trough, you will need some extra, because some will be left in the bottom of the trough. You must decide how many packages you will need to buy.

A Small Drum or Can - You will be mixing up 18 litres (4 gal) of preservative at one time. A drum or a can that will hold this much or a little more is just right. The drum must not leak and should not be rusty.

Soaking Trough - If you are going to use a trough, then you will need to have one made. Read the instructions about this under C.C.A. Soak of Bamboo on Pages 48 and 49.

If you are going to paint the Octabor on, then you will need:-

Plastic Sheet - This will be used to wrap up the pile of bamboo during treatment. Because of this you will need a big piece, big enough to completely cover the bamboo on top, underneath and on all sides. A piece 1.5 x 10 m (8ft x 30ft) should be enough.

Paint Brush - This is for painting the preservative onto the bamboo. You will want a brush about 100 mm (4") wide.

Water - However you put the preservative on, you will need plenty of water, for mixing the preservative and for washing afterwards.

When you have all these things, you will be ready to start. Please follow our instructions carefully.

INSTRUCTIONS:

Prepare the Chemical Preservative - On the side of your mixing drum, put a mark about where you think 14 litres (3 gal) of water comes to and another mark for 18 litres (4 gal). Then fill the drum up to the lower mark with hot water. You can build a fire under the drum if you like. Now put in one package of Octabor, 3.6 kg (8 lb) and stir until it is all dissolved. Finally add enough hot water to fill the drum up to the 18 litres (4 gal) mark. This solution now contains 2 kg per 10 litres (2 lb per gallon). This is a 20% solution.

Prepare the Bamboo - The bamboo should still be green when you treat it. Cut the bamboo, bring it to where you are working, split it and prepare it as quickly as possible. Do not start cutting the bamboo until you have everything else ready.

Using the Soaking Trough - This is exactly the same as the C.C.A. soak, except using Octabor instead of C.C.A. You should read the section on C.C.A. soak of bamboo as well.

Fill the Trough - Put the bundles of bamboo into the trough. Only put enough in so when you fill the trough up, all of the bamboo will be completely covered with preservative. On the top of the bamboo, put some big stones so that the bamboo does not float up.

Now fill the trough up until the bamboo is all covered. Because the preservative you have mixed is concentrated you must dilute it. So put one bucket of preservative into the trough and then add three buckets of water.

Put another bucket of preservative and another three buckets of water. Keep doing this until the bamboo is covered.

Wait 1 Week - The bamboo must soak for at least seven days, so that the preservative can soak in. During this time you should cover the trough with plastic, this will keep the rain out and stop children and animals from poisoning themselves with the preservative.

Remove the Bamboo - After one week, lift the bamboo bundles up onto sticks laid across the trough and let them drain into the trough. See how this is done by looking at the photo in the section on C.C.A. soak of bamboo. By doing this, you do not waste any preservative. After it has drained for a few hours, the bamboo can be used straight away. The Octabor treated bamboo should be kept in a dry place under cover at all times.

It is important not to let this bamboo get wet. If it does, the water will wash out the preservative and your work and money may be wasted.

Painting the Octabor onto the Bamboo - Spread out the plastic on the ground and put a layer of bamboo onto it. The bamboo must be laid with the inside upwards. Paint the bamboo with the 20% solution of Octabor you have made.

Spread another layer of bamboo the same way, inside up. Paint it also with Octabor.

Keep spreading layers of bamboo and painting it with preservative until all the bamboo is on the pile. If this takes more than one day, cover the pile with plastic overnight.

Finally, when you have painted them all, and they are all piled up, cover the pile with sheets of plastic.

Put stones or pieces of wood all around the edge so that no air can get into the pile.

Wait 2 Days - After the two days are over, remove the plastic. The bamboo is now ready to use. It does not have to be dried, but should be kept under cover, out of the rain.

It is important not to get this bamboo wet. If it does, the water will wash out the preservative and all your work and money may be wasted.

Wasted Bamboo - There will always be bits and pieces of bamboo left over when you have finished weaving it. Do NOT burn these scraps. Bury them in the ground far away from wells and streams. A pit latrine is a good place for the scraps.

E. THE USE OF WATER REPELLANT PRESERVATIVE (W.R.P.)

W.R.P.'s are specially prepared mixtures of a fungicide, resin and wax in an organic solvent. When dry timber is dipped in a W.R.P. or the W.R.P. is painted on the cut end of a piece of timber, it is sucked into the timber for a short distance. The solvent evaporates, leaving the fungicide, wax and resin behind. If you can do it, dipping the wood for about three minutes is better than painting the W.R.P. on.

The wax and resin help to seal the pores in the wood and stop water from soaking into the wood. The fungicide will prevent rot starting in the cut end where the W.R.P. was applied.

The W.R.P. will also help prevent splitting of the wood from the end, due to swelling and shrinking.

Because of these properties, W.R.P.s should be used on all cuts in all external weatherboards, facia boards, window joinery etc., even after normal preservative treatment is applied.

The method of using a W.R.P. is to dip the cut end of a weatherboard, facia post or pole in a bucket containing the W.R.P. for about 3 minutes, remove and drain the excess W.R.P. back into the bucket.

When cuts are made in the timber already in a building, especially when the cut part is on the outside, exposed to the weather, the W.R.P. can be brushed on to the cut surface.

W.R.P.s will burn like petrol and are also very poisonous to humans and animals.

Care should be taken to keep W.R.P.s away from children, animals and fire. If some is split on your skin, you should wash immediately with soap and water. If you do not wash properly, it can become infected. The best way is to be very careful and not spill the W.R.P. on your body and, if you do, to wash it away immediately with soap and water. If you are painting on the W.R.P. you should wear rubber gloves. These will protect your hands.

W.R.P.s are sold under different names. Some that are made in Papua New Guinea are Hicksons XJ, Taubmans "Rentokil".

APPENDIX 1

THE CHEMICAL PRESERVATIVES

Preservative	Components	Minimum pack size	Cost (app) March '74	Use
C.C.A.	Copper sulphate, sodium dichromate & arsenic pentoxide.	27 kg (60 lbs)	K 20	Treatment of all materials in wet use.
Octabor	$Na_2B_8O_{13}$ as a mixture of Borax/Boric acid (1 mol to 4 mol)	27 kg (60 lbs)	K 15	Diffusion treatment of rafters, framing and bamboo
Dip Diffusion Salts, (Formula 7 Timber Dip)	Borax/Boric acid/arsenic pentoxide/sodium flouride & sodium dichromate.	Used by sawmills only. Not available to the general public.		Diffusion treatment of all sawn timber.
Water Repellant Preservative Hicksons XJ	Tri-butyl tin oxide, wax, resin, solvent.	1 gallon	K3.50	Sealing cut ends of treated timber.
Taubman's Rentokil	Tri-butyl tin oxide, penta-chlora phenol, wax, resin, solvent.	1 gallon	K 7	Sealing cut ends of treated timber.
Taubman's Ranch Finish	Tri-butyl tin oxide, penta-chlora phenol, wax, resin, solvent.	1 gallon	K 7	Sealing cut ends of treated timber.

APPENDIX 2

Obtaining Wood Preservatives

All the preservatives recommended in this booklet are prepared in Papua New Guinea by Hicksons Timber Impregnation (N.G.) Pty. Ltd.* and may be obtained directly from this Company or through the office of the Department of Forests, in your area.

* Koppers P.N.G. Ltd (formerly Hicksons)
P.O. Box 682, LAE

Seagull Street
LAE

Telephone LAE 422993

APPENDIX 3

"Antidotes" for Wood Preservatives

C.C.A.: C.C.A. has a very bad taste and will burn the mouth if someone tries to drink some. It is very poisonous and if someone drinks some C.C.A. preservative, they will die, unless they receive immediate medical attention.

If someone does drink some C.C.A. or Octabor preservative, first make them drink lots of water and then encourage them to throw up (vomit) by placing your fingers down their throat. Then make them drink more water and throw up again. Do this at least three times. If you have milk, use this milk instead of water. (If the person does not vomit easily, then do not waste time, but start moving to the hospital, try to make them vomit some more).

Take some of the preservative and this booklet with you to the hospital so that the doctor will know exactly what has happened.

If someone drinks some preservative and gets immediate attention from a doctor, he will probably be all right.