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FORESTRY FOR SUSTAINABLE DEVELOPMENT: TOWARD THE 21ST CENTURY

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SUMMARY

Sustainable development could be considered as economic development in perpetuity because it is based on the exploration and exploitation of both renewable, non-renewable and land resources with little or insignificant environmental damage. The concept of sustainable development has been analysed in various ways, for instance in 1987 under the title "Our common future", the World Commission on Environment and Development asserted that "Humanity has the ability to make development sustainable to ensure that it meets the needs of the present without compromising the ability of the future generation to meet their own needs". The concept of sustainable forestry development has a limitation imposed by the present state of technology and social organisation on forest resources, and by the ability of the biosphere to absorb the effect of human activity. Therefore, forestry development that will enjoy sustainability in the next century and thereafter must be three dimensional; Development must not damage or destroy the basic life supporting system of planet earth: the air, water, soil and Biological system, (CO_2 emission, siltation, and Habitat destruction respectively), nor should they degrade tile natural resources on which human economies and social activities depends. Secondly, it must be able to provide for continued flow of goods and services derivable from the forest all through and in a continuous and steady rate without the resources being depleted. The third dimension of a good forestry project for sustainable development is that there should be a sustainable social system both internationally, nationally, locally and at family level. This system must ensure equitable distribution of the benefit of such goods and services produced.

Thus this essay has tried to address the Challenges of Forestry for sustainable development and suggests what can be done to achieve the goal in the quickest time possible. The need for research and development, extensive afforestation, reforestation, biodiversity Conservation, Information exchange, Reduced Deforestation and many more are advocated for.

FOREST AND FORESTRY

A non forester views forest as vegetation dominated by woody species in open or closed canopy from which grasses are virtually absent. This ascertion is an underestimation of what forest looks like. One can thus affirm that a forest is a renewable natural resource 1 which provides timber and other non timber products for home and industries, food and cover for wild and domestic animals, protection of soil and water value and other facilities for recreation. The science which deals with the theory and practice of the whole constitution, management and rational utilization of forest resources for continuous production of goods and services required for human existence is known as Forestry. Management in Forestry requires the application of Business methods and Technical forestry principles with its techniques in order to ensure efficient working of forest properties.

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BENEFITS OF FORESTRY

Forestry for sustainable development2 both in the past, present and the 21st Century can not be discussed freely without highlighting in detail the benefit derivable from Forest as a renewable resources. The benefits can be grouped into four major divisions. They are the Timber Products, Non Timber Forest products, Forest protective and Regulative services and its socio-cultural services.

Forests are reservoir of diverse and invaluable wood resources useful to mankind, For example *Lophira alatu* is referred to as iron wood due to its hardness, and strength properties. The Timber resources of Forest both logs, Post and Poles contribute immensely to the economic development of each Country and the world as a whole. They are used for construction, furniture, tool handles and interior decorations. Though its contribution to the Gross Domestic Product (GDP) of each country is not well documented but can not be over emphasized. Since the natural forest3 can no longer meet the demand for wood, attention are now directed towards Plantation Forestry4, ITTO (1993) reported that Tree Plantation do not satisfactorily substitute for natural forest, neither the products readily grown, nor the services provided match those of the rich and diverse woody ecosystem of the Tropics5, but Plantation Forestry has an important complementary role in Tropical forestry which can help relieve some of the pressure causing deforestation. *Table I* shows the area of Plantations including woodlots in the tropics and hotter sub tropics of the world as an evidence of complementary role of plantation in sustainable forestry.

Though timber supplies of the forest are catogorised as the major6 products of the forest, the so called minor7 forest products, which have always been neglected by the scientist are now becoming the major produce in most parts of the world. The non timber forest products (NTFP) have diverse range of products that is beneficial to human race. Non wood products from the forest represent an important, though underestimated part of the economy of many developing countries. Hundreds of millions of people depend, on the forest for food, medicine, raw materials and income (Spore 59 1995) derivable from non timber forest products. These non timber products range from fuelwood, pulp wood, gums, oils, rising, medicinal plants, wild food species, to some ferns and dyes. In India alone, between 1986 - 87 the estimated consumption of fuelwood was 235 million m^3 while the demand for wood for all other uses put together was only 30 million m^3 (lTTO 1993). *Table 2* shows the current production and employment in collection of some Non Timber Forest Products in India as at 1993. There are fodder and green manure for *In - situ* grazing, bamboo and canes are in great demand now to produce paper, rayon and other forms of construction together with interior decorations. Essential oils and juice are produced from flowers, fruit, leaves and bark of some plants like *Madhuca indica* (Mahua) *Azadirachta Indica* (Neem) *Shorea robusta* (Sal) *Pongamina Pinnata*, *Chrysophyllum albidum, anarcardium Occidentale* to mention few. The oils produced are useful industrially for soaps, cosmetics, medicine and pharmaceuticals. The juice extracted from *Chrysophyllum and Anarcardium* have been found to be anti cancerous and rich in vitamins respectively. The gums from tropical hardwoods, together with resins from the temperate tree canals are highly beneficial to chemical, food and beverage industries.

The contributions of non timber forest products (NTFPs) to the development of humanity are so numerous that comprehensive account of them all can not be presented once, for instance, it has been said that there are between 5 - 30 million species of both Wild flora and fauna in the world out of which only about 1 - 4 million have been identified and described (Amubode 1995). The potential of the described ones have not even been ascertained. Spore 59 of 1995 described the richness of a forest with respect to hunting, nutrition, medicine and income generation, it was then concluded that threatening or driving these resources into extinction means that lives of millions of people are

also threatened.

Forest acts as the protector of ugly landscape, the soil against erosion, control the Temperature, acts as carbon sink and induce the micro-climate around forest environment, thereby resulting in purification of the environment. Trees on a hilly area can induce rainfall, thus prevent drought, desertification, siltation of dams, manage effectively the water sheds and the wetlands. Trees sustain nutrient recycling and increase soil fertility through humus production from leaf fall. This is more noticed in an agro forestry farm where the *Leguminosae* are more abundant. Forests are crucial for agriculture in the area of land use, planning, integrated land use, and shifting cultivation of farming, especially in the tropics where the land is believed to be poor generally, relative to the Temperate forest ecosystems.

Forests generate employment opportunities under socio cultural services. Varying age groups are involved in forestry activities all over the world. The employment opportunities in forestry are so vast and numerous, but data on a world level is yet to be made available. Forestry activities range from tree establishment and tending operations, wood harvesting, processing, pulping, collection and utilization to other indirect services which can not be exhausted, such as transportation, sales and marketing of forest produce etc. A lot of industries with large numbers of employees are depending on the forest for their sustenance for instance Sawmills, Furniture and other wood processing industries are relying on the forest for raw materials to ensure sustainable production. The rural populace which accounts for more than 50% of the world population are majorly depending on the forest for their survivals.

OVERVIEW OF THE WORLD FOREST RESOURCES

Tropical forests being one of the major forest types, are found in more than Eighty (80) Countries and account for roughly one third (1/3) of the world forest cover (WRI 1992). This forest type is found under diverse environmental conditions from lush, constantly wet rain forest, to arid thorn woodlands.

Tropical rain forest flourishes in the high temperature and humidity of the low latitude 011 either side of the equator between latitude 23 1/2° North and South of the equator. They are represented by three fluoristically diverse formation, which are, The American formation found in the Amazon drainage basin of Brazil and along the Andean foothills, extending northwards through Panama, Costa Rica and Eastern Central America. The indo malaysian formation account for about thirty percent (30%) of the tropical forest, mostly fragmented and dispersed throughout the Island of Malaysia and the Philippines. Asian monsoon forest and drier deciduous woodlands separate the evergreen forest of the Malay peninsula, Myanmar and Thailand from those in the coastal region of Cambodia and Vietnam. The forests of Sri Lanka and Western India are similarly isolated from the main region. The formation reaches its southerly limit in eastern Queensland (WRl 199 ,). Most of the forested area in the African formation of the tropical ecosystems occur in the Congo basin of Northern Zaire, US eastern limit is essentially the African rift zone, the forest reaches Guinea coast in the west where it becomes restricted to the Southern part of Nigeria, Benin Republic and Togo. The dryer climatic condition usually referred to as Togo - Dahomoy gap separates the forest of Ghana, Cote d'Ivoire, Liberia and Sierra-Leone from the rest of African formation. The relics forest of eastern Madagascar are also recognised as part of this formation (IUCN 1992).

Other major forest ecosystems of the world are the temperate forest, coniferous forest, boreal coniferous, temperate deciduous forest, tropical savanna mountainous grassland, desert and the tundra forest. The coniferous forest occupies the upper part of the Northern Hemisphere stretching over parts of Canada, the United States. Scandinavia USSR and China (Tariq Hussain 1989). Further

South as the climate gets warmer, the needle leafed conifers give way to broad-leaved trees like *Oak* and *Beech*. Large areas of the United States, Europe, USSR and China are covered by deciduous broad-leaved forest whose trees shed their leaves with the onset of the colder season. temperate conifers and deciduous forest are distributed as a complex mosaic (Tariq Hussain 1989) rather than as two distinct bands, because high altitude has vegetation similar to high latitude. Temperate conifers grow in hilly and mountainous area well south of their normal range, thus adding to the mosaic effect in upper tropical latitudes. The arid or semi arid lands of Northern Africa, Asia and Latin America are covered by Savanna Woodland in which trees are widely scattered over grassy plains.

The extent of the world forests can not be strictly determined because of high rate of deforestation and vegetation loss through shifting cultivation and climatic changes by environmental degradation, but Tariq Hussain 1989 reported that closed forest cover 2.8 billion hectares or 21 percent of the Earth's land surfaces. This figure should be treated with caution for estimate of open woodland areas are highly uncertain and the actual tree density in such area is often very low.

CHALLENGES OF FORESTRY AND SUSTAINABLE DEVELOPMENT IN THE 21ST CENTURY

Sustainable development implies the continued maintenance of the quality of the forest in terms of its standing volume and the dynamic equilibrium between various biotic and biotic components, and genetic diversity while at the .same time harvesting a sustained yield of economically valuable products. For this to be possible, a lot of problems militating against forest ecosystem8 worldwide must be solved or reduced before or in the 21st Century. The problems hindering the sustainability of forest resources must be viewed from the perspective of the internally agreed criteria for sustainable forest management. They are, the extent of forest resources, health and vitality as provided by and for the forest, its biological diversity, productive functions, protective and environmental framework, development and social need and the legal, policy and institutional framework of forestry. The problems as identified with respect to the criteria for sustainable forest management revolve round population pressure, deforestation, lack of information, poor technology, inadequate evaluation and assessments, awareness and neglect from the constituted authority.

World population keep on increasing geometrically tile effect of which is showing on the world forest. Due to increase in population and infrastructural development, millions of hectares of forest are cleared annually. Estimates indicate that there are a lot of pressure on the land as a result of effort to satisfy human wants and increase per capita income. More than 200 million landless people have migrated into tropical forest in recent decades and the number keeps on increasing, (Spore 59 1995).

The practice of agriculture both in the tropics and other areas is also posing a threat to forest survival since there is no adequate and proper land use planning. Farmlands tend to loose their fertility and degrade very fast. Farmers who cultivate land can no longer give it time to fully recover, nutrient and organic matter in the soil are being depleted, all as a result of pressure on the land as a result of population growth which eventually brought about land hunger. The forests are recklessly and wickedly destroyed to salvage peoples thirst for farmlands and other social infrastructures. An example is the destruction and conversion of the strict Nature Reserve 4 (SNR 4) in Nigeria to a University Campus. Estimates have shown that 17 million hectares of forest are lost annually due to clearing for cultivation. (ITTO Vol.3 No.5 1993).

Unplanned land use can result in erosion of the forest which can as well be responsible for up to 80 percent loss of a forest estate. The rate at which the world is losing her forest is shown in the

discussion of Gerald O. Barney 1978, where he said that world forest area in 1950 was 4.85 billion hectares excluding woodland, shrubland, savanna and all areas where tree crown cover is less than 20 percent of the area together with land which has a primary use other than forestry. This forest diminished in 1973 to 2.66 billion hectares. He went further to affirm that by the year 2,000, the forest which covers only one-fifth (1/5th) of the land surface will be reduced to one-sixth (1/6th) of the earth surface and by the year 2,020 (i.e. 20 years into the century of focus) the closed forest will be reduced to one-seventh (1/7th) of the land surface unless the situation is arrested.

Deforestation is another principal problem militating against the sustainability of forestry. This change in land use causing depletion of tree crown cover to less than 10 percent leads to changes within the forest class (from close to open forest) which negatively affect the stand or site and in particular lower the production capacity of the forest, thereby reducing forest ability to support sustainable development.

The timber resources of the forest come from the natural vegetation and plantations established by forestry authorities and free areas9 from different parts of the world but deforestation has taken its toll on them as a result of demand and over exploitation of timber resources without due consideration for the regenerative capacity of the forest, and the principle of sustained yield, to the extent that some of the timber species has reached near extinction.

Forest degradation as a result of deforestation ignites a lot of problems for human existence and the problem if unchecked can cause further ecological problems leading to human extinction. Forest clearing due to logging, land degradation resulting from shifting cultivation social and economic development, range10 depletion as a result of overgrazing, project execution without environmental impact assessment (EIA) leads to climatic changes, global warming, loss of biological diversity pollution and desertification. The tropical forest ecosystem which has been described as home to more than half the earth's species (Spore 59 1995) has been disappearing at the rate of tens of thousands of square kilometers per year. Over this period, tropical deforestation rate increased by more than 50 percent and the world lost 10% of its tropical forest.

Loss of biological diversity is another major area of` concern in forestry for sustainable development. Countless plants and animals have been driven into extinction through deforestation, thus contributing to the build up of green house gases. Biodiversity is a comprehensive word for the degree of nature variety including both the number and frequency of ecosystems, species and genes in a given assemblage (Mc Neely 1988). Biological diversity is a word which embraces both species richness and genetic diversity of an ecosystem, both of which are threatened. Throughout the world, species extinction and a reduction in genetic variability is taking place at rates never before witnessed, especially in the tropical forests which are often thought of as being the richest area. These losses can be attributed to various factors including pollution, physical disturbance of the forest, exploitation for food and other uses, deliberate extirpation, habitat loss and fragmentation.

We owe our existence on earth to carbon dioxide spewed out by volcanoes before life began. The gas stabilizes temperatures at levels suitable for organic life but in the last 150 years there is increasing green house effect and the earth is getting warmer. The atmosphere concentration of carbon dioxide has increased by 26% (Houghton et al 1990) 35% of which is estimated to have come from changes in land use, largely deforestation. The atmosphere carbon dioxide is presently rising at 0.4% to 0.48% annually faster than at any time in the past 500 million years. Therefore if no immediate counter actions are taken a doubling of atmosphere carbon dioxide is expected to occur between the year 2,025 and 2,050. The green house effect causes major ecosystem change leading to loss of biodiversity and therefore affecting carbon sequestering systems which reduce interspecies competition in high diversity forest and causing extinction of some species.

THE WAY FORWARD

The authorities of forestry the world over must concern themselves about the idea of increasing the forest in order to meet the target of sustainable development. There is the need to have a stable global climate for the enhancement of sustainable development in decades to come. This can be made possible by reducing carbon emission in accordance with the recommendations of the United Nations and the Conference on Environment and Development (UNCED). Currently the world's forest as reported by Houghton 1993 contain about 75% of the living carbon held in the terrestrial ecosystem and their destruction contributes about 25% of current human emission of atmospheric carbon dioxide, but the most realistic ways of removing this accumulated carbon is through the action of trees. Therefore reforestation and afforestation are the best ways of removing significant amounts of carbon dioxide from the atmosphere.

Plantations have many positive functions including high level of timber production, erosion control and the rehabilitation of degraded land. Schroeder et al 1993 considered a net expansion of world forestry area of 20 million hectares annually between the year 2,000 and 2,040 as feasible. They propose a forestry programme that would include reducing deforestation by 10 million hectares annually through increasing sustainable agricultural practices in the tropics to lessen the pressure on the forest and better forest management. An annual increase in the implementation of agroforestry of 5 million hectares annually, reforestation and afforestation of boreal land of 2 million hectares per year and of both temperate and tropical land of 3 million hectares per year, Restoration of 10 million hectares per year of degraded tropical land and l million hectares per year of both degraded boreal and temperate lands. It may also be possible to reduce the cost of establishing plantations through agro forestry programmes carried out in cooperation with the rural population.

When forests are converted to other uses, especially tropical forest, biological diversity is dramatically reduced. A lot of wild flora and fauna resources are threatened and some extinct. In most countries, protected reserves do not exceed about 5 percent of national territory and individual countries must be made by all the countries to meet the minimum target of reserving 25% of their national territory in order to prevent genetic erosion that has crept in through deforestation.

Currently the changes in chemical composition of the atmosphere and climate are occurring within a frame which will be shorter than an average tree lifetime. This will prevent biological diversity (genetic, species, ecosystems) from having the necessary time to move or adapt naturally. Also, if there is significant global warming, its effect alone can lead to permanent loss of rain forest due to increased equatorial aridity. Hence measures to conserve the biological diversity will be most effective if only they are consistent with the self interest of local people for its conservation and sustainable use are heavily influenced by social, cultural economic attitude and the condition of the rural populace.

Focusing only on timber production as an approach to forest management is no more appropriate to sustainable development. Thus attention should be directed to non timber forest products too. Products such as *rattan, resin, medicinals* and the like could be conserved ex-situ if their in-situ conservation is difficult.

Common environmental problems can best be addressed by information changes. Indeed the earth summit (UNCED) process has led to a greater recognition of the need for science based information in the formulation and identification of the course of action on such issues. Therefore science based information for policy making and vital connection between science and humanity should be firmly recognized in the 21st century to ensure sustainable forestry for development.

There is also a pressing need for researchers to develop tools that can translate the abstract concept of sustainable development into an operational reality. it should centre on the impact of different logging intensity, rotation cycle, integration, availability, diversity and sustainability of

non timber products with timber production and conservation of biological diversity under specific ecological and socio-economic conditions.

The current issues relating to forestry and sustainable development for the remaining part of this century and in the 21st century can also be seen as requiring response to questions which are within the domain of science and technology. For instance, attention must be directed by the research scientist to the area of tree breeding and their genetic improvement more than before, agroforestry technology as a substitute for destructive agricultural practices, wild life breeding, domestication and ranching both in captivity, game reserves and national parks as a means of protecting them.

Building a sustainable future depends on knowledgeable citizens and decision makers negotiating trade off between the competing needs of polluting economic production, subsistence farming and a livable habitat. It will also be necessary to convince local communities of the benefits which can be obtained by retaining the forest as their natural heritage. Winning their cooperation can be possible through extensive forestry extension services and education. Also viable alternative courses of action available must be identified, according to the words of President Mugabe of Zimbabwe that: "If we want to stop people from cutting down trees for food or building themselves a home, we must be able to offer them some alternatives". Such alternatives that need be explored can be found in science that deal with forestry wildlife - soil, weather and climate to mention few.

The land use pattern and the present animal husbandry system which tends to deplete the forest and range resources must be changed. Natural forest management should be restructured. Nations need to take these steps towards sustainable forestry and enduring economic development. Timber concessions should be redefined so that concessionaires have greater incentives to guard the long term "health" of the forest. Community-based forestry schemes should be revived and expanded, to ensure more rational use of forest and a better life for enclavers l1 Criteria to help government, conservation organisations and donors should be developed. This will go a long way to help them recognise "Sustainable Forestry for Development" whenever they see it.

In all, if the goal of Forestry for Sustainable Development towards the 21st Century must be achieved, there is the need for consensus and cooperation among the continental blocs to ensure preservation of the world heritage for future generations. The need for cooperation between the developed countries and the developing ones is a thing of necessity to forestall future occurrence of the Rio Conference dilemma, where northern and southern countries are seeing the objective of sustainable development very differently and thus are unable to solve the colossal problems that were brought up vis-à-vis desertification, deforestation, wasted resources, global warming, sea pollution, biodiversity, overpopulation and many more. This is the more reason why many periodicals define the earth summit as the "Summit of Lost Opportunities". Had there been overwhelming cooperation and support for the agreements from all the blocks, the issue of developed countries adopting principles on forest conservation and the developing ones refusing to sign it would not have arisen, and the same goes in reverse order for the Convention on Climate Biodiversity. This has also contributed to the inability of the draft of the Environmental Action Plan (Agenda 21) to contain precise undertakings with a definite time scale nor is the signature of the Agreement binding.

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FOOTNOTES

1. Renewable Natural Resources: This are biological resources that have repenerative capacity. Examples are the Forest and Wildlifè resources.
2. Sustainable Development: Economic development that can continue indefinitely, because it is based on the exploitation of Renewable Resources - Michael Allaby, 1988, Macmillan Dictionary of the Environnment.
3. Natural Forest: Vegetation that has not been tampered with or that the intervention of humans on the vegetation is minimal.
4. Plantation Forestry: Vegetation raised artificially either by a forestry authority or private forester, in or outside the protected area.
5. Tropics: Area within 23 1/2 North and South of equator.
6. Major Products: All Wood Products of the Forest.
7. Minor Products: All Non Wood Products of the Forest.
8. Forest Ecosystem: Natural Forest consisting of plants and animals interacting together in their environment to form a stable unit.
9. Free Area: Ungazetted Area owned by Private Individual.
10. Range: Land area unsuitable for Agriculture and Forestry but suitable for grazing.
11. Enclavers: People living in and around the forest.

Table I

AREAS OF PLANTATIONS INCLUDING WOOD LOTS IN THE TROPICS AND HOTTER SUB TROPICS (OOOHa)

REGION	ESTIMATE		
	1965	1980	1990
Africa	1378	2724	3773
Asia including Southern China	4421	13046	29245
Australia and Pacific Islands	70	269	420
Central America and Caribbean	219	486	786
South America	579	4448	8470
Estimate total area between about 27 N & 27 S of equator	6667	20973	42694

Source: Julian Evan and Peter woods cited by ITTO 1993 Vol.3 No. 5

Table 2

CURRENT PRODUCTION AND EMPLOYMENT IN COLLECTION OF SOME NON TIMBER FOREST PRODUCT IN INDIA

Item (tonnes)	Production	Employment Person - years
Grasses	350000	1200000
Fibre Sc Flosses	5500	14400
Bamboo	1932000	48300
Canes	14000	700
Essential Oil	1698	27220
0il Seeds	342700	109037
Tanin and Dye	187400	21170
Gum and Resin	91200	87000
Lac and Lac products	22000	7300
Cinchona	1420	23635
Tendu Leaves	210000	74900

Sources: Gupta and Gulteria 19829 cited by ITTO April, 1993 Vol.3 No. 2.

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EFFECT OF SURFACE ROUGHNESS FOR PINUS NIGRA AND PINUS BRUTIA CUT IN TANGENTIAL AND RADIAL DIRECTION

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ABSTRACT

This study has been held to determine surface roughness value occurred after grinding of the tangential and radial cut Austrian pine and Calabrian pine samples using emeries # 40, 50, 60, 80 and 120. During the study, 60 samples were made use of grinned with the aforementioned emeries with 6m/min feeding speed on a roller emery machine prepared on band saw and thickness machine. Grinding process was realised through emery sheets not used previously.

A total of 900 testings were realised on the prepared samples using a needle scanning measuring device. Testings were held vertically to the leaves with a needle pin of 5µm radian and on a scannig distance of 12.5 mm (n.c). According to these tests, general arithmetic average of Ra roughness value according to the radial and tangent is Ra=13.65 µm for Austrian pine and Ra=13.18 µm for Calabrian pine.

Upon the testings, it has been statistically determined that the cutting type of the tree and grain size of the applied emeries have an impact of surface roughness. It has been also found out that increasing the numbers of emeries reduces the roughness on the surface.

INTRODUCTION

For cost-benefit analysis in woodworking industry, the most important factor to be taken into consideration is the higher prices of raw materials. Accordingly, it is essential to make optimum use of wood-originated products and semi-products.

In addition, an effective factor of marketing the finished products is the post-surface process and is to ensure a maximum reduce in the surface roughness through planing and grinding process, a former process.

Production losses have increased due to waste surface -- a result of not conducting surface roughness controls with required devices and methods - and to deficiencies in varnishing and painting. Therefore, in order to minimise the production losses, surface roughness controls are to be conducted with quality control devices developed merely for this purpose. In this study, Austrian pine (pinus nigra

arnold) and Calabrian pine (pinus brutia ten) have been cut through radial and tangential directions, grinded with emeries with various numbers, and their surface roughness values have been measured with needle scanning roughness measuring devices. According to the testings held, it has been aimed to determine the surface roughness values of the Austrian pine and Calabrian pine and to assist the researchers in this subject.

The surface roughness occurred due to the above-mentioned factors shows its impact on the top-surface and on plastering process.

MATERIAL AND METHOD

Wooden material used in the research

Austrian pine (Pinus nigro Arnold)

Austrian pine which is one of the tallest first class forest trees has deep cracks and thick layers on it. The resinous buds are like cylinders and tips are sharp. The thorn leaves are 8 to 15 cm long, dark green and hard. Since the thorn leaves which are at the edges of shoots are forwarded to the buds they look like a calyx. With this peculiarity, at first sight it can be differentiated from scots pine. The pale yellow male flowers of the austrian pine are like cylinders. The effloresce happen in april and may, depending on the region, latitude, altitude and exposition. The female cones are bright, pale yellow, dark colored and grow in two years time. Unlike scots pine the cones are symmetrical and have very short peduncles. The layer is outforward and the body is dark. The scales at the edges of the cones have a spine at their bodies. Austrian pines are located at different places and have varieties each of which has a different name. In our country we have pinus nigra, Coromonica and Pyramidalis all of which are the varieties of the austrian pine. (Aslan, 1994)

Austrian pine generally grows in Asia, Thrace, Cyprus, and the Crimea. It is mainly found in Turkey (2.204.381ha). It is found with juniper, beech and oak-tree. They are found in northern Anatolia's inner slopes, In western Anatolia around Dursunbey and at the Taurus Mountains. (Aslan, 1994)

Physical and mechanical specifications of the austrian pine

Annual ring width is 1.57mm, dry specific gravity is 0,520 gr/cm^3, air dry specific gravity is 0,560 gr/cm^3, volume density value is 0,456 gr/cm^3, narrowing ratio parallel to the fibres is 0,23%, radial narrowing ratio is 5,58%, tangential narrowing ratio is 8,19%, volumetrically narrowing ratio is 13,9 %, pressure stretching parallel to the fibres is 479kg/cm2, inclined stretching is 1096 kg/cm2, inclined elastical module 100.000 kg/cm^2, dynamic inclined stretching is 0,56 kg.m/cm2, tensile stretching parallel to the fibres is 1113 kg/cm^2, tensile stretching vertical to the fibres is 23,4 kg/cm2, crosswise stretching parallel to the fibres on radial direction is 67,1 kg/cm2, tangent direction is 62 kg/cm2, diffusion stretching on radial direction is 8,2 kg/cm2, tangent direction is 9,1kg/cm2.

Calabrian pine (Pinus brutia Ten)

Calabrian pine is one of our important forest trees which can grow up to 25 m and a have a radius of 60cm. It has thick branches and an irregular body and is similar to Aleppo pine. Yet, it also has some members that grow fast and have a smooth body.

Its young shoots are without feathers, thick, its color is initially red, then greenish brown and seldomly dark gray. Its thorn leaves are 15-16 cm. long, smooth and hard, the edges are thin cloved and light green in color. The cones with very short peduncles are approximately 7,2 cm (2,0-12,5 cm) long, with a diameter of 4,1 cm (1,9-5,6 cm) and weigh 40,7gr (2,5-107,9gr) and %4-5 of the fresh cones are pure seeds. The average seed length is 7,02mm (6,09-7,92mm), the seed width is 4,33mm (4,05-4,94mm) and embryo length is 5,51mm (4,84-6,38mm). In general two or three cones stand together in a rigid form. The outer layer is irregularly shaped, the body is pressed and has a brownish color. Egg-shaped seeds are 15-20cm long and have lashed edges and scales are downwarded. It can be differentiated from the Aleppo pine with its cones which have short branches, pressed cone bodies and un-downwarded cone edges. Calabrian pine grows in areas where it is warm in winter and hot and dry in summer. (Aslan,1994)

Especially at the sea looking slopes of the hills in the Mediterranean, Aegean and Marmara regions there are wide and uniform calabrian pine forests. In the western black sea region, in some micro-climatic parts that have Mediterranean climax there are small natural hoods. It is the most common tree type in our country and covers an area of 3.096.064ha.

Physical and mechanical specifications of the calabrian pine

Amongst the pine types that grow in our country calabrian pine has the heaviest wood. Its dry specific gravity is 0,53 gr/cm3, air dry specific gravity is 0,57 gr/cm3, volume density value is 0,478 gr/cm3. The narrowing ratios are forward direction 0,5%, radial direction 4,9%, tangent direction 6,8% and as volume 12,2%. The pressure resistance parallel to the fibres is 447kg/cm2, inclined resistance is 821,5 kg/cm2, tensile stretching vertical to the fibres is 19,6 kg/cm2, tangential cracking resistance is 5,7 kg/cm2, radial cracking resistance is 5,1 kg/cm2, the calorie value in the body is 4781 col/gr, in the branch 4752 col/gr, in the body skin 4771 col/gr and in the branch skin 4216 col gr.

DEFINITION AND IMPORTANCE OF THE SURFACE ROUGHNESS

Definition: Surface roughness is the surface irregularities with quite small intervals that occur because of manufacturing methods used and/or other factors, and restricted with other usual irregularities. (T.S.6956)

It is impossible to remove the roughness on the surface that is obtained through any kind of manufacturing method (shaping with wood chips or without wood chips). These rough layers can either visible or tactile, and it can also be in sizes that can be measured with sensitive electronic devices.

In wood work there are many factors affecting the surface roughness. The anatomical structures, humidity amount and wood defects of trees, rubbing down with emery and emery tools, geometrical shapes and cutting speed of the sharp knives affect the surface roughness remarkably.

MEASURING SURFACE ROUGHNESS

Various methods have been used for measuring surface roughness. However, in this study, needle scanning method has been used. Needle and its part attached to the main body of measuring device go in and out of the pores on the materials and, thus, the drawing pen records the graphic of the surface. With this measuring methodology, surface roughness of the wood can be measured to a certain extent.

Ra (arithmetic average) roughness values are the most common surface parameters, since they present a simple value for acceptance and rejection decision. Ra roughness is the arithmetic average length of roughness disorder measured in a sample length (L) from average roughness line.

Ra roughness parameter is calculated with the formula below:

$Ra=1/L_o f^{l}|y(x)|dx$ L=length

FINDINGS AND RESULTS

Table 1 and Table 2 give Ra surface roughness testing average determined upon grinding of Austrian pine samples with emeries #40, 50, 60, 80 and 120 at a fixed feeding speed of 6m/min on radial and tangential section.

Table 1. Ra surface roughness values of Austrian pine

Ra (mm) surface roughness values	Tree: Austrian pine Emery Numbers					General Arithmetic
Section directions&feeding speed	40	50	60	80	120	Average
Radial/6m/min	20.08	19.96	13.80	7.13	6.88	13.57
Tangential/6m/min	18.88	18.46	13.56	9.16	8.66	13.74
General Arithmetic Average	19.48	19.21	13.68	8.14	7.77	13.65
						13.65

Ra (mm) surface roughness values	Tree: Calabrian pine Number of emery					General Arithmetic
Section direction &feeding speed	40	50	60	80	120	Average
Radial/6m/min	16.20	17.24	10.79	9.31	8.75	12.45
Tangential/6m/min	21.96	16.76	13.69	9.72	7.44	13.91
General Arithmetic Average	19.08	17.00	12.24	9.51	8.09	13.18
						13.18

Table 3, 4, 5 and 6 give the results of Duncan test and variance analysis results for above values.

Table 3. Variance Analysis Table for Austrian pine

Variance Source	Degree of Free	Total of Squares	Square Average	VarianceRatio	F TableValue
Intergroup	9	4002.8639	444.7627	40.3759	1.88-241
Intragroup	141	1553.1937	11.0156		
Total	150	5556.0576			

Table 4. Duncan Test Results for Austrian pine

Group No	Group Average								
Group 9	6.8867	X							
Group 7	7.1333	X							
Group 10	8.6600	X							
Group 8	9.1667	X							
Group 6	13.5667	XXX							
Group5	13.8067	XXX							
Group 4	18.4667	XXXXX							
Group 2	18.8812	XXXXX							
Group 3	19.9600	XXXXX							
Group 1	20.0867	XXXXX							
Step	2	3	4	5	6	7	8	9	10
Space	2.80	2.94	3.04	3.11	3.17	3.22	3.26	3.29	3.32

Table 5. Variance Analysis Table for Calabrian pine

Variance Source	Degree of Free	Total of Squares	Square Average	Variance Ratio	F Table Value
Intergroup	9	3010.9853	334.5539	55.8670	1.88-241
Intragroup	139	832.3880	5.9884		
Total	148	3843.3733			

Table 6. Duncan Test Results for Calabrian pine

Group No	Group Average	
Group 10	7.4467	X
Group 9	8.7533	X
Group 7	9.3133	XX
Group 8	9.7200	XX
Group 5	10.7929	XXX
Group 6	13.6933	XXXX
Group 1	16.2067	XXXXX
Group 4	16.7667	XXXXX
Group 3	17.2467	XXXXX
Group 2	21.9667	XXXXXXX

Step	2	3	4	5	6	7	8	9	10
Space	2.80	2.95	3.04	3.11	3.17	3.22	3.26	3.29	3.32

· As stated on the tables above the surface roughness value of Austrian pine and Calabrian pine is much more on tangential crosscut than radial crosscut.

· The surface roughness value in the smallest radial crosscut is shown at the number 120 emery for both trees.

The appraisal results of Austrian pine and Calabrian pine is evaluated statistically. As the variant ratio (40.3759) is bigger than the table result (1.88-2.41), 99% of difference is stated in between the groups. According to this duncan test has been applied in order to match the average.

The results in the duncan test has been evaluated as per as of cutting directions and emery types and 10 different groups have been determined for the trees.

In Austrian pine; a small difference has been determined as of roughness in between number 120 radial crosscut, number 80 radial crosscut, number 120 tangential crosscut and number 80 tangential crosscut, number 60 radial and tangential crosscut, number 50 radial and tangential crosscut, number 40 tangential crosscut, number 50 tangential crosscut, number 40 radial crosscut.

In Calabrian pine; roughness value in between number 120 radial and tangential crosscut, and number 80 radial and tangential crosscut and number 50 radial and tangential crosscut is not high.

In Austrian pine the most roughness surface is determined at the number 120 emery radial crosscut where as in Calabrian pine at number 120 emery tangential crosscut.

The roughest surface in Austrian pine is at number 40 emery tangential crosscut.

The following has been achieved in scope of results gained;

The surface roughness is declined as the emery number is increased.

The tangential and radial direction difference has been determined in same number emery where as no difference has been determined in other number 50, 80 and 120 emirs.

The roughest surface has been achieved at number 80 and 120 when compared to number 40,50 and 60 in Austrian pine than in Calabrian pine.

The arithmetical Ra roughness values of Austrian pine is lower than of Calabrian pine. For Austrian pine Ra=13.18µm where as in Calabrian pine Ra= 13.65µm.

The emery traces after the emery process has been determined for all numbers.

SUGGESTIONS

- Radial direction surfaces can be preferred when all conditions are kept constant.
- The most suitable surface roughness can be examined for the paste process in different kinds of trees.
- The most suitable emery number should be chosen as the emery number increases the surface roughness is decreases.
- Less paint and varnish will be used as the most suitable emery process is applied and thus the ideal piece adjustment should be chosen and the emery process should be done neatly.
- As the roughness is achieved the paste quality will increase and thus the surfaces should be provided in appreciate roughness value.
- The emery panel should be changed in small periods as possible.
- The effect of the humidity at surface roughness can be examined.
- the mutability of the surface roughness as of different reachable Aries in tree kids.
- The wood defaults at the tress would effect the surface roughness negatively and thus under faults trees should be preferred.
- The pieces the emery process is supplied should be protected as of damage.
- The equipment used should be kept clean.
- The surface roughness the wood supplied from different parts of a tree or the most suitable area determination can be examined.

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TECHNOLOGICAL STUDY IN RESPECT OF TWO SPECIES OF ARBORESCENT PALMS: *Socratea exorrhiza and Iriartea deltoidea*

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SUMMARY

Socratea exorrhiza and *Iriartea deltoidea* are two species of arborescent palms specific to tropical humid forests which must be assessed in economic terms for their utilization and protection, since they have great potential for multiple use.

In this paper, the density of palms of these two species in the forest and the average height to which the trunk can be exploited for timber production are studied. The sawmill yield, the process of drying and physical/ mechanical properties are determined.

The results obtained indicate that there is an average population of 164 palms per hectare, of which 50% are exploitable to a height of 7.5 m, with high-quality drying being observed in a period of 35 days, and adequate physical and mechanical properties which categorize the timber as excessively heavy, with average contractions, high flexion capacity, strong resistance to compression and very great hardness, all of which impart an economic value to the two palms studied.

Key words: Palms, density, sawmill, drying, properties

INTRODUCTION

Resources in tropical forests are being over-exploited without there being any opportunity to study the production potential of the species which compose them, most natural forests being located in developing countries.

A decade ago, GONZALEZ, M. (1987), considered that these countries were actively bringing about the destruction of forests in order to improve their own economies. Today, this is still a reality for many of those nations, which, in the effort to find solutions, create ecological and social problems.

The owners of natural forests in Latin America are for the most part families with low economic resources, many of them natives. Forestry owners need to know the potential economic value of forest phytogenetic resources in order to achieve efficient exploitation, protecting and managing forests in an appropriate way. As part of the process of assessing forestry resources, research into two species of arborescent palm with a high use potential -*Socratea exorrhiza* and *Iriartea deltoidea* - is summarized in this paper.

The objectives of the research were as follows:

· To compile data which allow the number of palms per hectare for a tropical humid forest in Atlantic Costa Rica to be defined.

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· To define the commercial height of the trunk of the palms.
· To determine sawmill yield in respect of each of the two species.
· To evaluate the quality of air drying of the timber.
· To determine the physical and mechanical properties of the timber of both species of palm.

METHODOLOGY

To determine the number of parcels required in calculating the density of the palms, a preliminary sampling was carried out by measuring the diameter of all the individuals on parcels located at random, with an area of 3 000 m^2, and then applying the procedure proposed by the Mexican Forestry and Fauna Subsecretariat (1976). The exploitable trunk height of the palms was obtained by sectioning the trunk of the palm sample up to a height such that the woody or timber-yielding part surrounding the soft centre of the palm trunk will show a thickness not less than two or two and a half centimetres.

To guarantee that after the processing of the logs into timber, sections of around one centimetre in thickness were produced.

The sawmill yield was obtained by the difference between the total volume of the logs and the volume of timber obtained.

To evaluate the drying of the timber, weekly readings were taken of the moisture content until equilibrium with the environment was reached.

The physical properties were calculated using a minimum of two test pieces from each palm composing the sample. Each test piece was weighed and measured and its volume determined at different moisture content levels.

The mechanical properties of flexion and compression were determined using the methodology proposed by HOHEISEL, H. (1974), while hardness was established using Brinell's timber hardness methodology (NURMINEN, T., 1994).

RESULTS

Palm density per hectare is high in the case of both species, representing a significant volume of genetic material which could be utilized by means of sustainable management or for the establishment of plantations. This is feasible, given the characteristics of these species as regards the traditional uses and properties of the timber.

Table 1. Number of palms per hectare in the case of each species.

Species	Atlantic area	Other areas of the country
Socratea	51	13
Iriartea	113	19
Total	164	32

Note that the number of individuals is greater in the case of *Iriartea*.

The average usable height of the palms for timber production is 7.5 metres and this, together with the density data, means that the economic value of the palms is considerable.

With regard to sawmill production, average yields were noted of some 35% - values similar to those from exploitation on forest plantations. In the following table, sawmill yields are shown.

Table 2. Sawmill yields in the case of *Socratea* and *Iriartea*.

Species	Yield (%)
Socratea	37.9
Iriartea	31.0
Average	35

Sawmill yield is expressed in percentages.

In the process of drying the timber, it was found that this reaches equilibrium with the environment in 35 days; it does not suffer warping or contractions and the greatest loss of moisture occurs in the first 14 days, a fact which allows us to describe the drying of the timber as rapid and of high quality.

Table 3. Average moisture content values in the case of timber from *Socratea* and *Iriartea*.

Time (days)	Socratea	Iriartea
0	32.58	32.07
7	25.62	25.42
14	21.23	20.36
21	20.36	19.39
28	20.47	20.33
35	19.14	18.93

The basic specific weight and dry specific weight categorize the palms as excessively heavy according to a classification proposed by GONZALEZ (GONZALEZ, 1973) for defining timber quality. The mechanical properties of *Socratea* and *Iriartea* are valuable, in accordance with [the findings of] Ecuador's Ministry of Agriculture and Stockfarming (1978), by virtue of a high flexion capacity, strong resistance to compression and extreme hardness.

Table 4. Physical and mechanical properties of the two palm trees studied.

Species	Basic specífic weigh	Dry specífict weigh	Volumetric contraction (%) **a**	Flexion Kg/cm^2 **b**	Compression Kg/cm^2 **c**	Hardness Kg/cm^2 **d**
Socratea	0.997	1.112	10.31	1319	777	1125
Iriartea	0.861	0.995	13.59	1598	855	1336

a. contraction of unseasoned timber at 0% moisture content b. breakage module.
c. compression parallel to the fibre d. lateral hardness

These species of palms have been used by the natives of Costa Rica and other countries in Latin America, and this may have influenced their continued existence in the forest. At least in Costa Rica, in the territories inhabited by non-native peoples, the populations of these palms have decreased, perhaps because they are cut down to consume the heart, which is in great demand on account of its taste.

The natives use the leaves of the palms to build roofs and containers, which they use for feeding animals, the trunk for building purposes (dwellings, enclosures, etc.) and the fruit as pig feed, while other parts of the palms are used in craft trades and medicine (CASTILLO, U.; BORGE, C., 1995).

Since both palm trees possess broad quality, have the capacity for multiple uses and are extensively distributed in tropical countries, conservation and management measures must be taken to prevent their exploitation; this ought not to take place unless the resource is adequately assessed and its continued existence guaranteed for use in the future.

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FOREST FIRES

James Barki [1]

INTRODUCTION: IMPORTANCE OF FORESTS AND FIRE

Definitions: Forest

Forest is a complex association of trees, shrubs and other plants in which each individual plays some part in the life of the community.

FOREST FIRES

These are wildland fires not prescribed for the area by an authorized plan (as use by national and state fire control agencies).

Importance of forest

Forest is an environmentally and economically important renewable natural resource which provides a variety of goods and services. It provides timber for building homes, furniture and many other wood products from the timber industries, sawmilling and carpentry shops. It provides pulp for manufacture of rayon, paper and paper products.

Many chemicals are derived from the forest plants for the treatment of diseases and forests provide natural habitat for wildlife. They serve to prevent erosion of soil and flooding. They provide rainfall and protect natural water bodies from drying up. They purify the atmosphere. They are beautiful and employ more than half a billion people in the forest based industries world wide.

Despite the immeasurable benefits derived from the forest, man is destroying the forest especially in the tropical regions through careless use of fire. It is reported that the tropical forest is disappearing at the rate of 17 million hectares yearly through wild fire, agricultural practices and log exploitation (FAO estimates).

Fire is useful but dangerous when uncontrolled. Forest fires cause destruction of varieties of timber species which results in the extinction of genetic diversities of plant and animal species. Its effect results in fuelwood shortage, erosion, flooding, displacement of people due to desertification and many socio-economic problems world wide.

However due to the present escalation of the adverse ecological and environmental conditions of the forests in the world with high population, there is the need for immediate change in our practices of using fire.

Since time immemorial, man has been using fire for preparing food, creating warmth during cold seasons, for hunting, protection from wild animals, clearance of land, etc. Although fire has been part of human tradition, the 1871 forest fire at Pestigo (USA) which claimed 1,638 lives and destroyed a forest area of about 1.6 million hectares and the recent forest fire in China which destroyed forest cover of 3 million hectares, really shows the need for international concern for

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educating people about the escalating fire disasters which are killing the world of its beautiful natural resource, economic potentials and suitable environment for all life forms. Over 2,100 plant species, 200 species of mammals, many birds and reptiles become extinct every year through forest fires according to experts. The present rate of forest destruction threatens the future of the world and, if measures are not taken with immediate effect to arrest the situation, the world would be without trees for timber and other benefits of forest in the 21st century.

TYPES OF FOREST FIRES AND CAUSES

The cause of fire usually determines what kind of burn results. Forest fires are listed in four categories as follows:

(i) Single-tree fires,
(ii) Ground fires,
(iii) Surface fires,
(iv) Crown fires.

(i) Single-tree fires: These are those that burn in dry snags, possibly ignited by lightning or set on purpose to smoke out bees or game from den trees. Such burning snags are extremely dangerous in that sparks may be wind-blown from them and create surface fires where they fall.

(ii) Ground fires: These burn humus (partly decayed organic matter) or thick peat layes. These burn slowly and smoulder rather than flame and can burn for several months. They are very destructive to all vegetation due to its effect of root killing.

(iii) Surface fires: These burn on or near the ground in under-brush and leaf litter. These are the most common kind of fires; almost all forest fires begin as surface fires.

(iv) Crown fires: These burn in the tree crowns and usually occur only in coniferous species because of their inflammable foliage. Wind can make a crown fire spread very quickly through a forest.

Causes of Fire in the Forest

Accidentally fires do occur naturally, but more than 95% of all forest fires are related to human activities. Apart from lightning the following are also identified:

1. Landowners, farmers and the rural population:
   In most countries agricultural burning such as in shifting cultivation, grazing and fires to control vermin and insects, together with the many variations of rubbish and debris burning are major causes of wild fires. This cause of wild fire is often the result of a failure to select the proper time, place and method of burning or in the supervision and control of the burning operation.

2. Cigarette smoking: Picnickers, campers, hikers, fishermen, hunters, tourists or local residents who smoke while in the forest or grassland area can carelessly cause a disastrous fire by throwing the butt-end of the cigarette or the matches used.

3. Logging and other forest operations: Very often logging and other forestry operations cause wild fires. Careless employees and the use of different machines such as powersaws, tractors and bulldozers in hazardous areas during the fire danger season can be the cause of fires.

4. Arsonist/incendiary fires: These are those set maliciously and willfully to burn the property of another person. This frequently is done to "get even" with someone or purposely to do harm. It is difficult to prevent this new development. (Law enforcement is a general deterrent to arson.)

5. Children: Children playing with matches or other sources of fire are causing an increasing number of wild fires each year. Children are often too young to understand what is dangerous playing (e.g. Ghana, USA, etc.).

PREVENTION AND CONTROL OF FOREST FIRES

A. Prevention

Forest fire prevention is the means of reducing the number of unwanted, uncontrolled or escape wild fires. It is one of the most important functions of the fire control organization. This is the most economically way of reducing losses basically as it involves stopping the fire from starting in the first place. This can be done without expensive equipment.

The following methods are recommended:

1. Fire traces: Vegetational tracks of about 30-40 meters should be burnt or clearly weeded along the forest reserve boundary t avoid the spread of fire from outside. Burning should be well done under the control of a fire control expert t prevent the fire from getting out of hand into protected areas. The width of the strip will depend on the type of fuel, location, topography of the land and weather conditions.

2. Bufferbelt development: It is of permanent importance that a fire break is established along boundaries of forest reserves. The following should be considered in the selection of species for bufferbelt development. Fire tolerance trees, low leaf litter and evergreen trees. Some vegetation could be left uncleared between outside forest reserves and forest reserves. Some species identified which could be used in bufferbelt development include *Cassia siamea, Leucaena* species, *Gmelina arborea, Khaya grandifoliola*, etc.

3. Early burning: Intentionally setting fire into the forest at the beginning of the dry season to cause minimal fire damage to vegetation but reasonable reduction of combustible material to cause any upset in the advent of fire during the peak of the dry season. Controlled burning could be tried on a smaller scale and if the fuel consumption is big enough, the burning could be extended. It is important not to start burning too early to avoid the need to burn twice.

4. Fire patrols: There should be routine fire patrol by forest guards and fire detectors during the dry season.

5. Education: There should be a general education of the public about the causes and effects of forest fires and also enforcement of fire laws should be unveiled to the public especially in the rural areas.

6. Banning the use of fire source: There shold be a total ban on the use of any fire source such as matches, lighters and certain machines during the dry season in the forest or if possible permit should be obtained by forest workers.

B. Control

This is a term indicating the overall programme of control and suppression of fire losses as well as the control of individual fires.

The method of control should be aimed at eliminating at least one of the fire elements of oxygen, hear and fuel. There are two methods of fighting fire that is direct and indirect attack:

Direct: It is the method of fighting the fire at the surface by spraying of water, fire retardant (chemical), covering with sand and beating with fresh branches of trees.

Indirect: This is the control of fire by the construction of fire breaks such as fire lane, back firing, or other cutting traces.

FIRE CONTROL EQUIPMENT AND METHODS

Fire control equipment can be divided into four groups as follows: Communication, water pumps and earth moving equipment and hand tools.

A. Communication Equipment

(1) Telephone: This is very useful for fixed look-out and towers to report the discovery of a fire and for general fire reporting.

(2) Radio telephone: This can work on (a) LF-frequences. These radio telephones can be used on over very short distances, for instance between section and crew leaders on the fire line. (b) HF-frequences: This can be used over a long distance, i.e. between district headquarters and the alarm centre. (c) VHF-frequences: It can be used over short distances but is very useful in different forest fire control activities. (3) Visual or sound signals (alarm bells). These are used for reporting fire alarms to the people of the villages.

B. Water Pumps

There are two types of this equipment, i.e. (1) the portable pumps and (2) the fire engine pumps.

(1) Portable pumps: These are of light weight so it is easier to carry by one person during fire control. These pumps are useful if the water source is not accessible to fire engines and if the water is close enough to the place of the fire, e.g. all back-pack pumps such as Hale Fyr Pak, Mako Back-pump, etc.

(2) Fire engine pumps: These pumps are connected to a fire engine and getting their power directly from the engine. These pumps are used to connect water from the source through holes into the area of the fire for effective spraying of water through the pump and the nozzle. If the distance between the source of water and the fire is long, two booster engines can be used to increase the pressure to draw water, e.g. of the fire engines include: Esa-Ra 1600, Tractor Esa, Esteri 1000, Kaapio Esa, etc.

Tanker trucks, fire pick-ups, fixed with pumping machine and holes are used in some areas. Helicopters are often used in some advance countries to spray the surface of the fire with water and fire retardants.

C. Earth Moving Machines

These are heavy machines which are used to construct fire lanes, e.g. fire lines, cutting traces, etc. (e.g. bulldozers, trenchers and ploughs).

D. Hand Tools

These are frequently used for separating fuels when constructing fire breaks before the beginning of the dry season. They are used to construct based lines for back burning or to separate burning fuel from unburned material at the perimeter of the fire during direct control of fire, e.g. fire swatters, fire rake, chain saw, fire fighting shovel, bow saw, flat hoes, etc.

CONTROL USE OF FIRE

Fire is a good servant but a bad master if uncontrolled. Fire per se should not be seen generally as a threat of the sustainability of the environment. The answer to the status of fire lies in the intelligence of man as how to handle it. Fire yields positive results to satisfy our needs if controlled, such as the following:

A. Energy supply: When fuel wood is control burned it provides hear for cooking, roasting, etc. It can be used to prepare coal and charcoal for subsequent use, domestic and industrial.

B. Clearance: Prescribed fire can be used to clear unwanted vegetation, debris and for land preparation for agricultural purposes, etc.

C. Regeneration: Control burning on dry vegetation during the dry season enhances sprouting of fresh vegetation which can serve as fodder for livestock and game. It can be suitable for regeneration of certain desirable species. It can be used for seed treatment.

D. Salvage: Control fire can be used to treat pine trees of "brown spot" disease by burning the stands. It can also be done under old stands to eliminate all available fuel, litter grasses, dead twigs, etc. to avoid wild fire occurrence in the stands. Also it is used to control forest fire, i.e. back firing and as practice for fire control men.

ECONOMIC AND ENVIRONMENTAL COST OF FIRE

Economic losses through forest fires are so huge than no accurate value can be calculated even after fire disaster. It is estimated that billions of dollars are lost annually through forest fires world wide. Individual states which depend on timber exportation for their foreign earnings lose heavily through the destruction of timber which devalues its price.

Wild fire results in rural-urban migration due to infertility of the soil and shortage of non-forest timber products (NFTP) on which the people may be depending upon for their livelihood. Fire disasters lead to famine, drought, joblessness, etc. Wild fire results in the depletion and extinction of game and the scenic beauty of the heterogeneous forest which leads to poor tourist attraction thereby loss of income by an affected state.

Environmentally, wild fire causes the destruction of the ecosystem and the ecological base. Many unknown plant and animal species which may have been very useful in the future are also destroyed.

Wild land fire leads to erosion, flooding, loss of soil fertility, fauna and flora. It cause atmospheric pollution resulting in lung problems, etc.

NATURAL DISASTER AND SALVAGE TIMBER OPERATIONS

Natural Disasters and Timber Damage

Natural disasters that destroy or damage timber stands include: lightning, wind, rain, frost action, insects and diseases.

A) Lightning: This causes fire and severe burning results leading to damage and/or death of trees.

B) Wind: Trees can be uprooted and overturned by high winds. The tops of trees may be broken off by moderate winds and tornadoes and hurricanes can cause severe damage to forest.

C) Frost action: This can result in heaving of wet or clay soil. Due to expansion of water upon freezing, trees can be lifted out of the ground so that the roots are exposed and die by desiccation.

D) Insects and diseases: Insects that destroy stands of trees include: Gypsy moth, Bark beetle, Sawflies, White Pine weevil, etc. These cause defoliation, killing, growth reduction, fork and crooked boles, etc. of trees respectively. Diseases such as the Witches-broom, Phloem necrosis and other fungal infections also lead to damage and death of timber trees.

Timber Salvage Operations after Natural Disasters

This deals with all activities done to save the total loss of timber in quantity and quality, e.g. after fire disaster by lightning.

Lightning forest fire causes great damage to timber through burning of the stem, root, leaves and soil nutrients. Trees are renewable natural resources, so after natural disasters, well planned management and silvicultural practices should be done to save the affected trees for rapid recovery, e.g. salvage cutting, chemical treatment, clear cutting and protection, etc.

A) Salvage cutting: In this practice almost all the merchantable damaged or killed tree timber species are removed to recover some of the losses and to possibly forestall outbreak of an epidemic and for coppicing to yield better products.

B) Chemical treatment: Insecticides can be sprayed on affected trees to avoid attraction of insects and diseases which are common after forest fire disasters.

C) Clear cutting or thinning: Any of these silvicultural practices can be possible to save timber after calamities especially in the homogenous forests (temperate forests) to provide space for affected timber species to recover due to reduction in competition.

D) Protection: Burnt forests should be strictly protected from further disturbance by people.

CONCLUSION

Man must continue to exploit forest resources and use fire for his survival but thoughtfully with foresight and better planning than before to ensure that his activities and demands are compatible with the development and sustainability of the environment. Forest fires can be prevented and/or

controlled if only we value the importance of the forest as our life-blood. The future of the 21st century is threatened with the escalating population growth and decline of forest resources. It is expected that the socio-economical problems will be intense if measures are not taken now to arrest the threatened ecological imbalance to make the world a better place for the present and the future generations.

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INTERSPECIFIC CROSSES IN *EUCALYPTUS sp.*

Victor O. Botto [1]

ABSTRACT

As part of the strategy for genetic improvement of the genus Eucalyptus for the Pampas region (provinces of Buenos Aires and southern Santa Fe, Argentina), controlled crosses provide a useful tool for making substantial genetic advances. This paper therefore describes the techniques of extracting, conserving and evaluating pollen, and also the technique used in controlled crosses. We emasculated approximately 1 800 flowers on stocks of *E. dunnii* clones, and pollinated them with pollen from *E. grandis*, *E. viminalis* and eleven batches of pollen from *E. globulus* brought in from Portugal under the Agreement between the INTA (National Institute of Agricultural Technology) Argentina and SOPORCEL, the Portuguese Cellulose Company. The results obtained so far are extremely encouraging, for overall capsule formation was 60% across all the crosses made; and we observed differences between the matrices, some of them presenting high fertility values.

Ref.: Students prize, Genetic resources in forestry.

INTRODUCTION

Interspecific crosses are one of the various tools available for programmes of genetic improvement, as they make it possible to create new combinations of genes which would otherwise not exist in nature (van Wyk, 1987), bringing together in one individual one or more useful characteristics to be found in the parents.

When two individuals of separate species are crossed, the F1 may manifest hybrid vigour, which is the main reason for using it in improvement programmes.

When planning to carry out a cross between two species, it is important to analyse its feasibility in accordance with the systematic affinity that exists between them. The positioning of the species in the Pryor & Johnson classification (FAO, 1981) is a valuable indication of hybridising capacity. Under this classification, crosses are possible within the same sub-genus. However, there are three exceptions within the sub-genus *Symphomyrtus*: the sections *Adnataria*, *Dumania* and *Equatoria* do not hybridise with other sections in the sub-genus *Symphomyrtus* but they do internally. Crosses within and between other sections of the same sub-genus are possible and frequent, both naturally and in controlled form.

If we analyse the species that have shown they behave well in the Pampas region (Argentina) (Aliani, R., 1990), we note that most belong to the sub-genus Symphomyrtus, so crosses are possible between them.

The purpose of this paper is, firstly, initial and further training in controlled-pollination techniques with the material available at INTA Castelar, to conclude thereafter with the first step in obtaining hybrids of interest to the Pampas Region, such as *E. dunnii x E. globulus ssp. globulus*, specimens in which we hope to combine the characteristics of resistance to frosts and to hot summers, provided by E. dunnii, with the pulping quality provided by *E. globulus.*

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Producing hybrids with these characteristics would make it possible to extend the present limit of cultivation of *E. globulus ssp. globulus*, which is in the coastal zone of the South-East of Buenos Aires Province (Argentina), into a more continental zone.

MATERIALS AND METHODS

Phenological observations

For the purpose of preparing a successful programme of interspecific hybridisation, it is essential to have thorough knowledge of the floral biology of the species considered (van Wyk, 1987): an instance of this is found in the papers by Hodgson (1976) on *E. grandis* in South Africa, Griffin and Hand (1979) on *E. regnans* in Australia, and Cauvin (1983) on *E. gunnii* [sic] and *E. viminalis*.

Normally, when growing a species away from its natural habitat, which is the case with *Eucalyptus*, changes are produced in flowering - both timing and duration. Hence, not having phenological records for our region, it was essential first of all to conduct a phenological study of the species of interest, in order to determine the timing of each of the phenological phases. We therefore observed the flowering cycle in 36 specimens of the following species: *E. camaldulensis, E. tereticomis, E. dunnii, E. saligna, E. globulus ssp. globulus and E. viminalis*, which were sited both on demonstration plots and, in a species test, planted at INTA Castelar.

Observations were made every fifteen days over two years and for each specimen observed we recorded the presence of the following phases: flower budding, opening, fruiting and dehiscence of fruit.

In Table 1 (attached) we show the different phenological phases specified, for each of the species studied: it was observed that the full time from budding to ripening of fruit takes over a year, so that at certain times of the year there is an overlap of phases from different cycles. This overlap occurs in all the species observed but there are differences as regards the length and onset of each phase[(1)].

Extracting and conserving pollen

For pollen extraction we used the technique described by Rocha & Gea (1988) where they cut branches with open flowers and buds where the operculum is about to drop - shown by a change in its colour (from green to yellow). These branches are prepared by stripping off the open flowers to prevent contamination with extraneous pollen and cutting off 50% of the laminae of the leaves to reduce transpiration.

The branches are placed in a vessel with the bottoms under water (these must first be cut bevelled to increase the area of absorption); in the vessel and at a suitable temperature 25-30°C, the flowering process continues normally.

When the flowers open, they are cut at the pedicel and submerged in carbon tetrachloride for five minutes: the dispersion of the pollen in the solution can be seen. After the solution is filtered and the carbon tetrachloride evaporated, the residue adhering to the filter paper is transferred to glass tubes, using a fine hair brush.

We thought this technique too slow and complicated, and modified it with the technique described by Espejo (1993) where, after full expansion of the stamens, the anthers are cut and placed in Petri jars which are removed to a desiccator with silica gel for a period of 48-72 hours; after drying, the anthers passed through a sieve (500 µm) to separate the pollen from the remains of anthers and filaments.

For conservation, the pollen was kept in capsules of '0' gelatine, which are stored in flasks with silica gel and kept at 4°C if it is to be used within a few weeks or, if not, has to be kept in the freezer

at a temperature of -15°C.

We must stress the fundamental importance of the drying process for the proper conservation of the pollen depends on this since, when high-humidity material is frozen, the ice crystals formed endanger the cell structures and seriously damage the viability of the pollen.

Viability of pollen

Observation of the viability of the pollen is required when it has been stored for lengthy periods, to ensure that the material used in controlled crosses has acceptable percentages of germination.

According to Pryor (1976), the viability of the pollen can be evaluated *in vitro* by placing a small sample of pollen on a sheet of agar with a suitable sucrose content and incubated at 23°C. Brune, cited by van Wyk (1987) found that the medium which produced best results consisted of 1.5% agar, 35% sucrose and from 100 to 250 ppm of boric acid.

A detailed description of the viability tests was presented by Boden (1958), who used the suspended-drop method. He found that the medium which gave the best results contained 1.5% gelatine and about 20% sucrose. Germination occurred at a range of temperatures from 20° to 30°C. Boden adopts an incubation temperature of 30°C, observing germination after six hours.

Griffin (1982) found the suspended-drop method difficult and used a medium containing simply a 30% solution of sucrose and 1.5 ppm of boric acid, with incubation for 24 hours at 30°C.

In these proceedings, we used the viability test recommended by Schenone, R. (personal communication), in which the germination of the pollen is determined in a solution of 15% sucrose and 300 ppm of boric acid, after incubation from two to four days at 28-30°C. With temperatures lower than those mentioned, the process of germination can take up to twice the time.

Once the incubation time is over, a drop of the growing medium is placed on a slide and observed under the microscope. It is considered that the pollen is germinating not only when the seeds show a pollen tube but also when they change shape, presenting a near-triangular appearance, with widened tips.

Controlled crosses

The controlled-pollination technique has been described in detail by Hodgson (1976) and van Wyk (1977), and subsequently adapted by Campinhos in Brazil (Martin, 1987) and by Bouvet (1982) in the Congo.

Although the technique is simple, the height at which the flowers are positioned, especially on the trees selected, makes it almost impossible to carry out in normal plantation conditions.

To avoid this inconvenience of working, a hybridisation park has to be established (Martin, 1987; Cauvin, 1983). For this, INTA Castelar has installed such a park, planted at 4 m x 3 m spacing and comprising 15 five-year old clones of E. dunnii produced by techniques of grafting trees selected not only for growth and good shape characteristics but also for early flowering, from a commercial plantation of known origin, Urbenville (VIC), at Oliveros (Santa Fé, Argentina), in accordance with the technique described by López, Alliani, Gea (1990).

To avoid dropping of the flowers due to manifestations of a certain early vigour in grafted eucalyptuses, and with the intention of encouraging the formation of new flower buds, we followed the technique developed by Cauvin (1983) in France, whereby the branches of the scions were bent and trained to produce an increase in flowering and to achieve a positioning of the branches that facilitates the work of pollination. In addition, the main trunks of the scions were cut back to keep the trees low and encourage the putting out of new buds to give continuous flowering, and good spatial management of the branches. We hope to continue with this technique, to produce the material available for crosses every year.

The programme of controlled crosses that we carried out (see Table 2), involved using the E. *dunnii* clones as the stock or female parents on which we pollinated the flowers with pollen from E. *grandis*, origin Kendall and a nursery (Province of Concordia, Argentina), *E. viminalis*, origin Warburton and eleven batches of pollen from *E. globulus ssp globulus*, sourced from selected specimens brought in from Portugal under the International Technical Assistance Agreement between the INTA and SOPORCEL.

There are two stages in the actual process of controlled pollination: emasculation, or removal of the male structures on the trunks used as female parents, and pollination, viz. the transfer of the pollen to the female structure by artificial means (Espejo, 1993).

Emasculation and isolation: We selected the branches showing inflorescences with flowers at pre-anthesis, or a slight presence of open flowers. First we removed the flowers that had opened, to avoid contamination with unwanted pollen, and then we proceeded to emasculate the unopened flowers, which involves removing the operculum and the stamens, to prevent self-fertilising: this was done with a cutter making a perimetral incision below the ring of the calyx and then removing the stamens that remain or have curved below the hypanthium.

Table 2: Interspecific crosses carried out

	MALE PARENTS													
		EGl.1	EGl.2	EGl.3	EGl.4	EGl.5	EGl.6	EGl.7	EGl.8	EGl.9	EGl.10	EGl.11	EV	EGr.1	EGr.2
F	ED1														
E															
M	ED2														
A															
L	ED3														
E															
	ED4														
P															
A	ED5														
R															
E	ED6														
N															
T	ED7														
S															
	ED8														

References: ED= E. dunnii; EGl.= E. globulus; EV= E. viminalis; EGr.= E. grandis

After emasculation, the flowers have to be isolated to prevent contamination with extraneous pollen: the flowers are covered with a bag of synthetic cloth supported on a wire spiral and wired to the branch, taking the precaution of placing a piece of cotton between the branch and the wire to avoid rubbing damage to the tissues. The bags must be made of material that is light and non-absorbent with a close enough weave to prevent contamination of the stigmata with unwanted pollen - on the other hand it must admit air and light. Special attention must be paid to avoiding the stigmata touching the bag or the wire, which would cause them to drop.

Pollination proper: Ten or fifteen days after the flowers are emasculated and isolated, the female structures are at their most receptive, which is shown by elongation of the styli, thickening of the stigmata and secretion of a sticky substance that both sticks the pollen and is also an appropriate medium for promoting germination. After this time, when maximum receptivity of the stigmata is observed, they are pollinated using a fine hair brush, taking care to use only one brush per parental combination, so avoiding the contamination that may occur when the pollen sticks to the hairs of the brushes used.

Remembering that for the species of the sub-genus *Symphomyrtus* - the case here - the stigmata remain receptive for between four and ten days (Hodgson, 1976), pollination was repeated four or five times, with three days between sessions, trying to ensure fertilisation.

After the period of pollination, and when the styli dropped (a clear sign of loss of receptivity) after 30 to 40 days, we removed the bags that had served as insulation, to avoid damage to branches and to encourage development of the capsules.

As the development of the fruits to complete maturity takes a long time and, according to the species, more than a year, the branches with the pollinated flowers must be labelled, in order to monitor ripening and avoid flowers being mixed up and/or lost.

RESULTS AND CONCLUSIONS

Differences are observed between clones, as regards the percentages of fruit-formation (Table 3): the ED2, ED3, ED5, ED6 and ED7 (*E. dunnii*) clone is outstanding with several of its crosses showing 100% or close to 100% taking. The good fertility of these stocks is found not only in crosses with *E. globulus* but also in those with *E. viminalis* and *E. grandis*. It is also important to point out the overall high percentage (almost 60%) of capsule formation observed.

The percentages of capsule formation on each of the clones used as female parents are very encouraging, considering that this is the first experiment carried out for this purpose.

Table 3: Capsule formation by crosses made.

CROSSES	FLOWERS EMASCULATED	CAPSULES FORMED	%
ED1 x EGl.3	38	1	2.63
ED1 x EGl.4	63	44	69.84
ED1 x EGl.5	22	5	22.73
ED1 x EGl.6	32	13	40.63
ED1 x EGl.7	23	12	52.17
ED1 x EGl.8	104	19	18.27
ED1 x EGl.9	40	0	0.00
ED1 x EGl.11	80	34	42.50
ED2 x EGl.2	54	40	74.07
ED2 x EGl.3	32	27	84.38
ED2 x EGl.4	54	52	96.30
ED2 x EGl.5	24	24	100.00
ED2 x EGl.7	19	15	78.95
ED2 x EGl.8	50	47	94.00
ED2 x EGl.9	22	16	72.73
ED2 x EGl.10	25	25	100.00
ED2 x EGl.11	18	18	100.00
ED3 x EGl.1	33	31	93.94
ED3 x EGl.2	103	63	61.17
ED3 x EGl.3	53	15	28.30
ED3 x EGl.4	41	17	41.46
ED3 x EGl.5	53	50	94.34
ED3 x EGl.6	51	27	52.94
ED3 x EGl.7	130	43	33.08
ED3 x EGl.8	58	19	32.76
ED3 x EGl.9	42	8	19.05
ED3 x EGl.10	36	34	94.44
ED3 x EGl.11	28	13	46.43
ED3 x EV	23	21	91.30
ED3 x EGr.1	49	46	93.88
ED4 x EGr.1	47	0	0.00
ED5 x EGl.4	13	13	100.00
ED5 x EGl.8	24	11	45.83
ED5 x EGl.11	28	28	100.00
ED6 x EGl.1	46	38	82.61
ED6 x EV	38	34	89.47
ED6 x EGr.1	68	66	97.06
ED7 x EGl.6	34	32	94.12
ED7 x EGl.7	26	18	69.23
ED7 x EGl.11	43	36	83.72
ED8 x EV	6	0	0.00
ED8 x EGr.2	13	7	53.85
TOTAL	**1786**	**1062**	**59.46**

References: ED= E. dunnii; EGl.= E. globulus; EV= E. viminalis; EGr.= E. grandis

In all cases it is important to carry out reciprocal crosses, for there have been cases of differential hybrid vigour (Venkatesh & Sharma, 1977). But this is not possible with crosses using pollen from *E. globulus*, since the species used in the crosses have smaller flowers and the elongation of the pollen tube on the small flowers is less than the length of the stylus on *E. globulus*, which is a cause of unilateral cross incompatibility.

As regards the number of seeds expected per capsule, this varies according to the bibliography consulted (Griffin, 1982; Hodgson, 1975; van Wyk, 1987) and almost invariably depends on the time when the female parent flowers, the time that the stigmata are receptive and the process for conserving the pollen which reduces its viability.

Subsequent selection of the hybrids obtained will require good development of the technology of vegetative propagation, to fix the high genetic gain produced when outstanding specimens are crossed. However, there is a narrowing of the genetic base: to minimise that, the male parents used in a programme of controlled crosses must be sourced from some other mode of improvement, so managing to maintain genetic diversity.

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CONSERVATION AND SUSTAINABLE MANAGEMENT OF BROAD-LEAVED FORESTS ON THE NORTH COAST OF HONDURAS

Ricardo Brown Salazar [1]

SUMMARY

An analysis is presented of progress in the conservation and sustainable management of the broad-leaved forests on the north coast of Honduras through a historical outline of the involvement of the State, international organisations, and non-governmental projects and organisations (NGOs). Reference is made to experiences in community forestry and their relationship to the ecologically sustainable and economically profitable use of forests through manual sawing and transportation using local technology. Also discussed are advances in forestry legislation and the measures being taken to conserve forest resources in this region. A list is given of broad-leaved species traditionally used for timber, of ones not traditionally used but now being used commercially for this purpose, and of species that are potentially suitable for commercial timber production.

Key words: Broad-leaved forest, Honduras, forest management

The Republic of Honduras is in Central America. [Originally] 98 629 km2 of the country's 112 492 km2 were covered by forest, i.e., 87.7% of the land area. At present the area covered by forest is 56 805 km2, of which 2 899 000 ha are made up of broad-leaved trees (SILVIAGRO, 1996). This means that Honduras has the potential to become the largest producer of timber and non-timber forest products in Central America (Sandoval, 1996; PLANFOR, 1996).

The broad-leaved forests are mainly located in the northern and eastern regions of the country, forming a chain across the Departments of Atlántida, Colón, part of Olancho, Gracias à Dios, Yoro and El Paraíso. For the most part these forests stand on slopes exceeding 30% where the soils are poor and average annual precipitation is 3 000 mm (PDBL, 1995).

Forest management is mostly practised in areas on the Cordillera de Nombre de Dios. This region is in a leeward position with high rainfall, varying between 3 000 and 4 000 mm per annum, and a mean temperature of 25°C, and consequently the forest is of the humid tropical kind. The topography is irregular, characterised by slopes exceeding 30% and poor soils, mostly of the Choloma and Toyos series. The hydrological system consists of approximately 24 short rivers that flow

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directly into the Caribbean. In the eight (8) protected areas of the Departments of Atlántida and Colón the diversity of the flora and fauna, the scenery and the tropical climate are propitious for the development of an ecotourism industry (PDBL, 1995).

The richness of the broad-leaved forests presents a potential that has so far been little exploited. Recent investigations indicate that there are some 200 timber-yielding species in these forests, but the only ones being used are mahogany, cedar, *redondo*, *granadillo* and some of the traditional species now being promoted on the market (PDBL, 1995). A list of timber-yielding species is given in Table 1.

The Regional Office of AFE/COHDEFOR for the management of broad-leaved forests is responsible for an area of 13 000 km2 (PDBL, 1993) on the north coast, where, as in most tropical countries, there is a risk that the forests will disappear in the medium term, given that the rate of clearing is 80 000 ha per annum. This represents about 2.5% annually of the broad-leaved forest cover remaining in the country (PDBL, 1995).

In order of significance the causes of this destruction are: extensive livestock farming, migratory agriculture involving felling and burning, and irrational exploitation of the forests. In the north of Honduras the problem has been exacerbated during the past 20 years by the immigration from the south and west of the country of large numbers of people seeking land on which to practise subsistence farming. This has led to changes in land use resulting in the destruction of broad-leaved forests (PDBL, 1995; SILVIAGRO, 1996).

Table 1. List of timber-yielding species in broad-leaved forests

TRADITIONAL TIMBER	
Mahogany	*Swietania macrophylla*
Cedar	*Cedrela odorata*
NON-TRADITIONAL CURRENTLY COMMERCIAL TIMBER	
Barba de jolote	*Pithecellobium arboreum*
Cedrillo	*Huertea cubensis*
Cumbillo	*Terminalia amazonia*
Huesito	*Macrohasseltia macroterantha*
Jigua	*Ocotea sp.*
Laurel	*Cordia alliodora*
Laurel Negro	*Cordia megalantha*
Marapolan	*Guarea grandifolia*
María	*Calophyllum brasiliense*
Pepenance	*Byrsonima spicata*
Piojo	*Tapirira guianensis*
Rosita	*Hieronyma alchorneoides*
Sangre Real	*Virola kosnyi*
San Juan Areno	*Ilex Skutchii*
San Juan de Costa	*Vochysia guatemalensis*
San Juan Rojo	*Vochysia guianensis*
Santa María	*Calophyllum brasiliensis*
Varillo	*Symphonia globulifera*
Granadillo Rojo	*Dalbergia tucurensis*
Redondo	*Magnolia yoroconte*

POTENTIALLY COMMERCIAL TIMBER

Aguacatillo	*Nectandra sanguinea*
Amargoso	*Vatairea lundellii*
Asajarillo	*Gordonia fructicosa*
Cañamito	*Aspidosperma cruentus*
Coloradito	*Gordonia brandegeei*
Bellota	*Quercus corrugata*
Guapinol	*Hymenaea courbaril*
Jobo	*Spondias mombin*
Matasano	*Casimiroa edulis*
Manchado	*Billia hippocastanum*
Negrito	*Simarouba glauca*
Paleto	*Dialium guianense*
Selillón	*Pouteria izabalensis*
Vaca	*Mortoniodendron sp.*
Zorra	*Schizolobium parahybum*

Adapted from: PDBL 1995 & Sánchez, Del Gatto 1996.

In order to achieve the sustainability of broad-leaved forests, strategies are required that allow the establishment of management guidelines in co-operation with the people living on the fringes of the forests. International co-operation agencies have given support through resource management projects: forest management plans have been devised and implemented and groups of sawers have been formed in the rural communities to exploit the forests in ways causing the least possible damage to the ecosystem. A list of the communities possessing forests subject to management plans is given in Table 2.

It is estimated that 90% of the timber leaving the forests in the area is exploited and marketed illegally and this is saturating the market, lowering prices and seriously jeopardising the survival of legal operations, on which taxes are paid to the State (Sánchez, Del Gatto 1996).

LEGAL ASPECTS

In its endeavour to establish a legal framework to direct future measures in relation to the exploitation and management of natural resources, the State of Honduras is introducing new laws and decrees facilitating the technical/administrative work of the State Forestry Administration.

On 11 June 1996 the General Manager of AFE/COHDEFOR formally submitted to the President of the Republic a three-volume Forestry Action Plan for 1996-2015 (AFE-COHDEFOR/USAID 1996), containing the general policy, its objectives and instruments, the basic strategic outline and specific measures for obtaining the participation of the public in forestry activities (PLANFOR, 1996).

PLANFOR lists a set of priorities for applied forestry research, among which are the management of forests for timber products, the management of areas producing water and other forest services, plantation management, studies on agroforestry and forest grazing systems, the conservation of forest genetic resources, forest industry and social studies. Each of these matters is vitally important for the achievement of ecologically viable and economically sustainable use of the broad-leaved forests on the north coast of Honduras, as well as for the integrated development of the communities that depend on this resource.

PROJECTS AND INSTITUTIONS INVOLVED IN THE MANAGEMENT OF THE RESOURCE

Various projects are now working towards this goal. The Canadian International Development Agency (CIDA) is a pioneer in this field, having begun its activities in 1974 with the establishment of the Honduras-Canada Forestry Programme. Four years later the Project for the Protection of Broad-leaved Forests was initiated. In 1982 the Land Use Plan was started with the aim of evaluating the potential use of soils in the Bonito Oriental Management Unit. A year later two new projects were set up: an agroforestry project intended to determine which techniques were most suitable for the soil and climatic conditions of the region, and a supporting project of the Atlántida Colón Regional Agroforestry Cooperative, Atlántida, Honduras, Ltd. (COATLAHL), specifically concerned with analysing manual sawing activities and their impact on the rural economy, with a view to proposing alternatives that would improve the quality and quantity of production (PDBL, 1995).

In 1985, CIDA and COHDEFOR concentrated their activities in a specific area, giving managerial and technical autonomy, and creating the Broad-leaved Forestry District, now called the Atlántida Forestry Region, in which the Broad-leaved Forest Development Project (PDBL) was designed and began functioning in 1988 (PDBL, 1995).

Decree Law No. 103 of 1974, establishing the Honduran Forestry Development Corporation (COHDEFOR), led to the formation of more than 100 co-operatives through the Forestry Social System. One of them, the Atlántida Colón Regional Agroforestry Cooperative, Atlántida, Honduras, Ltd. (COATLAHL), established in 1977, now has 392 members in 13 groups concerned with manual sawing (Sánchez and Del Gatto, 1996).

Manual sawing has many advantages: it is inexpensive, simple, and ecologically sustainable, and it provides employment and allows exploitation in areas with a low volume per hectare (Reuter, 1991). The timber is removed on mules using forest tracks, in river currents, or simply on foot as far as the storage areas in the communities. These methods have only a very slight impact on the environment (CIDA, 1992).

Table 2. Management plans by community.

La Ceiba Management Unit	
El Naranjo	1605 ha
San Francisco	973 "
San Antonio*	295 "
El Recreo*	702 "
El Urraco*	2296 "
Lis Lis*	987 "
Río Viejo*	1665 "
Yaruca*	4730 "
Toncontín*	2034 "
Piedras Amarillas*	658 "
San Ramón*	1456 "
Santiaguito*	345 "
San Marcos*	3850 "
Tela Management Unit	
Mezapita	926 ha
Jilamo	2552 "
Zapote 1 y 2	4560 "
Texiguat	2606 "
Piedras de Afilar	658 "

Bonito Oriental Management Unit	
Coyolito	1541 ha
Las Minas	2394 "
C. de Piedra	2777 "
Meangul	2338 "
El Venado	1702 "
Río El Oro	1537 "
La Abisinia	528 "
Río Sangro	1318 "
Las Mangas	745 "
El Carbón	455 "
Olanchito Management Unit	
Paletales	1516 ha
Montevideo	570 "
Barranco Chele	1195 "
Regaderos	1127 "
Macora	2401 "
Polomoy	2997 "
Pacura	518 "
Palos de Agua	1267 "*/ COATLAHL groups. The rest of the communities are organised in collective societies.

Source: SIG-PDBL II/AFE-COHDEFOR 1997.

The production of timber by means of minimal impact methods enabled the Rainforest Alliance to grant "Green Seal" certification in accordance with the standards of the Forest Stewardship Council, providing credible independent verification of forestry practices as a step towards the recognition of good forest managers and at the same time ensuring that the exploitation of forests is planned so as to take environmental, biological and social matters into consideration (CIDA, 1992; PDBL, 1995).

At present, measures are being implemented for the conservation of broad-leaved forests by the establishment of extensive protected areas of forest in which operations of any kind are subject to regulation, and conservation by the people through the sustainable use of natural resources. This alternative has real possibilities of success, since it involves the direct participation of the communities in the activities and benefits associated with forestry (AFE-COHDEFOR/PDBL II. 1996).

Three non-governmental organisations are prominent in the protection of the protected areas of the broad-leaved forest region: the Cuero and Salado Foundation (FUCSA), established in 1987 for the protection of the Cuero and Salado Wildlife Refuge; the Pico Bonito National Park Foundation (FUNAPIB), established in 1992; and the Foundation for the Protection of Lancetilla, Punta Sal and Texiguat (PROLANSATE).

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MANAGEMENT OF THE TROPICAL HUMID SECONDARY FOREST

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Essay on the vision and role of forestry in the 21st Century: A prize for students

ABSTRACT

The process of the 'secondarization' of forests in tropical countries is surging ahead and the area of secondary forest is tending more and more to exceed proportionally that of primary forest. The sustainable management of secondary forests is an important alternative for the conservation of biological diversity since the pressure (for example, timber extraction) on tropical humid primary forests will decrease. Similarly, secondary forests possess a number of ecological characteristics which differ from those of the primary forest which make them valuable to the community and from which many other economic benefits, including timber, can also be derived. Various forestry systems have been applied with satisfactory results to boost the productivity of secondary forests proving that their management using sustainability criteria is a technically and economically viable activity.

Key words: sustainability, secondary forests, management, biological diversity, conservation.

DEFINITION OF THE PROBLEM

The area covered by secondary forest has increased in recent years at the expense of the exploitation of primary forests, so that it will have to be these which will be managed and utilized in the future. Gómez-Pompa and Vasquez-Yanes (1974) define the present age as the era of secondary forests due to the fact that, with some exceptions, the statistics show that the area covered by secondary forest tends to be greater than that covered by primary forest (FAO, 1981; Finegan, 1992).

From these arguments, the great importance and attention which must be paid to the secondary forest may be inferred and accordingly tropical forestry must go deeper into the study of ecological characteristics, its goods and services and the management of this forest, in order to ensure the sustainable development of forest resources and maintain the natural heritage for the benefit of future generations.

Primary or mature tropical humid forests, especially those on lowlands, represent an important source of goods and services for man and will continue to do so; accordingly, intervention in such ecosystems, in addition to being necessary, also appears - in some cases - to be unavoidable. As a result, its total world area could continue to decrease, unless better techniques are applied for the sustained management of this resource. These wooded areas are being exploited irrationally without

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[2] Establishment of secondary forests due to the exploitation of the primary forest.

[3]Estimates based on the rates of deforestation, since data on the secondary forest area in tropical countries are not available.

any really sustainable management plans or being converted into agricultural crops, pastures or other uses, at the rate of 70 000 to 200 000 square kilometre per year (FAO, 1981). The examples appear to indicate that if this trend continues, the production capacity of their soil will be reduced by alarming degrees which would result in very low production yields or yields which make it impossible to maintain even the minimum stocking density per unit of area.

According to Finegan (1982), the secondary forest is that woody vegetable mass which develops on derelict land after its original vegetation has been destroyed by human activity and subsequently regenerates rapidly, in large areas in the humid tropics, until it forms a forest. In the neotropics, according to FAO (1981), it was estimated that in the late Seventies, secondary forests regenerated on 21 million hectares of agricultural land abandoned in Mexico, Central America and the Caribbean. Similarly, in the case of South America, 78 million hectares of secondary forest are identified as having the same origin. According to the same document, it was projected that by 1985 those values would rise to 23 million and 83 million hectares respectively in Central America, the Caribbean and South America (FAO, 1981).

Currently, in all social and political circles, the loss of the tropical humid forest - especially the primary forest - is recognized as being the responsibility of society in general, although mainly of the forester/forestry specialist, [with the latter] studying carefully the ecological, biological, social, economic and environmental characteristics of the secondary forest so as to devise and apply, using the results, measures for sustainable management which contribute towards conserving biological diversity and its other values.

There are various significant reasons for the secondary forest being important for the conservation of biological diversity in the tropics. Firstly, these forests are the result of the greatest human activity and for the most part are very accessible on account of generally being located very near human settlements. Arboreal species of the secondary forest are known to possess many characteristics which make them valuable and useful for humanity. The existing pressure on primary forests may be lessened if the value of secondary forests were recognized and they were accordingly managed on the basis of a sustainability criterion to satisfy some of the human needs which initially led to the destruction of the primary forest. Secondly, apart from its important natural role in the restoration and maintenance of some degraded soils due to the change of use, initially, they are likewise necessary for natural regulation, for example of springs and biological diversity (Brown and Lugo, 1990).

Finegan (1992) documented, mainly in Costa Rica, the occurrence of many secondary forest species having a potential commercial value as timber producers. Among the most valuable are, for example: *Cedrela adorata, Ceiba pentandra, Jacaranda copaia, Vochysia ferruginea and Trema micranta.*

With the potential and extent of secondary forest, it is hoped that humanity will not continue requiring substantial areas of primary forest in order to satisfy his needs (timber, wild fauna, oils, i*nter alia*), and will thus foster the conservation of biological and genetic diversity in these forests (Brown and Lugo, 1990).

MANAGEMENT ALTERNATIVES

Research into the use of goods and services from the tropical secondary forest must be directed towards implementing acceptable efficient and environmental techniques which are necessary for rational exploitation, and also determining new, good quality products which this type of forest can provide. It is hoped that through these studies other species might be arrived at which are not traditionally marketable but which are abundant in the secondary forest (Madriz, 1965).

Within the concept of 'sustainability,' appropriate management of these forests (just as in the case of primary forests) entails the use of intensive forestry or forest management practices applied -

generally periodically - for a time whose duration, depending on the location, can be 15-20 years and even more before the following harvests are continued with. The important principles for forestry in the tropical forest have already been established, so that they do not need to be re-discovered. These management criteria must be applied to secondary forests only with great care (Finegan, 1992), since on account of their distinct floristic composition by comparison with the primary forest, the management techniques to be applied may vary substantially from those traditionally applied in the management of forests of other types.

Tropical forestry seeks to use the processes of forest dynamics to manipulate positively the composition of the forest according to pre-established forest management objectives. In this way, the basis for the management of secondary forests could be the handling of secondary succession (Alexandre, 1993). Wadsworth (1987) suggests four possible alternatives for improving secondary forest productivity:

1. No treatment or use for protection (for example, fallow forests).
2. Refinement (improvement of stands for timber extraction) to reduce competition.
3. Stimulation of natural regeneration for removal of the canopy to supply seeds and promote the growth of desirable species.
4. Plantation under the canopy, or enrichment, in clearings in the forest, produced in a natural way or caused by man's action.

According to results from the studies available in the bibliography relating to the management of the tropical secondary forest, it may be seen that this can be established by means of two systems: the establishment of the forest by means of the natural regeneration, with seeds from adjacent trees, [of] the forest initially felled, or of trees (seed plots) which remained standing directly on the site. In both cases, and when natural regeneration has been low and/or deficient, management activities such as additional artificial planting (supplementing those established naturally) of saplings or enrichment, can considerably help to ensure a good stand of trees which will form the final harvest in the future. Examples of the first case referred to above are described by Finegan (1992). In Costa Rica the 'Trinidad protection canopy system' was used, modified for the management of secondary forests, and this achieved good results only in those areas where there was sufficient regeneration of desirable species. Similarly, Martínez (1979) applied management techniques for natural regeneration in southern Florencia, Turrialba, Costa Rica for the same purpose.

Among the experiments with plantations of trees or enrichment, I encountered a system in which the establishment of the secondary forest was stimulated by the planting of saplings in rows in the clearings - a technique successfully applied in various tropical countries. Similarly, the author found bibliography describing the 'Recru-method' system, used to enrich recently exploited forests with desirable species in Gabon, Africa (Sips, 1993), modified for application in secondary forests in Brazilian Amazonia (Yared and Carpanezzi, 1981).

The very important experiments carried out in the neotropics (Trinidad, Malaysia, Costa Rica, Colombia, Peru and Brazil) illustrate the technical feasibility of managing lowland secondary humid forest (Finegan, 1992). As stated in this paper, there is important evidence that the management of secondary forests can be sustainable and [that] from [it] goods and services can be obtained for multiple use although not at the expense of the environment or biological diversity in general.

CONCLUSIONS

The conservation of the biological diversity of the tropical humid forest is a focus of world concern on account of the degradation to which this forest is subject. Management of secondary

forests will be able to stimulate that conservation since the pressure on primary forests will lessen, mainly in the population's striving to obtain the useful goods and services which these forest areas provide.

The policies for the reafforestation of the States of tropical countries are in themselves a strategy for increasing the planted area. However, there is still an extensive area in those tropical countries which is not reafforested due to the high costs per hectare and the lack of technical experience in reafforestation with tropical species. Accordingly, natural reafforestation via the management of primary and secondary forests may be the viable alternative for increasing the forest area in the tropics.

Timber, particularly firewood, is a resource of great value in the tropics. The bulk of the timber harvested in developing countries is for firewood (NATIONAL ACADEMY OF SCIENCES, 1980). The primary cause of deforestation in the tropics is agriculture, [and] although the use of firewood is high per capita (1.0-1.5 t/person/year), much of it can be felled on fallow land and in nearby secondary forests (MACDICKEN & VERGARA, 1990). The sustainable management of the secondary forest offers a good opportunity of obtaining firewood, as a by-product, for the community in general so that the pressure to obtain this product, for example, which is exerted or will be exerted on the primary forest, can be reduced or perhaps totally eliminated.

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HIDROANDES ENVIRONMENTAL EDUCATION PLAN

Karina Peña Rodriguez[1]

INTRODUCTION

Environmental problems are becoming daily more acute and the measures taken to control them are far from being really effective. In particular, it may easily be seen that scant attention is being paid to nearby populations when taking measures for the recovery of protected green areas, with the capacity of response and support of which they are capable in the rescue of the environment being overlooked.

Nor is this neglect absent among children or young people. And it is from them that the responses for the future will be forthcoming. Without their conviction that the environment should be protected, no action can be successful.

The present plan is intended to be a simple contribution to the increasingly vast, costly and undeferable task of rescuing the environment and natural resources. It is directed at pupils in the 4th to 9th grade of primary education.

The focus of the work is fundamentally the creation of tree nurseries, although subjects and techniques around them are dealt with which allow the pupil to acquire a broad outline of knowledge and skills concerning environmental management. It consists of a series of practical learning activities fundamentally made up of workshops and field activities seeking concrete success which is visible and rapidly achieved and which motivates the pupils towards learning, work and research.

The presenter of this paper works, in implementing this plan, for the New Readers' Circles Project [Proyecto Círculos de Lectores Nuevos] (CILEN) and HIDROANDES, together with a team coordinated by José Ramón Días.

JUSTIFICATION

HIDROANDES, the hydrological undertaking in the Andean region of Venezuela, supplies the State of Mérida's major population centres with water for human consumption; for this purpose, it is supplied from rivers and gorges. However, it is a fact that the volume of these sources is decreasing as time goes on as a result of man's intervention. This may lead in the very near future to serious supply shortages of this vital element, so that measures need to be taken to conserve drainage basins.

In this activity of basin conservation and recovery, there is a key group - the communities which are users of the basin - which, by committed conservationist action, will ensure the sustainability of recovery and preservation plans.

For these reasons, the implementation of a focused inter-institutional plan for environmental

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education incorporated in formal primary education is proposed. In this way, we are involving children and young people in the formation of an environmental culture, thereby guaranteeing the permanence and continuity of the educational programmes.

The work is justified right from the earliest ages in the family and educational circle, since childhood and youth are the main stages in the development of an environmental culture.

The Environmental Education Programme proposed is in accord with two educational factors, both of which currently apply and are of fundamental importance:

(a) The constructivist theory of the development of thought:

According to this, a child develops intellectually 'by constructing its own learning.' To do so, it needs to be offered a number of conducive conditions in which this process originates. This means organizing the conditions in its environment so that the child, as an active subject:

(a) detects resources
(b) assimilates them in his/her constitution
(c) recognizes them as being useful and
(d) fits them to the requirements of his/her community.

In the case of interaction with natural resources, this assimilation and accommodation take place far more spontaneously, particularly in the rural area in which the child naturally feels integrated in the environmental context: a knowledge of plants, their usefulness, properties, conditions of cultivation and productivity; that of fauna, its characteristics, the possibilities of carrying out exercises in taxonomy, the control of diseases and the use of chemicals and fertilizers are topics of the utmost interest which can be dealt with by the young in a context of systematic experimentation which promotes effective and stable learning for pursuing cognitive development at new stages.

It is in this way that learning becomes significant - the process of acquiring knowledge gains a meaning by virtue of being the product of an individual experience with a social projection and not just an accumulation of information unconnected with reality in the child's mind.

(b) The proposal for work through School Projects:

Within the ambit of primary education in different countries, work through School Projects is being tried out; such projects entail research activity in which the use of the scientific method is adopted. In this way, attitudes of discipline and systematization which the rigour of science demands are promoted and at the same time an awareness is created in the pupil that it is a factor which is more relevant to a context in which, and for which, he lives.

The Ministry for Education in Venezuela has proposed this method of working in the desire to eliminate the tendency to comply with supposed objectives which prove to be specific and lead nowhere and which compartmentalize information, preventing pupils from reconciling different subjects of the curriculum in a theoretical construct which is adapted to their reality and cohesive for developing intellectually and maintaining an enquiring mind in the solution of their problems and those of their community. However, it has been difficult to comply with these directions and the experiments which have been fostered in this way in schools are few and far between.

PRELIMINARY CONCEPTIONS

Generally, 'awareness' is the term given to the sensitivity to nature which awakens in the child and the reaction he/she manifests in response to negative events such as deforestation, fire and, in general, the destruction of nature and also the trend which is changing into the habit of 'wanting to

care' for renewable natural resources and the value which the child ultimately places on natural ecosystems.

The hypothesis is proposed that this 'awareness' is acquired only with symbiotic and harmonious interaction between the child and nature. This 'awareness', which we will call 'conservationist tendency', is linked to affection and to the development of awareness, as well as being subject to the natural inclination of the individual.

It is suspected that a child does not acquire a conservationist tendency through a process of memorization or unilateral transmission of knowledge and information through an educator or other adult who performs educational functions; rather, the child, in a free process, gradually constructs interests and concerns in relation to nature which allow him/her to confirm the importance of the harmonious co-existence of human beings with forests and the conservation of the diversity of life to be found in them.

It is difficult to think that anyone can acquire 'awareness' and a 'love for nature' through meaningless talks and without any contextualization as far as the subject is concerned. On the other hand, through the establishment of relationships of interest, it is possible to create simultaneously a field of concern through knowledge and a respectful approach to the natural world. This is what we would like to try by means of our project during this school year.

GENERAL OBJECTIVE

To strengthen conservationist practice among pupils at the educational centres in Mérida with a view to water conservation and with the focus of interest in active participation by pupils in generating school tree nurseries.

SPECIFIC OBJECTIVES

1. To plan environmental education activities for each educational institution.
2. To establish a tree nursery in each educational institution.
3. To create a conservationist group with motivated young people from the community in which the school is located.
4. To reafforest degraded areas of selected drainage sub-basins.
5. To involve educational communities and non-governmental organizations in reafforestation and conservation plans.
6. To involve other public and private institutions of interest in the different activities.

IMPLEMENTATION OF THE PROGRAMME

The fundamental activities consist of:

· Meeting with the educational community and community support groups to present the Programme and draw up agreements.

· The selection of priority activities and of work sites, both within the school and within the basin.

· An initial meeting with the children to:

a) apply the initial diagnosis whereby the learning of information concerning environmental subjects and the conservationist tendency of the child covered by this plan is proposed (see evaluation component);

b) present the video 'Forests in the Sky,' produced by the FUNDACITE's Museum of Science and Technology and which shows the fauna and flora of the fog forest;

c) explain the planning to be carried out for working on the subject of the environment.

· A guided tour of the basin. This consists of a walk, in which the children enjoy the environment which the forest presents. The guidance on this field trip consists of fostering recognition by the children of the composition of the ecosystem, the relationships, the forms and the processes involved and their admiration of the complexity and beauty of this environment.
· The preparation of the compositions, stories or sketches which are requested from the children at the end of the guided tour.
· The establishment of the tree nursery through workshops.
· The constitution of environmental school brigades: the tree nursery requires constant care by a group of children. In this group all the children in the group take turns. The care given has to be in accordance with the standards laid down. Tree nursery maintenance activities are carried out on a weekly basis.
· A school journalism workshop whose aim is that the children should permanently publish, on a notice-board for example, all the activities they are carrying out.
· Supplementary activities: on a casual basis and in accordance with the implementation of the programme, workshops for worm farming, organic fertilizer, solid waste or other ecology videos are shown.
· Afforestation: at the end of the school year, the saplings grown in the tree nursery are sown in a selected area.
· Application of the final diagnosis, on completion of the implementation of this Plan, during the school year (see evaluation component).

EDUCATIONAL INSTITUTIONS IN WHICH THIS PLAN IS CARRIED OUT

- Sub-basin of the River Mocotíes: Mesa Bolívar School
- Sub-basin of the River Mucujén: El Vallecito School
- Sub-basin of the River Albarregas: Elmiro Fuenmayor School

EVALUATION

The learning processes and the successes achieved by the children through the events held are systematically evaluated.

The work of the children can be evaluated using two criteria: conservationist tendency and theoretical and practical knowledge.

In the evaluation it is likely that we will ultimately catalogue as a conservationist tendency an attitude which is the product of the child's inclination to the social opinion expected from him/her; this is an aspect we will not obviate, although we do stress the evaluation of this parameter.

The evaluation consists of requesting the child to prepare a story founded on a basic group of given words: for the initial diagnosis, the words are 'river,' 'desert,' 'basin,' 'tree,' 'mountain,' 'forest,' 'destruction,' 'Alberto,' 'environment,' 'animals,' and for the final diagnosis, they are 'river,' 'tree,' 'Alberto' and 'environment.'

Another way of gauging attitude and knowledge is via the interest, disposition and work the child shows during the school year, for which different yardsticks are used.

Finally, we wish to express the view that this Programme seeks to be a proposal which contributes, from its own particular perspective, towards the formulation [of] much more extensive plans and greater coverage of environmental education.

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THE SIGNIFICANCE OF FOREST ECOSYSTEMS CONSERVATION IN INDONESA

by Agus Salim[1]

INTRODUCTION

Indonesia has three significant features in natural resources and national development. These are its strategic location, its geographical characteristics, and the density and distribution of its population. In the world, Indonesia ranks as the largest archipelago nation forming a bridge between the Pacific and Indian Ocean, and between the continent of Asia and Australia. The fifth largest country by population.

Five islands : Java, Sumatra, Sulawesi, Kalimantan and Irian Jaya, account for 90 % of the land area. Java with 7 % of the total land mass, is home to over 60 % of the population, and has an average density per square kilometre of 759 people, while in Irian Jaya this number drops to 6 (Central Bureau Statistics, 1989). Indonesian archipelago form a bridge between the Pacific and Indian Ocean, and between the continent of Asia and Australia. During the last decades, the government of Indonesia has been attempting to redistribute the population through transmigration program.

The conflict between population growth and food supplies is a continuing issue. The current population is excess of 170 million and estimated up to 216 million in the year 2000 (Ministry of Population and Environment, 1989). A continuous and increasing demand for food, land and fuelwood pressures the natural resources base, and results in the clearing of forestland for agricultural use, settlement and industries.

TROPICAL FORESTS DEVELOPMENT IN PRACTICE

Forestry is defined as the art, science and practice of managing the natural resources that occur on and in association with forestland for human benefit. Forest is much more than assemblage of trees. It is rather than a biological community of plants and animals existing in a complex interaction with the non-living enviroment. Although trees are predominant woody vegetation in terms of biomass, trees represent only a small proportion of the total number of species present in the forest. There are thousands different organisms of plants and animals in the forest.

As a tropical country, Indonesia has a wide range of tropical forest. Ten percent of the earth's remaining tropical forests and nearly 60 % of all tropical forests in Asia is located in Indonesia (World Bank, 1989). Long-term strategies are being developed to ensure that the future of the tropical forest is the result of appropriate policy, rather than reactive or circumtances. Tropical rainforests provide environmental as well as economic benefits for all people, and have an important role in regulating the global climate, and in shelting unique species diversity. In addition, rainforests are the source of highly-valued and widely-trade timber. These tropical forests contain the world's

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most extensive concentration of tropical hardwoods.

Indonesia also has a famed diversity of ecosystems, from the ice fields of Irian Jaya to a wide variety of humid lowland forests, from deep lakes to shallow swamps, from coral reefs to mangrove forests and valuable genetic resources, the economic benefits of which are only just becoming clear.

In 1983, the Department of Forestry intituted a system of forest classification by functional role. They are protection forest, conservation forest (nature reserves, wildlife refuges, national parks, hunting reserves and recreational park) and production forest (limited production forest, regular production, conversion). The Indonesian Selective Cutting and Planting (TPTI) is a silviculturally viable system which can lead us to sustainable management if properly applied and controlled.

Indonesia is concerned with the long-term management of its forest resources, as indicated by recent government actions. Research is continuing on the regeneration of native species in natural forests, and plantation forest development is being encouraged to meet future industry supply requirements.

Indonesia's forest management is aiming at the right or prefossional tract, at the national level as well as at the unit area level. As noted by Manan (1992), the following activities and documents support this statement :

1. The presence of a qualified organization : Ministry of Forestry and its regional offices.
2. The presence of a Forest Land Use
3. Long-term forest management is existing (RKPH)
4. The requirement of an environment impact assesment study
5. A national forest inventory is progressing
6. Detail aerial photograph maps are being prepared
7. A separate silvicultural organization is responsible for regeneration and tending of residual stands
8. Recruitment of adequate number of professional foresters is in progress
9. Establishment of local community participation through village-forest concession development
10. Establishment of Industrial Timber Estate (HTI)
11. Measures are already taken for forest protection against disturbances.

MAN'S DEPENDANCY TO FOREST ECOSYSTEMS

There is a growing acceptance by nations outside the lesser-developed countries that conservation of the environment is a moral and economic obligation for all. It has large variety of life on earth-plants, animals and micro-organisms. It is most used for species, but the term also encompasses the variety of ecosystems or habitats, and the genetic variation that exist within a species which is so valuable in man's attempt to breed desease-tolerant, pest-resistant or more productive organism.

Eventhough it occupies only 1.3% of the Earth's land surface, Indonesia is incredibly rich in species. The forests of Indonesia are the country's most valuable natural resources asset and still cover two-third of the land area. They comprise the most extensive forest reserves in Asia and are only exceeded in the world by Brazil's forests of the Amazon basin. Their immense diversity of species is renowned and reflects the wide geographical range and heterogenity of the country. The forests of Indonesia contain some of the richest flora in the world with more than 4,000 known trees species. The number of species presently considered to be commercial, however, is no more than 250 and in practise many loggers are concerned with less than 50 main species (RePPProT, 1990)

The entire forestry sector employs an estimated 745,500 people. As the number of its population increases, the pressures on natural resources is higher. Deforestation is one of the continuing issues

faced by the country. Deforestation in developing countries is rooted in development patterns, population, land ownership, investment incentives, logging agreements, agricultural pricing policies and global market imbalances. The forces responsible for deforestation are as complex as the consequences, and can not be disaggregated. In Indonesia, conversion of forest land is primarily for agricultural use. Over one million families still practices shifting cultivation, mainly on the islands of Sumatra and Kalimantan. Government, private sector and NGOs are implementing projects designed to reduce shifting cultivation by providing incentives for practising permanent agriculture.

Indonesia's species-rich forests harbour the world's greatest diversity of palms, more than 400 species of dipterocarps (the most valuable commercial timber trees in S.E. Asia) and an estimated 25,000 flowering plants as well as a rich and diverse fauna. Indonesia ranks first in the world for species richness for mammals (515 species, 36 percent endemic), first for swallowtail butterflies (121 species, 44 percent endemic), third for reptiles (600 species), fourth for birds (1519 species, 28 percent endemic), fifth for amphibians (270 species) and seventh for flowering plants (Biodiversity Action Plan for Indonesia, 1991).

Many of Indonesia's biological resources are economically important. Several plant species of global and national importance originated in Indonesia. An estimated 40 million people are directly dependent on biodiversity for subsitences. Twelve million people live in and around forests and many more are dependent on costal resources. It is the poorest rural people who are most dependent on biodiversity and natural habitats for their livehoods and it is they who suffer first and most when those habitats are simplified, degraded or otherwise improverished.

REAL EFFORTS TO CONSERVE FOREST ECOSYSTEMS

Efforts needed to protect biodiversity encompass legislation, institution, and international convention and program.

The 1945 Indonesian Constitution (UUD 1945) stresses the need to use Indonesia's natural resources base wisely and sustainably for economic and social development to improve the prosperity and welfare of the people.

The government agency with direct responsibility for protection of natural habitats and conservation of nature is the Directorate General of Forest Protection and Nature Conservation (PHPA) within Ministry of Forestry. PHPA is responsible for protection and management of all terrestrial and marine conservation areas and for management of protection forests.

Legal framework through which Ministry of Forestry addresses the issue of forest protection and wildlife conservation is primarily the Basic Forestry Law of 1967. This law specifies the responsibility of the government towards all aspects of conservation as well as the relationships between the people and State regarding forest ownership and use. This law provides for protection and conservation areas but needs to recognize traditional common property uses and to be compatible with the objective of in-situ conservation outside protected areas.

The Indonesian NGOs have played an active role in stimulating public interest in biodiversity issues, urging government to strengthen conservation and environment issues in national legislation, policy document and development activities. Indonesia has more than throughout the archipelago working with local communities to resist and counter destruction and simplification of habitats e.g. replanting mangroves, soil conservation and sustainable agriculture.

As forests play a global function and role to people all around the world, international cooperations as well as conventions and programs are certainly needed. Indonesia supports and implement international conventions and international programs which are relevant to conservation of biodiversity. Indonesia is already a party to CITES, to the World Heritage Convention and the ASEAN Heritage Convention. Indonesia has already nominated three national parks as World

Heritage Sites, Komodo, Lore Lindu and Ujung Kulon.

Since species live and evolve in complex natural habitats within even larger ecosystems, the primary means of conserving biodiversity is conserving ecosystems. Indonesia already has a system plan parks and protected areas. Terrestrial and wetland sites of highest conservation value in each of seven major biogeographic regions were identified according to criteria of species richness, endemism, range of habitat and management viabilities as well as for socio-economic benefits.

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Certification - system of global control of wood raw material world market

Grzegorz Wegrzycki[1]

I. THE PROBLEMS OF PRESENT WORLD FORESTRY

We live in the time of global changes of climate. The deformation of the environment has become a more important problem and from time to time we learn about some ecological disasters. We are aware of the critical situation of the tropical forest . Deforestation on a global scale is growing. The FAO data show that annually 15,4 mln ha of world forest disappears. Deforestation covers 0,8% surface of tropical forest and 1,6% of forest in Asia annually. The foresters from many countries try to solve the problem of the forest which was polluted during the catastrophe in Chernobyl. In that time, 13,1 mln ha of surface including lots of forests were polluted. Three countries: Russia, Byelorussia and Ukraine are facing a big problem: how to manage the polluted area? The turnover of the wood raw material in the world is growing. Wood raw material is transported over long distances, often to different continents, but the sources of this raw wood are frequently unknown. In this situation, there is a big possibility to introduce new fungi or insects into areas where they have never been. The results of this human activity can be unpredictable.

These are only some of the problems which have to be solved by the new generation of foresters. It appears that creating the model of production of high quality wood stock which will be consistent with the model of sustainable forest is one of the important tasks for present world forestry management. In addition, I have to state that in the time of global treatment traditional forms of environment protection which are based on interdictions and punishments are insufficient. We have to undertake activity covering all the globe, not only continent, country or region and also this activity should be accepted by local societies. One of the operations assisting legal protection of our environment can be the certification of wood and forest activity as environmental and human friendly. The certification takes advantage of the most powerful mechanism in the present world which seems to be the economic mechanism.

II. HISTORY OF CERTIFICATION

This action was initiated in 1987 by the organisations World Wildlife for Nature and Friends of the Earth. Soon the action was accepted by numbers of countries and obtained the advancement of

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FAO. The 1993 Helsinki Ministerial Conference established a decisive impulse that accelerates works by documentation concerning forest of tropical and moderate zones. The results of these works were elaboration of international norms (ISO 9000 - ISO 9004). These norms standardise the way of problems of quality, estimation of social, economical and ecological criteria. We can grade principles of management in forest and management in wood manufacturing by these criteria. These principles have to be respected in the all stages of management and production.

III. CERTIFICATION PROCESS

The certification of wood may be defined as a process leading finally to written certificate form for the company. This form is given by the independent and professional advisory body dealing with the rules of forest management in this area. Certification takes place by assessing the effect of forest activities against standards previously agreed and acceptable to interested parties.

The certificate has two parts:

Part one considers the field verification of practically implemented rules of silviculture, management as well as forest utilisation. This part of the certificate concerns exclusively the previously checked and described forest space, e.g., Forest Division - in Poland. It appears that the necessity of obtaining this part of the certificate extorts from the forest proprietors more ecological forest management. Obtaining this part of the certificate is the form of the acknowledgment to the forest management in the given area. For the Forest Division it can be useful in obtaining bank letters or credits.

Part two deals with the specific raw material, intermediate products or final products obtained from the forest. In the case of wood raw material - all the operations of wood harvest transport and accompanying activities are subject to certification. This part of certification could facility to obtain permit for trade turnover. As a result, we are going to eliminate products made of raw material from badly managed forests or the unknown origin raw material from the market. Certification also increased the possibility of selling wood raw material outside one's own region. Since January 1997 British exporters have banned trade of non certified wood. Certification provides a rapid and accurate system for tracking and obtaining data on logs and wood products. For governments it is a good system for environmental and fiscal control.

IV. WOOD RAW MATERIAL WORLD MARKET

It is estimated that approximately 1,5 mln m3 of certified wood is subject annually to international trade turnover. Comprising this amount with production of wood in an average surface European country as Poland (20 mln m3 annually), it is not so much. But the quantity of certified wood is increasing. 3,1 mln ha of moderate climate forests have 42 certificates in 17 countries. In the 6 - 12 months the surface of certified forests will cover 5 mln ha.

Today there are 5 institutions dealing with forestry certification. They are as well non-government institutions as consulting institutions, productive enterprises and factories. The following should be listed:

1. Forest Conservation Programme of Scientific Certification Systems (USA),
2. Smartwood Certification Programme of Rainforest Alliance (USA),
3. Woodmark of The Soil Association (UK),
4. SGS Forestry (UK),
5. Pacific Certified Ecological Forest Products USA).

All these institutions have their own standards and criteria that differ from each other. Non-government institutions focus on improvement of methods of forest management and the necessity of local societies development. Factories concentrate on profits from certification and on elimination from the market wood without certificate. It is very important to make the process of certification straightforward. In some countries, the difficulty with the certification process is caused by frittering of forest property. There are 1,4 mln private forest owners in Poland. That means we have to make more than one million separate certification processes in this country. This is a trap nowadays in world forestry management. We have another problem with certification - finance of the certification process. The expenses of obtaining certificates amount to about 1-2 DM for 1 ha or 1 US$ for 1 m3. This amount can vary. It depends on volume of production. In Poland, the certification process is financed by the foreign wood raw exporters' money. But I am sure, that it is a profitable investment, because distinguished products will be preferably bayed by the customers.

In Europe, England, Holland, Belgium, Austria, Switzerland and Finland are most interested in certification. Some of European countries have already created joint international commissions in order to find out common principles that could be accepted by forest policies of their member states. All foresters know that effective rules of certification depend on obeying local laws and international conventions in all countries. It is very important to solve others problems too:

1. It is necessary to make one organisation which will be responsible for thre certification process. However nobody can show which organisation has enough authority and is in a position of great trust in non-government organisations, government institutions. firms and societies. So, nobody knows which certificate is obligatory.

2. We have to find a universal criteria of certification which can be useful for all kinds of woods, species of trees, types of the propriety and kind of forest management. So it is possible that one day, in the same shop when we buy two boards of origin from two different countries, both of them will have certificates in spite of different certification criteria in these countries.

3. We have to find such methods of certification that costs of this process can be devised on all stages of obtaining final product - from production of wood, through processing to final product.

V. FUTURE OF CERTIFICATION

In my opinion, the present world is not prepared to introduce a global system of certification because the financial and political mechanisms are not suitable yet. However I think that it is not a passing fashion but necessity which is a result of the real situation on the world wood market and taking global activity for environment protection. This process develops gradually and takes over more and more countries. But, it is obvious that now the wood products with certificates need more promotion on the world market. We have to make world publicity and education campaigns for millions of average wood products consumers. We should start this education from foresters introducing a new subject in universities: certification. Then we should make a big campaign on TV, radio and in the press. Societies have to recognise the problems of certification, certification process and advantages from certification. I think, that this is the only way to obtain support of certification by societies. Increasing ecological consciousness in societies should have influence on demand for certificate products. For that reason we have to create a special trade mark. Certified products will be provided with it. It was successful for the ozone friendly products and the recyclable products. Everybody knows these trade marks. These attempts are being made by the British firm

SGS Forestry making promotion of the trade mark LOGTRAK. LOGTRAK is something more. It is a high technology system, designed to track logs and other wood products throughout the supply chain - from the forest to the final point of sale. However, in a situation of unequal development of forestry management in numbers of countries it will be very difficult. Countries with high developed forestry management with collaboration of international organisations should create a certification system of their own wood industry and the experience should be transferred to the less developed countries. This activity can create in the future a global certification system.

SUMMARY

In the time of global treatment, traditional forms of environment protection which are based on interdictions and punishments are insufficient. One of the operations assisting legal protection of our environment can be the certification of wood and forest activity as environmental and human friendly. The certification of wood may be defined as a process leading to finally written certificate form for the company. This form is given by the independent and professional advisory body dealing with the rules of forest management in this area. The quantity of certified wood is increasing. 3,1 mln ha of moderate climate forests have 42 certificates in 17 countries. In 6 - 12 months the surface of certified forests will cover 5 mln ha. Some of the European countries have already created an international commission in order to find out common principles that could be accepted in forest policies of their member states. This process develops gradually and taked over more and more countries. This activity can create in the future a global certification system.

Key words: certification, environment, wood raw material, wood market, forest management.

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