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IDENTIFICATION OF MEANS BY WHICH THE COMPETITIVENESS OF NATURAL PRODUCTS WITH ENVIRONMENTAL ADVANTAGES COULD BE IMPROVED

Reducing the environmental stress of consumption without affecting consumer satisfaction

Report by the UNCTAD secretariat

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CONTENTS

I. INTRODUCTION

1. A multitude of environmental effects occur and modify the earth's ecology when a product is produced, transported, consumed and disposed of. Given that production and transportation are undertaken to permit consumption and that disposal results from consumption, the effects of these activities on the environment can be linked directly or indirectly to consumption.

2. It is generally accepted that owing to these effects, the earth's carrying capacity will be inadequate to support the continuation of the rapid consumption growth experienced over the last century, especially in the developed countries, particularly if consumption patterns with the same environmental impact are maintained. Ways and means to reduce unsustainability of consumption therefore need to be explored. Two approaches can be identified in this respect. The first revolves around reducing consumption in the developed countries, whilst concomitantly avoiding replication in developing countries of the consumption patterns of the developed ones. The second approach seeks to reduce the environmental impact of consumption by identifying environmentally preferable1 products with less harmful environmental impacts during their life cycles, improving the awareness of consumers and industries about the existence of such alternatives, improving the competitiveness of these products, and shifting demand towards them. The two approaches are not mutually exclusive. Whilst there is much room for reducing consumption, particularly of certain items such as energy or packaging, and especially in the industrialized countries, this study, focuses on the second approach, with particular emphasis on improving the competitiveness of environmentally preferable products.

3. If prices of goods and services reflected their full environmental costs and benefits, environmentally preferable products would have a price advantage over alternatives, unlike the current situation where a large proportion of such costs and benefits is externalized. Although full cost pricing can be approached through appropriate policies and measures that promote the internalization of environmental externalities, this is unlikely to be attained in the near future. Non-price methods to improve the competitiveness of products with environmental advantages will therefore need to be utilized for some time to come. A first step in this direction is to bring to the attention of consumers and industry the existence of environmentally preferable alternatives and to stimulate their interest in using them. Although this would naturally not be a solution to all, or even the main, environmental problems, it would appear to be a cost-effective first step, benefiting from the 'mega trend' of increasing environmental consciousness, with potentially significant impacts on reducing environmental stress.

4. With this understanding, the present study aims at providing initial information on natural products with claims to environmental advantages and to establish a basis for action to increase their competitiveness. It focuses on products with supply potential from developing countries. Increased utilization of these products could help in both reducing environmental stress without impairing consumer satisfaction, and increasing the foreign exchange earnings

of developing countries, thus contributing to their development efforts.

II. ENVIRONMENTAL ADVANTAGES AND CONSUMER INTEREST

5. Undisputed scientific proof of environmental advantages is very difficult, if not impossible, to obtain. In spite of the advances achieved in life cycle analysis, ranking of products according to their environmental impacts is always controversial. Given the rather modest purpose of this study, natural products with environmental advantages are defined as those which cause less environmental stress at some stage of their lifecycle than do other products that serve the same purpose. They may have been produced in an ecologically preferable production process and/or they may have an ecologically preferable end to their useful life. Products which do not have harmful effects on human health (because they do not contain harmful residues and other harmful items) are also included in this definition.

6. There would, however, be many occasions where an environmental advantage on one account (e.g. biodegradability or the use of recycled inputs) may be associated with an environmental disadvantage on another (e.g. pollution at the production stage). Whether the product can be considered to have environmental advantages on balance depends on the importance attached to different criteria. When specific products with claims to environmental advantages are referred to later in the study, the emphasis is put on the positive side but, where they are significant, environmental disadvantages are also mentioned. Claims to reducing environmental stress can be made for many products originating from developing countries. These products merit particular attention because their increased use and trade would contribute not only to environmental protection but also to development and poverty alleviation which, themselves, are seen by many as the prerequisites for preventing environmental degradation in developing countries. In this broad perspective, therefore, it would seem reasonable that products supplied by developing countries should be considered to be environmentally preferable even when they have environmental effects equivalent to those originating in richer countries.

A. Environmental advantages at different stages of the life cycle

7. Environmental advantages can be associated with the upstream or downstream stages of a product's life cycle.2 The geographic scope of the environmental advantages will also influence attitudes towards environmentally preferable products.

8. Lower environmental stress at the upstream stage of a product's life cycle can occur in terms of input use and the adoption of environmentally preferable technologies. Thus, organically grown products reduce water and air pollution caused by external inputs to agriculture. Similarly, products made of otherwise polluting agricultural wastes reduce methane emissions owing to rotting or carbon emissions caused by burning of the wastes. Also, products which use recycled materials as inputs diminish the need for landfill space and the potential pollution caused by discarded materials.

9. Other natural products which reduce upstream environmental stress are those which (i) use renewable instead of non-renewable inputs, provided that the regenerative capacity of the renewable resource is maintained3; (ii) use inputs produced under more sustainable conditions than those used by alternatives; or (iii) foster the sustainable management of exhaustible resources, including biodiversity.

10. Lower environmental stress at the downstream stages of the product's life cycle, i.e. when goods are used, consumed or disposed of after utilization4, stems from the physical or chemical properties of a product. This includes reduced health and safety risks when the product does not contain toxic residues of external inputs (e.g. as a result of biological pest control in agriculture) that could directly affect health or accumulate in animal and human food chains when the product is consumed; and non-environment-friendly disposal, retrieval and recycling possibilities, as when the product does not contaminate air, water or soil when it is disposed of or incinerated, or is biodegradable or easily recyclable or reusable.

11. Geographically, the reduction of environmental stress achieved by the production and utilization of environmentally preferable products can either occur exclusively in a specific locality within national boundaries and jurisdictions or span a larger region.

12. Advantages which are not bound to one country's territory include pollution reduction, with positive environmental effects on air, water or land in an adjacent country or in a shared geographical region, and the improvement of conditions with regard to transboundary living resources (e.g. migratory species). The effects can sometimes reach the whole global commons, as in the case of reductions in the greenhouse effect achieved by making use of agricultural waste, or by using agro-based fuels instead of fossil fuels.

B. Consumer interest in environmental advantages

13. Among the environmentally preferable characteristics of products mentioned above, those that occur at the downstream stages of the life cycle will be of immediate concern to consumers, whether the products are produced in their country or not. It can be expected that advantages at the upstream stages will also be of particular interest to them when the product is produced in their country. Especially in industrialized countries with a high level of environmental education and wealth, the concerns are likely to extend to the overall advantages of domestic or imported products, regardless of the stage of the life cycle at which these advantages occur.

14. Opinion polls and surveys indicate that consumer interest in environmental impacts of products is growing. For example, in Germany between 1981 and 1991, the proportion of consumers who would buy an environmenta-friendly product rather than another rose from 57 per cent to 72 per cent.5 In the United Kingdom in the summer of 1989, it was "found that 53 per cent of those questioned had declined to buy a product during the previous year because they were worried

about the effects the product or its packaging might have on the environment." A significant proportion of these environmentally conscious consumers are also willing to pay more for the products that they choose. In a study of United States consumers "in November 1990, it was found that 90 per cent of those interviewed said they would pay more for environmentally sound products".6 In a separate survey "consumers throughout the United States [said] they would be willing to pay, on average, 6.6 per cent more for products that they think are environmentally friendly".7 According to a survey in Germany, a small majority of consumers would not refuse to spend more for an environment-friendly product, and up to 16 per cent would accept to spend more than 5 per cent.8

15. The interest of the consumer in environmental issues is necessary, but not sufficient, to reduce the environmental stress of consumption. Although the consuming public can exert a pressure on, and regulations can force, the business sector to be environmentally conscious, this would not be sufficient if there was no independent corporate will to take better care of the environment. Recently, a growing interest has been manifested by the business community in being "clean and green". A survey undertaken by the UNCTAD Programme on Transnational Corporations "confirms that transnational corporations have started seriously to consider their role in sustainable development and to integrate environmental concerns in decision-making".

16. To the extent that consumers and producers manifest a concern for the local environmental impacts associated with the production of imported products, certain problems of national sovereignty may be raised. Principle 2 of the Rio Declaration proclaims that "States have ... the sovereign right to exploit their own resources pursuant to their own environmental and developmental policies". The same Principle adds, however, that States also have "the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or areas beyond the limits of national jurisdiction".

17. In the case of tradable products with local environmental advantages at the production level, the apparently conflicting principles of ecological interdependence and national sovereignty can be positively reconciled because, by producing and exporting such products rather than others, a country takes better care of its own resources and environment and simultaneously contributes to the protection of the global environmental system.

III. PRODUCTS WITH ENVIRONMENTAL ADVANTAGES

18. Environment-friendly attributes, as discussed in the previous section, can be identified in a large number of products. In this section, a systematic review is undertaken of the principal groups of such products and of the significant environmental advantages that they can claim, as well as the principal environmental disadvantages which may be associated with them and most of which can be relatively easily eliminated. This review also provides an initial assessment of the market situation and potential for some specific products. Important factors, including the regulatory framework, which affect their market share are also covered. Emphasis is put on the products supplied

by developing countries.

19. The products with claims to environmental advantages are classified into three groups according to their perceived potential in terms of market size and acceptability by the users, be they consumers or industry. Although this division is necessarily somewhat arbitrary, it provides an analytical framework which helps in identifying priority issues as well as policy measures.

20. The first group comprises environmentally preferable products which have currently established markets. For some of these products (such as recycled products), the markets are already very large but are expected to grow even further. For some others (such as biomass fuels and organically grown products) markets have the potential to grow relatively easily and become globally significant under certain conditions discussed below.

21. The second group includes products with environmental advantages which have considerable potential but the markets for which are not sufficiently developed. The enlargement of these markets is mainly dependent on variables different from the first group. The determining factor for these products, which are mostly inputs to production processes, is acceptance by the users.

22. The third group is made up of "niche" items such as non-wood forest products and natural inputs into agriculture. Even if demand for these products rises as a result of an acknowledgement of their environmentally positive attributes and better marketing strategies, supply constraints are likely to prevent them from becoming mainstream items.

A. Products with relatively large and established markets

1. Reusable and recycled materials/products

23. Within the panoply of materials/products with claims to reducing environmental stress, reusable and recycled materials have a special place. First, in volume terms, reusable and recycled materials account not only for the lion's share of materials with claims to environmental advantages currently utilized, but represent for a good number of key industrial raw materials such as steel, wood, aluminium, copper, nickel and natural rubber a sizeable share (between 20 and 50 per cent) of total consumption. Secondly, markets for reusable and recycled materials have rapidly expanded, in particular in developed countries, in recent years. In several cases, e.g. wood and aluminium, secondary materials have been the most dynamic element in meeting demand growth for raw materials. Thirdly, public awareness and regulatory activity of governments in the area of reusable and recycled materials are much more pronounced than for other materials/products with low environmental stress. Finally, the scale and costs of many reuse and recycling schemes, notably in developed countries, are leading many governments to employ or experiment with various forms of full cost pricing, breaking new ground as regards the internalization of environmental costs.

24. Reuse9and recycling10 of materials are not new phenomena; what is new is

the revived, in particular public, interest in them and the rapidly rising volumes of materials being recycled and, to a lesser extent, reused. The driving forces behind this development differ however between developed and developing countries. In the former, the enhanced consumption of reusables and recycled materials is chiefly fuelled by shrinking disposal sites, tough disposal standards and high disposal costs. In the other countries many industries are dependent on reusable and recycled materials because of constraints on the availability of virgin materials.

25. Although there are some cases where material reuse and recycling are mutually exclusive, e.g. washable crockery and cutlery versus throw-away substitutes made of paper or plastics, in general, reusable and recycled materials are of a supplementary nature, e.g. refillable beverage containers for local distribution systems and recyclable containers for long-haul distribution, or coexist, e.g. breaking scrapped cars to recover reusable parts and sort the rest for recycling. Reuse can hold out additional savings in resource consumption, emissions and waste prevention vis-à-vis recycling; the choice and balance between reuse and recycling, however, have to be weighed up carefully for every material/product.11

26. The use of secondary materials versus primary has expanded steadily for almost all important industrial commodities but zinc during the past two decades. The consumption of secondary materials increased steeply for copper, steel, nickel, tin and wood. The recycling rate (calculated as the ratio of recovered material used for recycling to industrial production measured at semi-fabricates level) for the most important industrial commodities (i.e. aluminium, copper, steel, nickel, lead, tin, zinc and wood) varies between 25 and 50 per cent for the developed countries and 2 and 40 per cent for developing countries.

27. Reusable and recycled materials can, under certain conditions and up to a certain level, not only reduce the overall consumption of virgin materials but also relieve environmental stress in terms of waste disposal and air, water and soil pollution. Environmental stress created by reusable or recycled materials is dependent on (a) the type and quality of the scrap or residues to be recovered, and (b) design and material selection which is conducive to reuse and recycling. The reduction of environmental stress based on enhanced consumption of reusable and recycled materials can be considerable.12 However, as several examples demonstrate,13 recycling is not a cure-all.

28. Based on the recognition that the market, left to itself, often prefers virgin to reusable and recycled materials, if only for their greater consistency of quality, many governments, notably in developed countries, have, in the last few years, created a rigid regulatory environment with a view to encouraging reuse and recycling. The surge of regulatory activity has however in most cases taken place at such a rapid pace that (a) the scientific knowledge concerning the overall consequences of the regulatory measures has been overtaken by the political momentum, (b) many recycling schemes rely on significant explicit or implicit subsidies to create or expand the markets for recycled materials,14 and (c) there is a danger that meeting imposed targets may cost society more than is saved by economizing on raw materials, emissions and waste disposal.

29. Faced with the challenge of having to take back products, manufacturers in many developed countries increasingly feel obliged to rethink in a radically new way the choice of materials, product design, manufacturing and service processes. Companies are starting to take the disposal of a product increasingly into account while designing it and selecting input materials ("cradle-to-grave concept").

30. This new perception has three general consequences. First, it will affect the demand of manufacturers for primary materials in quantitative and qualitative terms. To what extent and how producers of virgin materials, in particular in developing countries, will be affected is as yet unclear and needs to be analysed on a commodity-by-commodity, and, in some cases, on a country-by-country basis. A recent UNCTAD study on the relative position between ferrous scrap and iron ore in the input mix of steel production, for example, concluded that deteriorating ferrous scrap quality made it unlikely that the rate of recycling would increase any more in the foreseeable future.15 Secondly, the anticipation by manufacturers of the disposal of a product may influence the relationship between the consumption of reusable and recycled inputs. Reusables are likely to gain ground at the expense of recycled materials, in particular in areas where recycling rates surpass optimum levels. Thirdly, the concern of manufacturers for disposal of their products (in particular, rising costs of disposal, recuperation, sorting, upgrading and reprocessing of waste) will step up pressure on governments to internalize environmental costs and resource values. It can be expected that, in particular in developed countries, waste disposal charges and liabilities will be drastically increased and that, as outlined in the White Paper of the European Commission on Growth, Competitiveness and Employment, resource taxes will be levied while simultaneously decreasing social charges to employers, thus making the labour inputs cheaper.16

31. For developing countries, the enhanced consumption of reusable and recycled materials is both an opportunity and a constraint. On the opportunity side, for countries short of non-renewable and some renewable (e.g. natural rubber, wood) resources, increased consumption of reusable and recycled materials can contribute to coping with problems of resource scarcity and domestic waste disposal.17 An increase in the use of recyclables may lead to a decline in prices of, for instance, scrap metal and have beneficial effects for scrap using industries, including those in developing countries which are significant scrap importers. Furthermore, despite international agreements which ban or complicate international trade in certain recoverable wastes, various developing countries can be expected to profit from a more active participation in the international division of labour of recovering, sorting and upgrading materials for reuse and recycling, provided that cheaper labour inputs offset additional transport requirements. As far as primary commodity producing countries are concerned, changes in material choice of manufactures triggered by reuse and recycling may increase demand for several virgin materials, e.g. jute, cotton, direct reduced iron.

32. To what extent the trend towards enhanced consumption of reusable and recycled materials will lead to additional demand for various virgin materials is difficult to predict as, (a) the extent of and incentive for consuming

reusables and recyclables differ significantly between countries, and (b) technological and policy changes encouraging reuse and recycling are either still at an incipient stage or hard to forecast.

33. As far as constraints are concerned, for producers of several non-renewable virgin materials, the enhanced global consumption of reusable and recycled materials has the potential to put a brake on growth of primary commodity consumption worldwide.18 The risk seems to be a potential one in some cases, e.g. iron ore, tropical timber, natural rubber, and a real one in others, e.g. aluminium, copper, zinc. There are also huge differences between commodities and regions/countries.19 As information on environmental regulations, environmental impact assessments of reusable and recycled inputs and the likelihood of substitution between secondary and primary materials at the commodity and country levels is rudimentary or incomplete, more systematic analytical work and a regular dissemination of information are necessary to evaluate the role of an enhanced consumption of reusable and recycled inputs and assess the consequences for primary commodity producers in developing countries.

2. Biomass fuels

34. The growing worldwide concern about the increase in greenhouse gas emissions and local concerns about pollution have led to more attention being focused on the potential use of biomass fuels, and the improvement of technologies for economically viable production. This increased interest in biofuels, principally in the European Union, the United States, and Japan, could well usher in a new era in energy use and entail interesting export opportunities for developing countries. It is of great importance that developing countries follow these developments, not only because of the potential impact on their own energy and environmental policies but also so that those countries in a position to produce substantial amounts of such fuels can benefit from any export opportunities. Moreover, improvements in technologies which favour the use of biomass fuels can enable developing countries to reduce import dependence for fuels. However, in countries without surplus land and agricultural labour, shifting resources from food and other production to biomass feedstock can have adverse economic and social effects.

35. There are several types of biomass fuels, which can be produced from a wide range of inputs, including many cash crops, wood, and even waste. Ethanol and methanol are both bioalcohols. Ethanol is produced mainly from sugar-rich agricultural products, whereas methanol can be made from natural gas or any carbon-rich material such as wood.20 Biodiesel fuels (also called diester) are mostly based on vegetable oils. Gaseous biofuels can be obtained from agricultural products, crop residues and wood.

36. Both the bioalcohols and the biodiesel fuels can be used in varying concentrations in blends with gasoline or in their pure state in engines that are designed for this purpose. The use of biogas is mainly for electricity generation. The principal reduction in environmental stress resulting from the utilization of biomass fuels is in respect of the global commons. The CO_2 cycle is neutral for biofuels. Biomass absorbs carbon dioxide from the atmosphere.

If new biomass is grown as fast as old biomass is burnt, there is no net change in the amount of carbon dioxide in the atmosphere. An added environmental advantage is that the creation of new biomass plantations brings about a one-off reduction in carbon dioxide up front, before the system settles down into its steady state.

37. Environmental effects related to the cultivation of biomass crops depend on the agricultural practices applied and the type of crops replaced. As for all agricultural production, inputs that can be used for biomass production are varied, and bear different environmental characteristics. In general, the more intensive the intended yield, the higher the pressure on the environment. As biofuels are not targeted to human consumption, however, standards for the quality of crops and for levels of pesticide residues could be less stringent, with a concomitant risk of increased chemical use and pollution of soils and watercourses. Especially in the case of the substitution of traditional crops by large-scale monocultures, biomass feedstock production could therefore lead to increased environmental stress.

38. During both the fermentation and the production processes of ethanol some liquid and solid pollutants are generated. However, the characteristics of these pollutants are generally well known, and waste treatment technologies are available for their control. Relatively little information is available about the environmental characteristics of biomethanol plants.

39. During the gasification of biomass feedstocks, some dust, waste water, and ash are generated. The ash waste from biomass can be used as fertilizer, however, unlike the waste from coal gasification which must for the most part be landfilled as a hazardous waste. Apart from the reductions of C2O emissions mentioned above, biomass fuels generate mixed results for atmospheric pollution in the later stages of their lifecycle.

40. Currently, when compared to prices of fossil fuels, biofuel costs twice or even three times as much. When uses that can be made of co-products and by-products of biomass fuels are taken into account, however, the competitiveness of these fuels improves. Moreover, improvements in biomass-related technologies (see box 1) and possible increases in petroleum prices, are likely to make biofuels more competitive. It is estimated that cost reductions in the United States in biofuel production will reach more than 10 per cent of the current costs in the foreseeable future.21

41. The main reasons for an increase in petroleum prices which could make biomass fuels more competitive include the inherent exhaustible character of fossil fuels, and the possible increases in extraction costs22. Another reason for fossil fuel price increases could be the internalization of external costs, by means of policy measures (for example CO_2 taxation). However, fossil fuels enjoy the benefits of a more efficient organization of production and distribution, which keep costs down.

42. The key factors regarding commercial opportunities for stubiofuels are policy decisions by governments in terms of regulations such as fuel

specifications and government procurement principles, and economic instruments such as taxes and subsidies on both fossil and biomass fuels as well as on biomass fuel feedstocks.

43. In both Europe and the United States, programmes to develop alternative clean air fuels are multiplying, partly in response to the need to reduce greenhouse gases and address other environmental concerns such as local air pollution, and partly to develop new uses for crops and idle agricultural land. Whereas ethanol is currently the prime commercialized alternative fuel in the United States, lagging only behind Brazil, in Europe interest is strongest in biodiesel made from vegetable oils, particularly rapeseed.23

44. In 1993 a European Communities subsidy programme went into effect that will pay farmers $300 per hectare to take land out of surplus food production and put it into oilseed production for non-food use. European production of biodiesel, according to one estimate, is projected to match the fuel consumption of 250,000 cars and trucks very soon.24

Box 1: Alternative technologies for biomass fuel use and production

Several new technologies have been developed that can make bioethanol derived from sugar cane (or other feedstocks) more competitive.

Aquahol

The "aquahol" technology was originally developed by Rolls-Royce and T.R.W. It concerns a 50:50 ethanol blend of water. Unlike the current "gasohol" blend of ethanol with gasoline that will be mandatory in the United States starting in 1995, the 50% water/alcohol mixture is injected into the conventional engine rather than blended into the gasoline. This process has been recommended by the United States. Department of Agriculture as being 800% more efficient than gasohol. Other benefits include longer engine life, fewer tune-ups and lower requirements for high octane gasoline.

With regard to environmental benefits, this alternative is claimed to produce less NOx and aldehyde. Other significant benefits of aquahol are the oxygen and hydrogen emission benefits. By molecular weight, water has about 89% oxygen versus most gasoline chemical additives which have only about 6%. Since it is now mandated that all gasoline in America be oxygenated, water could eliminate all chemicals including the current methyl tertio-butyl ether (MTBE) additives.

Splitting of sugar cane

Compared to the conventional processing of sugar cane by milling or crushing, the splitting of sugar cane has some advantages. First, this newtechnology, developed in Canada during the early seventies, requires less energy than crushing or milling. Second, the splitting process produces a valuable by-product named "cane-rind" instead of the crushed or milled bagasse. Since the rind is not crushed, it can be used to make a strong fibre board that appears to have structural advantages compared to conventional chipboard made from wood chips. It is also simple to rinse the sugar or sucrose residue, thereby eliminating fermentation. The process also provides an alternative source of paper pulp or any of the numerous products now produced from the cutting of trees.

New varieties of sugar cane and sweet sorghum

The ethanol part of the "aquahol" blend can be based on biomass crops (sugar cane and sweet sorghum) originating in developing countries. New varieties of plants now seem to be available that grow all the year round with lower water requirements and less susceptibility to diseases than current crops. The minimal water requirements are especially important in countries that have droughts. The year-round aspect is also very important for developing countries, since many rural agricultural areas are losing their residents to large cities because of the lack of the year-round employment and lower

45. In 1992 the Commission of the European Communities adopted a draft directive fixing a tax structure for biofuels at levels notably lower than those applicable to fossil fuels. The aim would be to reduce the difference in costs between the two alternatives. Germany, Switzerland and Italy have exempted biodiesel from all sales and road taxes. Austria has exempted biodiesel from 95 percent of its highway tax. In Sweden and Finland, biomass energy obtained mainly through gasification is economically viable because "harm taxes" levied on fuels such as petroleum products that harm the environment lead to the internalization of some environmental externalities associated with them.

46. In the United States, the Clean Air Act requires that by January 1995, the country's smoggiest cities must begin using reformulated gasoline (called gasohol). To reformulate gasoline, the refiners will add an oxygenate - either ethanol, mostly made from corn, or methanol, usually made from natural gas. The oxygenate fuel additive market is highly competitive, and bioalcohols face high barriers to entry into a market that is highly dominated by the fossil fuel industry, which favours methanol. However, the Environmental Protection Agency's proposed rule would require at least 30 per cent of the oxygenate to come from renewable sources - that is ethanol. If implemented, this will require an estimated 500 million gallons of new production above the current annual capacity. It is believed that this production level can be achieved by United States producers by early 1995.

47. In the near future, and in spite of the possibly significant positive impact of regulations on biofuel demand, neither Europe nor the United States is likely to offer promising opportunities for biofuel exports from developing countries because the bulk of the feedstock can be provided from idle land. However, both the interest in and the technological support for biofuels could potentially increase biofuel use worldwide and affect positively, in the longer run the export opportunities for developing countries with large potential to produce biofuels. Agricultural commodities' costs bear a large share in the total cost of these fuels and this presents potential export opportunities for developing countries which can produce feedstocks and biofuels competitively. However, the selection of agricultural commodities as feedstocks and the price competitiveness of biofuels produced in different countries are very sensitive to, and dependent upon, policy decisions such as payments of subsidies. As a result of the Uruguay Round the importance of these policies will decline, but in any case it is mostly the industrialized countries that can afford whatever support is allowed under new trade rules.

3. Organically grown products

48. There are various definitions of organic25 agriculture and various standards used for certifying products as organic (see box 2). According to the FAO, "organic agricultural products are the products of organic farming which employs cultivation methods avoiding environmental damage and chemical inputs"26, the latter being one of the principal non-point sources of water pollution, particularly in developed countries. The United States Department of Agriculture's definition of organic agriculture is "a production system which avoids or largely excludes the use of synthetically compounded fertilizers,

pesticides, growth regulators and livestock feed additives".27

49. The reduction of environmental stress by organic production occurs principally at the upstream stage of the product's life cycle, in principle locally, but also possibly, at a transborder level. Moreover, consumption advantages also occur because any possibility of adverse health effects due to toxic residues is eliminated.28 For the consumers of products grown domestically both aspects are equally important environmentally preferable attributes of organic products. For traded products, however, the advantages at the consumption stage appear to be the dominant, but not exclusive, attribute of organic products.

50. Although consumer interest in organically grown agricultural fibres, such as cotton, is rising, the concept of an organic product is generally associated with food items. The share of organic products is currently about 0.5 per cent of the food market in industrialized countries, but it reaches 2 per cent in Denmark, Austria and Germany. Experts expect that it will reach 8 to 10 per cent by 2000.29 Although in many instances organic products are sold in "niche markets", they have already entered mainstream markets through products such as baby foods. Organic cotton, besides being an input to fashionable clothing, has considerable demand from medical gauze and baby clothing manufacturers.

51. Organic products currently sell at prices which are from 20 per cent to more than 100 per cent higher than conventional products, but the premiums are declining.30 Surveys indicate that demand could be more than doubled if the consumer prices for organic products were not more than 30 or 40 per cent higher than conventional products. This is roughly equal to the price of a premium conventional product. Moreover, demand would be likely to increase considerably if such products were easily available and consumers could get them without a greater effort than that needed to obtain conventional products31 (see box 3)

52. Another factor which will increase consumer demand for organically grown produce is the decision by certain industrialized country governments to make conscious efforts to switch their own agriculture to organic methods. For example, the Swedish parliament has decided to demand a governmental programme for reaching the goal of 10 per cent of Swedish agriculture converted to organic agriculture by the year 2000.32 As consumers are presented with greater numbers of domestic organic products, their preference for organic products in general,

Box 2: Certification of organic products

In line with the overall definitions of organic production, strict standards are set for products to qualify as "organic". Work at the intergovernmental level is carried out at the Codex Alimentarius Commission serviced by FAO and WHO. Some countries have national legislation on standards for organic farming. These include the United States Organic Food Production Act (1990) and the European Union's Council Regulation 2092/91.

The International Federation of Organic Agriculture Movements (IFOAM) which has over 500 member organizations in more than 80 countries has accepted a set of "Basic Standards of Organic Agriculture and Food Processing", covering the process of conversion to organic agriculture, choice of crops and varieties, rotations, manurial policy, pest, disease and weed management, growth regulators, and use of plastics. Since local conditions are so varied, national and regional organizations are needed to develop standards appropriate for the conditions prevailing in each country or region.

Individual certification programmes have been developed for specific products on this basis. For example, the ECO-OK Banana Certification of Rainforest Alliance in New York includes requirements to maintain or establish vegetated zones in order to filter sediments and agrochemicals from drainage into waterways, provide animal migration corridors along rivers, and shelter populations from the drift of sprayed agrochemicals along roads and adjacent to housing; restrictions on new plantation development in order to protect certain types of lowland tropical forests, national parks and local communities; requirements for proper management and disposal of organic, liquid, plastic and solid wastes including commitment to reducing, reusing and recycling wastes; provision of environmental education and training programmes for plantation workers; reclamation of unproductive plantation lands through forestry, and conservation of natural zones that are not part of the productive plantation, but are within property limits.

including imported ones, is likely to increase as well.

53. Organic products are either consumed directly or enter the production of final products as inputs. In the first case, the consumer pays the total price differential between the organic and conventional products. When the organically grown item is an input, this differential should not make a major difference to the price of the final item because the raw material typically comprises only a minor part of the total cost of the final good. For example, in the case of regular chocolate bars, the cost of the final product would increase by only about 1 to 2 per cent if twice the current market price was paid to organically grown "fair trade" cocoa.33 In the case of "organic" cotton garments, the cost of the final product is particularly influenced, not by the price of cotton, but rather by the high price of acceptable soaps and dyes (often produced by a very small number of companies in developed countries) and the high fees paid to assessment and labelling companies, rather than the price of cotton. Certification expenses may account for up to 20 per cent of costs for small organic farmers.34

54. Although yields are lower in organic agriculture by about 30 to 50 per cent for both tree crops such as coffee and field crops such as cotton or wheat,35 expenditures on external inputs are lower and the current price premiums may lead to higher income per hectare. Lower yields do not therefore seem to be the principal problem for producers. An important cost that discourages a switch to organic farming is the need to leave the field fallow (in the case of field crops) or apply principles of organic production (in the case of tree crops) for two to three years before the crop can be certified as organic, thus foregoing significant revenues during this period.

55. According to traders in organic products, for the time being, there is an unsatiated demand. Whatever is produced organically is easily sold. As a consequence, more producers are turning to organic production on their own initiative, as opposed to the 1980s when such changes were prompted by consumers. For the expansion of exports by developing countries of organic products which compete with local organic production in developed countries, the assistance and subsidies received by the latter are an important factor. It is expected, however, that production in the main organic markets will not be enough to meet

Box 3: Organic coffee

For the indigenous Indian communities in southern Mexico, shifting from conventional to organic coffee production was economically and politically motivated. They upgraded their tree stocks by replanting newer, shorter, high-yielding and disease-resistant varieties, strengthened natural topography by planting on contour lines in secondary jungles, and minimized external inputs by using composted bean pulps and other farm by-products as fertilizers. Because there was less need for agrochemicals, they avoided incurring loans from intermediaries, the terms for which included exclusive purchase rights. They then formed an intercommunity union and obtained an export license.

The union has been selling to Europe since the mid-1980s through fair trade organizations. Marketing their produce as organic earned them a premium which, together with their increased share in value added, has been ploughed back into communal development activities. The union has since set up an infrastructure for the transport, storage, processing and export of their product. Its contributions to public service include an improved educational system in the remote communities, a public transport system into the otherwise inaccessible mountain regions, shops stocked with basic necessities and a medical insurance system. As of the early 1990s, the union has a membership of 37 communities with a total of more than 3000 families. For these communities and families, organic farming served as a vehicle towards a better standard of living, in addition to ensuring the sustainability of agriculture.

The market for fair-trade coffee is about 2 per cent in Germany, 2.5 per cent in Switzerland and 4.5 per cent in the Netherlands. Coffee grown under strict organic conditions supplies only 0.1 per cent and 0.2 per cent of the German and United States markets respectively. As of 1992 there were about 40 organic coffee "projects" world wide, holding some form of certification. The countries from which organic coffee is imported include Brazil, Costa Rica, Dominican Republic, Guatemala, Haiti, India, Indonesia, Madagascar, Mexico, Papua New Guinea, and Peru. The world's largest supplier of organically grown coffee with third party certification is Papua-New Guinea, which exports about 10,000 60-kg bags a year to Germany, Australia and the United Kingdom.

Organic coffee currently on the market comes mostly from plantations which have links with organizations in consuming countries. These links have been instrumental in organizational formation, technical assistance, trade facilitation, and marketing distribution. Marketing is done principally through fair-trade organizations, which provide assistance in surmounting certification and labelling requirements of consuming countries, and secure the products a niche in their own distribution outlets. Perhaps one of the best documented fair-trading successes is Max Havelaar coffee, which has an annual turnover of twenty million pounds (sterling), with a fair price guaranteed to some 300,000 small coffee producers in 13 countries. Of the price premium, it has been stated that 30 per cent can be attributed to environmental and 70 per cent to social advantages.

Normally, the cost of raw coffee accounts for only a fourth of the consumer price. The producers receive between 1/3 to 2/3 of this with the intermediaries taking the remainder. Under fair trade arrangements, however, payments are made directly to producers who are usually small-scale holders. It is estimated that currently about a million small-scale coffee growers receive considerably higher prices for their produce. The number of coffee plantation conversions from conventional to organic agriculture is increasing. Combined with the fertility build-up from improved soil regeneration of current organic plantations, a larger and more stable flow of organic coffee into the market is expected in the near future. Although organic coffee commands a premium in the market and its consumption is expected to increase further, there is a limit to the level and frequency with which consumers are willing to pay more. In order to stimulate sales volumes for the smooth absorption of an increasing supply of organic coffee supply, a move to widen

the demand. In the year 2000, "the degree of self-sufficiency in organic products will be about 60 to 70 per cent in Germany".36 Thus, opportunities will exist for developing countries to fill this gap. One advantage in terms of competitiveness, at least for some developing country producers, is the relative ease of switching to organic production because of generally lower current use of external inputs.

56. It seems inevitable that the price differential between organic and conventional products will become narrower as supplies increase. Producers and traders of organic products believe that some of the supply side factors which cause this price differential such as the relatively small size of shipments and associated higher transport costs, and the need to create, or make use of, marketing outlets outside mainstream distribution networks can be overcome by improving organization and marketing. They expect that organic products will be sold at prices comparable to those of premium conventional products.37

B. Products with considerable potential but rudimentary markets

1. Agricultural fibres as raw materials

57. Agricultural products, in particular fibres, are used as inputs in a wide variety of industrial activities and in construction. Many of these uses are traditional ones, but these products have a considerably larger potential for use in many branches of industry than is currently the case. Estimations on the size of the EU market for plant fibres, when promising applications have been successfully developed, indicate that the increase could be large enough to absorb fifteen times the current EU production of agricultural fibres.38 Thus, the potential for increased imports from developing countries is considerable.

58. Research is being undertaken in both developed and developing countries in order to increase the utility of agricultural raw materials for industry. Work in this area is underway in the United States and the European Union, principally as a means of finding alternative uses for surplus agricultural land, but also emphasizing the environmentally preferable characteristics of natural fibres and other agricultural raw materials (see box 4). Developing countries, on the other hand, put the greater emphasis on finding useful alternatives for their natural products, which are often wasted. There is scope for developing countries to benefit from the active promotion in developed countries, a trend which should increase acceptance and open up new export opportunities.

59. The principal environmental advantage of using natural fibres as industrial inputs rests in their biodegradable and biocompatible qualities. Thus, important benefits exist in the area of waste management. These products are also generally more worker-friendly and easier to handle.

60. The industrial areas where natural fibres can help reduce environmental stress caused by currently used products include packaging, composities and geotextiles.

Box 4: Alternative Agricultural Research and Commercialization Center (AARC Center)

Environmentally preferable commodity-based products frequently fail to reach the market because of the gap between research and the market. Assistance is therefore needed to close this gap. In 1992 the United States Department of Agriculture established the AARC Center which operates on a commercial basis specifically to serve this purpose. The main focus is on providing assistance to private enterprises at the pre-commercialization stage where the costs are the highest and the ability to obtain loans from traditional sources the most difficult. Finance may be obtained from the Center to cover the costs related to the identification of viable markets, testing products for performance and consumer acceptance, verifying the performance of the technology on a commercial scale and obtaining regulatory clearance.

Financial assistance is provided by the Center through partnership arrangements which involve sharing the risk between the agency and the private entrepreneur. A large percentage of the Center's work is with the small firms and entrepreneurs who have virtually no other source of lending.

Assistance provided by the Center covers a wide array of products for industrial uses, with preference for projects that have environmental advantages at the production, processing, consumption or disposal stages. Recent projects that have gained AARC assistance include the following.

(1) The production of "Roll and Grow" kenaf-based grass mat which is entirely biodegradable and helps fertilize the grass seed as it grows. The project, originated by Agro-Fibers Inc., attracted a US$ 800,000 investment by AARC on the grounds of employment generation impact and environmental benefits. The company expects to carve out an estimated US$ 50 million niche market in the home gardening industry.

(2) Research into a technology for turning waste straw into a tree-saving source for the specialty paper used in making cardboard boxes. The project has received a contribution of US$ 350,000 from AARC on the grounds that, if successful, it could generate substantial environmental benefits. These include replacing wood with annually renewable straw in certain paper manufacturing processes, helping eliminate the air-pollution problems caused by farmers' burning waste straw and turning a disposal problem into a new market for farm straw.

(3) Production of ethanol from low-cost, renewable sources such as grain sorghum stalks, switchgrass and other woody materials. Since the United States need for ethanol as a less-polluting, crop-derived alternative to petrol is expected to increase steadily to comply with the strict emission standards set by the 1990 Clean Air Act, the AARC decided to contribute US$ 1 million to Arkenol Inc. for a project to convert biomass to ethanol.

(a) Packaging

61. Packaging including the use of twine for hay and straw bailing, is an important area where natural fibres such as jute, sisal and kenaf can claim environmental advantages because of their biodegradability and lower energy use. Initial analyses suggest that in packaging, natural fibres are more environmentally sound, and thus less costly to society, than competing synthetic materials, particularly at the disposal stage.

62. However, certain local environmental problems also arise at the production and processing stages of hard fibres.39 These include surface and groundwater pollution and release of toxic substances and methane caused by organic waste. There are, however, relatively simple ways to remedy these problems. For example, the unrefined oil now in use for batching could be replaced by biodegradable oils which do not affect human health. Some changes in extraction habits and the use of organic waste materials would also significantly and easily increase the environmental advantages of hard fibres over alternative synthetics. Some other measures such as water treatment, however, can be rather costly.

63. The competitiveness of natural fibres in the packaging industry is affected by the complex packaging regulations applied in the high-income countries, which put very heavy emphasis on recyclability. While such measures would imply rising costs for plastic packaging materials, the widespread implementation of legislation concerning plastic waste recycling could significantly alter supply/demand balances, and contribute to the oversupply of plastics and their continued relatively low prices.40

64. Competitiveness will also be affected by the development of "degradable" plastics, made either of vegetable oils or by converting starch from various crops into polymers. The environmental performance of some such materials has not been found to be as satisfactory as that of natural fibres.41 Nevertheless, recent research is reported to have removed some of the problems such as only partial degradability.42 Although an increase in the utilization of biodegradable plastics could harm the competitiveness of natural fibres, markets for some products of developing countries, such as vegetable oils, would expand subject to competition from developed country products.

(b) Composites

65. Flax, cotton and jute are most frequently used as a substitute for glass fibres in reinforced polymer matrix composites (PMCs). The principal environmental advantages of natural fibres over glass fibres in this area are biodegradability and combustibility. Burning of glass fibres leaves much ash and recycling is possible for only a very limited range of composites containing glass fibres.

66. Composites are used for their greater strength and stiffness compared to other materials. Various applications for plant fibres can be found in the automotive industry, for example, in brake and clutch linings. Replacement of asbestos by cellulosic fibres with high wear resistance is being studied by the

industry. But conventional production techniques in the automotive and engineering industries are strongly anchored and therefore composite processing and especially plant fibre PMCs are difficult to introduce.43 This is exacerbated by the lack of readily available information on relevant fibre characteristics.

67. A related area where natural products can reduce environmental stress is in building materials. "Despite environmental problems, asbestos fibres are still the most applied reinforcement fibre in inorganic matrix composites" such as cement and concrete.44 In developed countries wood pulps and flax are the main products with environmental advantages used as a substitute for asbestos. Among such products of developing countries, bamboo, sisal and reed have the desirable qualities and potential for expanded utilization.

68. It is of great importance for industrial users of new raw materials to have information concerning health aspects but such information for cellulosics is lacking. Generally, it is assumed that cellulosics do not give rise to health problems like asbestos or glass fibres. Scientific evidence supporting this hypothesis will promote the introduction of agricultural cellulosic fibres in industrial uses.45

(c) Geotextiles

69. In civil engineering large quantities of geotextiles, mainly based on synthetic fibres, are used in road construction and hydraulic engineering for erosion control, soil stabilization, drains, foundations and soil separations. The consumption of geotextiles in the industrialized countries grew 70-fold between 1980 and 1990. Some experts forecast a further doubling by the year 2000.46 As modern civil engineering practices are adopted in the developing countries, markets for geotextiles may boom there as well. In applications where geotextiles are not permanently required, or as temporary support for rooting plants on civil constructions, plant geotextiles can be used. In these cases, jute, coir and straw have significant potential. Being biodegradable, they decompose into humus, thus eliminating the need for post-installation work at the end of their useful life and consequently saving costs. Another potential use is in landscaping: the AARC (see box 4) is participating in the financing of a project to develop kenaf mats with grass seeds implanted in them as an environmentally preferable means of seeding lawns. The potential for geotextiles based on plant fibres will increase as biodegradability is designed or programmed into the product and the lifetime becomes controllable.

2. Alternative wood sources and wood substitutes

70. These products which reduce environmental stress by limiting deforestation include non-traditional timber varieties, with a wide range of potential uses from construction to furniture manufacturing, and other products which can be used as alternative raw materials for the pulp and paper industry (see box 5).

71. Traditionally, certain types of trees such as rubber and coconut trees have been destroyed, mostly by burning, when they become old. Even in Malaysia, the

second largest producer of rubberwood after Thailand, about 70 per cent of the rubberwood is burned on the felling site and, at the sawmill, 65 per cent of what is received is discarded.47

72. In their natural form these trees produce non-durable wood, but new research in the producing countries48 has resulted in processes by which these woods can be treated and preserved. The uses of properly treated coconut wood include, apart from furniture, other wooden household items, fence posts, and electric power and communication poles. Its use, however, is less developed and it is a relatively new item compared to rubberwood which has penetrated foreign markets, in particular, as furniture and parquet flooring. In 1991, Malaysia exported $160 million worth of furniture, of which 80 per cent was made of rubberwood 49 whose price tended to be lower and more stable than that of other indigenous species for the same end uses.50

73. Increased utilization of these trees reduces environmental stress, in particular atmospheric pollution, on two accounts. First, they can be substituted for other types of trees that come from forests, thus helping to conserve of forest resources, with positive impacts on carbon absorption and climate change. Secondly, increased utilization of rubber and coconutwood reduces the atmospheric pollution caused by their burning on site.

74. The economically available volume of rubberwood logs in the world is equivalent to the total volume of wood exploited from about 0.6 million hectares of tropical rainforest on an annual basis.51 The recoverable cocowood volume can reach 1 million cubic metres annually in the Philippines alone.52 This would be roughly equal to 20 per cent of this country's non-coniferous industrial roundwood production.

75. It has been estimated that rubber trees could provide about 0.3 per cent of the world's timber needs during the last decade of this century.53 In some rubber-producing countries, rubberwood already makes up a significant proportion of total timber production. In Thailand, Sri Lanka and Malaysia, where the rubberwood industry is most developed, this proportion reaches 24 per cent, 19 per cent and 6 per cent, respectively.54 In other rubber-producing countries such as Viet Nam and China, the potential for increased supplies is considerable.

76. Trees which have been badly tapped and poorly maintained do not produce wood suitable for economical and effective processing. Unfortunately, the growers in most desperate need for alternative sources of income from their trees, i.e. independent smallholders, are those most likely to have poorly maintained trees. Other problems concerning supply which need to be resolved include shortage of raw material supply during certain periods because supplies are dictated by the replanting pattern of plantations, the low recovery rates and transportation logistics.55

C. Niche products

1. Non-wood forest products

77. Some non-wood forest products used as food, industrial inputs and health care ingredients can also claim to reduce environmental stress because of the added value they bring to the forest cover, which promotes conservation. It can be argued that the higher the earnings from sustainably managing a resource, the greater will be the tendency to do so. "Managing tropical forests only for

Box 5: Agricultural crops and wastes as raw material for the pulp and paper industry

Many crops, such as sugar cane, flax, various kinds of grass, reeds, straw, hemp, jute and kenaf are potential raw materials for the paper industry. The environmental implications of using annual crops rather than pulp from sustainably managed forests and waste materials of the timber industry are not yet fully understood. The proponents of using annual crops point out examples such as kenaf paper which uses less energy than pine, requires minimal chemical inputs in both field and mill operations, and produces wastewater which, when treated, can be used to irrigate nearby fibre fields. Moreover, compared with wood-pulp paper, kenaf paper is stronger, whiter, less prone to yellowing, capable of sharper photo-reproduction and more user-friendly because of better ink adherence.

One of the problems with using annual plants instead of wood is the relative bulkiness of the former. This implies that transport, storage and processing need more volume than with wood. Annual harvesting requires a year-round storage system. Moreover, climatological conditions affect not only the quality of fibres but also the quantities supplied, which become unpredictable. Inconsistency of fibre quality can be diminished by improved fibre extraction methods, which are in an advanced stage of development.

The pulp and paper industry also provides an environmentally preferable use for many materials which are normally wasted and disposed of in an environmentally undesirable manner, for example, thrown into waterways or burned. For example, waste straw is mostly used for making specialty paper grades, e.g. for cardboard boxes in Europe, particularly in Spain and France. Projects are also under way in the United States. Various plants which are considered as environmental nuisances, including water hyacinths and several grasses, have been identified as environmentally preferable raw materials for paper because their use prevents potential environmental problems such as clogging of waterways and methane emissions.

One major problem impeding increased use of alternative raw materials for the pulp and paper industry is the lack of sufficient knowledge about the behaviour of fibres and their chemical composition in relation to paper making. Increased information flows could therefore generate large benefits in this area.

timber to the exclusion or neglect of non-timber products may fail to maximize the social value of the scarce resource and to ensure its sustainability over time.56

78. Calculations on the value of the intact forest compared with alternative uses and the value of non-timber products compared with wood, show that when necessary adjustments are made the financial value of the forest can be two or three times higher than that of alternative uses for the land, such as cattle ranching or plantation management.57 The value of non-timber forest products compared to that of wood is also significant. For example, the value of six principal non-timber products foregone because of agropastoral expansion into forest areas in Brazil was calculated to be between 11 and 21 per cent of the value of the wood.58 It has been argued that although a specific timber harvest can have a much greater value than that of non-timber products, the net present value of the latter when measured over a longer period of time can sometimes exceed that of the timber harvest.59 So far these products have not received much attention from the governments of the countries producing them because their value in terms of export earnings, in comparison to timber, has been rather small.

79. Realization of the importance of potential earnings from such "exotic" products for encouraging forest conservation could considerably increase the attractiveness of these products to consumers who are concerned with the effects of deforestation on climate change and biodiversity as well as with the living conditions of forest dwellers.

80. The significance of non-timber products for specific local communities becomes clearer when it is considered that timber is exploited by large firms, whereas non-timber products are usually produced by local residents of the forests, and that processing of these products is a labour-intensive activity (see box 6). "Harvesting systems for non-timber products usually leave more benefits in the hands of local communities than is the case with industrial timber exploitation where benefits accrue to urban-based entrepreneurs".60 This is particularly important because "conservation of a rain forest perceived by the local populace to be of direct economic importance is far more likely to be successful in the long term than is conservation for its own sake".61 However, the dynamics of non-wood forest exploitation abounds with examples where "when a forest acquires greater value in the society, it is appropriated by external entrepreneurs at the expense of local communities".62 Thus, land and resource rights lie at the heart of the problem. Forest residents are unlikely to protect forest resources if they do not have clear rights or guaranteed access to these resources or if they feel that at any time they can be displaced by outsiders.

81. A large proportion of the value added of the final product is generated at the marketing stage.63 Thus, the more the local producers participate in the marketing of their products, the more of the value added will accrue to them. Establishing new marketing channels, however, is an expensive operation. Marketing through existing institutions, therefore, including those established by exporting countries for other products such as timber and other agricultural commodities, appears to be a cost effective solution in the short term.

Most food products from tropical forests have well defined and relatively

short harvest seasons. Markets for such products, however, could easily be sustained

Box 6: Brazil nuts

Brazil nuts (also called Amazon nuts) are, together wi th rubber, one of the main non-wood forest products extracted in th e Amazon region. They represent a significant source of income for some local communities. Brazil supplies about 75 per cent of the world market, followed by Bolivia and Peru as the other principal exporters.

Generally, dispersed extractors collect the Brazil nuts and deliver them to middlemen. These transport nuts to more central collection points where buyers take delivery. The nuts are then shipped to processing plants which are highly centralized in urban areas of Brazil. After processing and packaging the nuts are mostly exported. 55 per cent of the market is controlled by three of the major processors/exporters, all owned by the same family, Matran.

As the internal market represents only 3-5 per cent of total production. the Brazil nut industry is highly dependent on exports. The United States is the world's largest importer of in-shell nuts and it is second after the United Kingdom in imports of shelled nuts. Brazil nuts comprise about 1.5 per cent of the international edible nut market but their share has been constantly falling over the last two decades as a result of a decline in total production, in favour of other types of nuts.

To reverse this decline and gain market share in the markets of other countries, two main problems need to be solved: insufficient supply and relatively high production costs.

Deforestation of Brazil nut producing regions caused b y earlier policies has cut down production and contributed to the loss of market share. I n addition, only slightly less than half the potential area in the Amazon is exploited for the extraction of nuts today. Transportation towards centralized processing plants is too costly to justify their being gathered from isolated sites. Moreover, prices paid to producers may not be high enough to stimulate production as new opportun ities open up for extractors to earn more money outside the sector in activities such as prospecting for gold or hiring out their labour.

Prices paid for Brazil nuts at di fferent points of the market chain are derived from international prices and passed down to extractors who receive about 12 per cent of the f.o.b. export price of in-shell nuts. The cost of transportation to processing plants and the earnings of the intermediaries approach 15 per cent and processing costs amount to 50 per cent of the export price. One of the reasons for the very low share received by extractors is the monopsonistic situation of the buyers and the lack of market power for individual producers.

The processing itself involves several time-consuming and labour- intensive stages. In-shell nuts that make it to the market, for instance, have been processed and packed to guarantee a shelf life of 12 months. They have been throu gh seven processing stages, namely, removal of substandard produce, 10-hour oven drying, cooling, classification by size and weight, removal of damaged nuts, deh ydration, and waxing. Processing shelled nuts requires more stages and involves higher dama ge loss. Production costs in large processing units in cities are high, owing to costs of t ransportation from remote areas, losses due to spoilage during transport and generally higher wage levels in plants located in urban zones as compared with rural areas. Experience from Bolivia shows that small processing plants buying their raw material from the same border region and paying the same price to the extractors are able to export at lower prices than large Brazilian processors.

Among the solutions proposed for increasing the competitiveness of Brazil nuts are decentralization of processing (as economies of scale are insignificant), which could cut transport as well as labour costs and lead to a larger part of final price accruing to the gatherers, while remaining internationally competitive. For example, the Cooperativa Agro-Extractivita de Xapuri, the only small production-processing-export venture, owned and operated by extractors, has been able to double the price paid to them, thanks to a reduction in cost through decentralized processing.

Another option to increase production and lower production costs is to plant Brazil nut trees. Just planting trees close to the extractors and to the processors will lower the time and distances of gathering and therefore reduce the production costs. The time from planting to first commercial production is shorter for planted trees and they can do very

throughout the year if produce were available. Transportation to market is difficult and often must wait until a change of season. All of these factors make the reduction of post-harvest losses, including losses during transport, a high priority objective. To the extent that the product can be sold for a higher price during the off-season, it will also stabilize the price during the peak period of availability.

82. As regards the competitiveness of the "exotic" non-wood forest products, one problem is to introduce them to the market. It seems easier to expand the utilization and trade of products already on the market than to introduce new ones. However, a long term view is also necessary and some of the profits of the current operations can be allocated to diversification into new items.

83. One of the main difficulties concerning the competitiveness of non-wood forest products lies on the supply side. It is often difficult with the current organizational structures to provide the quantities that would be required by even a modest manufacturer interested in using these products. For example, the Xapuri Brazil nut shelling factory produces 70 metric tons (MT) of Brazil nuts per year, whereas 70 MT of peanuts per eight-hour shift are used to produce certain candy bars. Individually, local Brazil nut shelling cooperatives could not convince large companies to use their nuts. By working together, however, producer groups can supply economically viable quantities to users, and thus gain larger market shares.

84. It is important to assure the consumers who are interested in the sustainability of the forest from which these non-wood products come that they are indeed contributing to forest preservation. To this end a monitoring system is necessary to ensure that the production of non-wood forest products does not destroy the forest. Such monitoring and certification needs to be undertaken for each commodity by scientists and forest residents. In the end, it is the local communities whose present markets and future livelihoods will depend on such certification. The authority to monitor and certify should be primarily theirs.

2. Natural inputs for agriculture

85. Some natural products of developing countries with very little or no negative impacts on the environment have a considerable potential to replace synthetic products in pest control. Pyrethrum, mostly produced in East Africa, and neem (see box 7), a tree native to India and Burma but also grown in Africa, are among such products. Some scientists believe that neem, whose products appear to have little or no toxicity to warm-blooded animals, could well be the basis for development of safe natural pesticides.64 It is because of these characteristics that natural inputs to agriculture discussed in this section are generally acceptable for use in organic agriculture for pest control.65

86. This advantage in reducing environmental stress of agricultural production, including the management of lawns and gardens, could be a significant environment-friendly attribute from the perspective of consumers. Moreover,

there are other advantages associated with using plants as a source of pest control. The carbon absorption capacity of plants while they are growing is of

Box 7: Natural pesticides

The neem tree *(Azadirachta indica),* called "the village pharmacy" in its native India because of its varied pharmacological uses, may be the harbinger of a new generation of "soft" pesticides. Extracts from its extremely bitter seeds and leaves are lethal to many pestiferous species but are harmless to beneficial insects, people, and animals. Extraction of active elements is very simple and can be done at the farm level. In trials in the Gambia, for example, neem leaves or seeds crushed and steeped in water or alcohol compared favourably with the synthetic insecticide malathion, and in Nigeria performed just as well as DDT, Dieldrin and other insecticides. Certain plant species, among them wheat, rice, sugar cane, tomatoes and cotton, also take neem compounds as systemic agents, that is, they absorb aqueous neem extracts sprinkled on the soil and transport these throughout the plant system including stems and leaves, where they provide protection from within. Unlike conventional pesticides, systemic agents cannot be washed off by rain or watering. They also provide protection to new growth occuring after application.

Unlike conventional pesticides again, the efficacity of neem as a pesticide does not seem to diminish with continued use, indicating absence of genetic resistance build-up. Entomologists attribute this phenomenon to neem's complex blend of compounds which have diverse functions and affect different parts of an insect's life cycle and physiology. The chemical compounds found in the neem tree's oil disrupt the production of growth hormones in more than 200 insect species and thus prevent the insects from reproducing.

Although stabilization and other advances were already developed by Indian scientists as early as the 1960s, these have not been patented, probably as a token of recognition that the bulk of the groundwork had been done by generations of anonymous experimenters. However, this left their work open to loss of rights to its usage when a firm was granted an international patent. Moreover, what was once an abundantly free resource has become increasingly out of reach to ordinary farmers, with the price of neem seed rising sharply due to the patent-holding company's more attractive purchase price. A prevalent belief in India is that, unless checked, the diversion of neem seeds from community use to industrial raw material will ultimately establish a regime in which the use of neem will be controlled by a handful of commercial entities. A grass-roots campaign in India against what is generally considered a violation of intellectual property rights to collective indigenous knowledge has gained the support of prominent Indian scientists.

Source:
National Research Council, NEEM: A tree for solving global problems, Report of an Ad Hoc Panel of the Board on Science and Technology for International Development, National Academy Press, Washington D.C., 1992.
V. Shiva and R. Holla-Bhar, "Intellectual Piracy and the Neem Tree", The

global benefit, and their contribution to controlling soil erosion and deforestation is a local benefit with wider potential implications.

87. There are several problems, however, in expanding the use and trading of these products. First, chemical companies have developed synthetic alternatives in the case of pyrethrum and patented the extracts of the natural product itself in the case of neem. Secondly, the supply of these products may not be as reliable as would be required for their expanded use. Thirdly, and perhaps most importantly, the greatest impediment to commercial development may simply be a general lack of credibility, or even awareness of what these products are and what they can do.66 Neither the farming sector nor the public in general is well informed of the possibilities of reducing environmental stress by expanding the use of these products. There is room for scientific research to provide a well established basis for all their relevant properties. Equally important issues for ensuring that the producing countries obtain economic benefits from increased utilization are finding ways to resolve the intellectual property problems, establishing an effective marketing structure and providing reliable supplies in sufficient quantities.

3. Products made from agricultural waste

88. Agricultural waste not only reduces the economic benefits that can be realized from the production process but also leads to environmental problems. These problems include water and soil pollution at the local level as well as the emission of methane when the wastes are left to rot and of carbon when they are burned. Making useful materials from agricultural waste would thus help to increase farmers' earnings and reduce environmental stress at both the local and the global level.

89. Research and initial commercialization experiments with products made from agricultural waste are under way in both developed and developing countries. Apart from the use of straw and other agricultural waste as raw material for the pulp and paper industry, and as feedstock for biomass fuels, as discussed above, there are many other new and promising areas for attaining economic and environmental benefits. For example, the projects financed by the AARC Center (see box 4) include the use of waste wool as a clean-up product for oil spills, turning waste animal fats into fuel and using milkweed as an alternative to cotton. (In the last case, commercial viability would require that this "troublesome weed" be cultivated.)

90. In the developing countries as well, research into finding economic use for natural waste products is relatively advanced. A study in the Philippines67 has identified no less than 24 items developed in the country, the expanded production and utilization of which would help in reducing environmental stress. They include products made from rice wastes (building blocks and sodium silicate for cleaning materials and adhesives), banana peels (vinegar), coir dust (cation exchange resin for water treatment), forestry wastes (building materials) and fishery wastes (food flavouring). Some of these products are commercially available, some are still at an experimental stage, and some are thought to have

export potential. Production, however, is mostly experimental and it is on a small scale even for those items sold on the domestic market. Expansion of markets, including export markets, and of production could lead to scale economies and improve the commercial viability of several projects. Bottlenecks to increasing production include the lack of financial support for technical research, lack of capital for expansion, lack of knowledge and experience in the export business and lack of government support for product promotion and technology dissemination. Logistical difficulties in obtaining adequate supplies of major material inputs for full-scale production also hinder commercial scale operations.

IV. CONCLUSIONS AND POLICY ORIENTATIONS

A. Conclusions

91. The above review of products with claims to reducing environmental stress caused by current consumption patterns reveals that there is considerable potential for expanding their utilization. In many areas products with environmentally undesirable properties can be substituted by environmentally preferable ones. The problems to be surmounted in doing so are different for different products but can be classified into five groups.

1. Price competitiveness

92. Some environmentally advantageous products such as organically grown products items and biomass fuels are more expensive than the products that they could substitute. One of the main reasons for this is that environmental costs associated with the latter products are not included in their prices. This is particularly important for fuels but is also relevant for agricultural products. As the internalization of environmental externalities advances, however, this source of price disadvantage of environmentally preferable products should gradually diminish.

93. The initial outlays needed for changing production practices play an important role in raising costs, particularly for organic products. Necessary expenditures for certification are also a significant factor in this respect. In the case of recycled materials, the sorting and upgrading of waste and scrap is an important cost factor. Costs associated with modifying traditional technologies in cases where the environmentally preferable alternative is an input to the manufacturing process may also be considered as impairing the competitiveness of these products. A similar constraint may be mentioned for biomass fuels as well, since they sometimes require modified combustion engines. In both cases, however, experts claim that the issue is more a reluctance to change than economic considerations.

94. For some items such as products made from agricultural waste, production technologies are at an experimental stage and costs of production could fall drastically if commercial scale production is attained.

2. Information about quality

95. Particularly for products with potential uses as inputs in agriculture and industry, scientific information about their physical and chemical properties is indispensable for increasing competitiveness. The potential private users accustomed to traditional inputs are unlikely to initiate scientific inquiries about alternative inputs unless cost advantages are strongly expected or they are forced by regulatory measures or public pressure to change their inputs. Thus, it falls principally upon the producers of the environmentally preferable inputs as well as the public institutions or industry associations and NGOs in the consuming countries to provide the scientific data needed by the users.

3. Information about environmental advantages

96. Many of the claims to environmental advantages and contribution to reducing environmental stress are based on partial information and even anecdotal evidence. Undisputed scientific proof, which is very difficult or impossible to obtain, should not be a prerequisite for acceptance of a product as environmentally preferable. It could paralyse actions by binding them to endless study. Nevertheless, to increase competitiveness, more credibility is necessary for the claims of environmental advantages by many products. In some cases, such as organic produce, advantages have been extensively studied and the products are certified and labelled. However, environmental advantages at the downstream stages of a product's life cycle, in particular for recycled products and for industrial inputs, are usually less well documented. Moreover, many such products which are used as inputs in industry are not amenable to labelling schemes and need other means of assessment and information dissemination.

4. Marketing

97. Many of the products reviewed in the study are "new" products and introducing them to the market is an important issue. For several items such as non-wood forest products, marketing expenses are important cost elements because of the relatively small volume of trade. For some others such as organic foods and alternative wood products, new strategies are necessary to reach wider consumer groups and graduate from niche markets to mainstream markets. An important aspect of marketing, which would increase competitiveness considerably, lies in the provision of reliable supplies of consistent quality, especially for products used as inputs in production processes. For many products, collection from producers is an important stage in the marketing chain which influences crucially the quality and price of the product.

5. Government regulations and policies

98. Through regulations, financial incentives, and command and control measures, governments have a significant role to play in correcting the existing distortions which favour environmentally disadvantageous products. This is particularly important in the cases of recycled products and biomass fuels. Equally important are sectoral policies such as agricultural subsidies which are a determining factor for the relative competitiveness of alternative products. Trade and sectoral policies also have a significant impact on the competitiveness of supplies from different origins. In developing countries, governmental policies are also vital for the development of indigenous scientific capacity. This capacity is critical for the development of commercially viable and environmentally preferable products and for the demonstration of the technical and environmental qualities of these products.

B. Policy orientations

99. The following policy orientations are formulated with a view to enabling developing countries to benefit from increasing environment-consciousness in the main markets, thereby improving their export earnings while contributing to reducing local and global environmental stress caused by current consumption patterns. In this context, ways and means to increase the competitiveness of products with environmental advantages will need to focus on the five main problems mentioned above. There are also some general policy considerations which address simultaneously a number of these problems.

1. Price competitiveness

100. (a) Policies and measures to internalize environmental externalities should be pursued at both the national and international levels. To be effective, such internalization needs to cover all products which are potential substitutes for each other. Cooperative approaches to multilateral internalization schemes, in particular for traded products, seem to be a particularly attractive vehicle in this context.

101. (b) To facilitate the adoption of environmentally preferable agricultural practices it would seem appropriate to provide financial assistance to cover transition costs. Given the financial constraints faced by developing countries, resources for such purposes would need to come in large measure from international institutions and/or the consuming countries. The distribution of such assistance could be organized through producer groups, including cooperatives, and could take the form of long-term loans to these groups, guaranteed by the government of the recipient country. Repayment could be linked to the prices of organic products produced. Similar financial arrangements and other types of cooperation or partnerships could be designed between importing firms and producers.

102. (c) The costs of certification need to be brought down. This could be done through the establishment of competent certification authorities in

developing countries and the vesting in them of internationally recognized powers to certify products. Such authorities would require qualified personnel whose competence could be verified periodically by international inspection; there would accordingly be a need for assistance from developed countries and international organizations to train them.

103. (d) Technical research into reducing the costs of biomass fuel production should continue. Crops (such as sweet sorghum) which may be more suitable for biomass fuel production, and technologies (such as splitting of sugar cane) which may be more cost-effective than the conventional ones should be seriously considered. In this connection, cost comparisons between biomass fuels and fossil fuels should take into account the existence of different technologies for producing the biomass fuels and different options (such as aquahol) for using them.

104. (e) Logistical and infrastructural support, for example, improvements in rural transportation systems and storage equipment and facilities, will contribute to bringing the costs down for many products.

2. Technical qualities

105. (a) Research on the technical qualities of environmentally preferable inputs that can be substituted in production processes is indispensable for improving their competitiveness. Such research can most cost-effectively be undertaken on a generic basis. Producers of the same or similar products could jointly embark upon such research to reap economies compared to the case in which each country engages individually in related work. As several products (such as natural fibres and inputs to the paper industry) are produced by both developed and developing countries, and the same research facilities can be used for several similar products, there is much scope for easily realizable co-operation. An important and easy step in this direction would be for developed country governments to take measures to facilitate access by developing country producers of raw materials to research facilities.

106. (b) When certain technical qualities of an environmentally preferable product do not fit satisfactorily the requirements of the industry, an effective focus of research could be on improving these qualities.

3. Environmental qualities

107. (a) There appears to be a need for methodological improvements in life cycle analysis to permit serious use of such methods to ascertain the environmental advantages and disadvantages of products, particularly those (such as recyclables) that have important impacts on global trade and industry patterns.

108. (b) Credible research into the environmental attributes of products needs to be expanded, especially for products which are not subject to certification and ecolabelling schemes. Although ideally life cycle analyses and environmental impact assessments would be appropriate, initial research could usefully focus on the particularly strong and weak points of such products with a view to emphasizing the former and improving the latter.

109. (c) Publicizing the importance of environmental benefits that occur mainly in the producing countries and those which are not immediately obvious to the consuming public (as in the case, for example, of forest friendly products and products made from wastes), would be an important step towards increasing the competitiveness of environmentally preferable products. In order to raise the consciousness of consumers, it would seem useful if the NGO community and other public pressure groups such as the media were involved in such activities.

110. (d) In those cases where increasing supplies can imply environmental degradation (such as for non-wood forest products), cooperation of producers with independent observers would help not only to ensure the sustainability of production but also to publicize it and thus inspire confidence among potential customers.

4. Marketing

111. (a) Increased competitiveness and more widespread consumption of organic products and non-wood forest products, is likely to require acceptance of such products by large distributors and supermarkets in developed countries. This would require organizational changes on the supply side to secure the continuity and quality of supplies. Such changes are in turn likely to require technical and organizational assistance, e.g. for the reduction of post-harvest losses and storage problems.

112. (b) Market awareness requires that developments in the consuming countries, in terms of consumer interest and rules and regulations, particularly for fuels and recycled products, be closely followed. As this is a product-related activity, the cooperation of international organizations and possibly commodity bodies would be a cost-effective approach.

113. (c) Generic promotion and concerted marketing activities for items such as agricultural raw materials, wood products, and non-wood forest products would seem to be a useful tool for increasing competitiveness.

114. (d) The development of product data sheets merits being encouraged as this can facilitate acceptance of new products by industry.

115. (e) Given that environmental conditions change from country to country, and that many environmental problems are location specific, certification and ecolabelling schemes need to provide equivalences for environmental advantages in different locations.

5. Government regulations

116. (a) Government regulations and policies should, first and foremost, eliminate the explicit or implicit subsidies given to environmentally undesirable products and practices.68

117. (b) In some developing countries measures to define secure property rights will provide incentives for improving environmental protection at the production sites, particularly in the case of products from forests as well as for agricultural production in general.

118. (c) The competitiveness of natural products with environmental advantages would be increased by governmental review, and appropriate revision, of industry and trade standards which may be based on established practice rather than technical requirements and which may act as barriers to entry for such products.

119. (d) In many cases government procurement practices can act as an important signal for the private purchasers. An obvious and powerful incentive for the expanded use of environmentally preferable products would therefore be the adoption of provisions to give preference to such products in government procurement. By enlarging the production this could also lead to economies of scale, reduce costs and improve the competitiveness of such products. Action taken in this respect includes the Federal recycling and procurement policy of the United States as well as the proposed legislation that would require the United States Government Printing Office to use soy-based ink in Federal documents instead of petroleum-based inks.69

6. General considerations

(a) Importance of a multifaceted approach

120. In order to increase the competitiveness of natural products with environmental advantages, the private and public sectors of producing and consuming countries as well as the academic and NGO communities need to act in concert. Each of these actors has a specific role to play, ranging from establishing the requisite regulatory and policy framework to generating and disseminating information at all stages of the product life cycle. Competent international organizations can play a very important role and act as catalysts in this respect, bringing together the various actors.

(b) The need for an organized information base

121. An electronic information system on environmentally preferable products covering their principal characteristics and market developments would be instrumental in expanding the awareness of key actors. Several modalities can be envisaged for this system. It could be an independent entity, linked to the existing databases on products70 or systems such as UNCTAD's MICAS (Microcomputer-based Commodity Analysis and Information System), or be associated

with information systems such as UNEP's International Cleaner Production Information Clearing House. It should be mentioned that work has been initiated in UNCTAD on recycled materials, for which information is extremely scarce and government regulations differ widely between countries and change frequently.

(c) Funding needs

122. Development of environmentally preferable products, improvements in their qualities, establishment of certification schemes, and amelioration of environmentally undesirable effects as well as marketing of these products by developing countries require substantial amounts of finance. Given the contribution that expansion of production and trade of these products can make to the sustainable development process, it would seem appropriate that provision of finance for these purposes be included in official development assistance programmes. Consideration might be given to the creation of a trust fund which would provide venture capital to developing country firms interested in improving and commercializing environmentally advantageous products. This entity could be modelled after the United States Department of Agriculture Alternative Agricultural Research and Commercialization Center and cooperate with the private sector in developing countries.

(d) Technical cooperation among developing countries

123. Many of the issues mentioned above, ranging from scientific to marketing problems, are relevant to most developing countries producing the environmentally preferable products. Cooperation among these countries would reduce the costs to be borne by each of them. Moreover, as larger supplies will help, through increased exposure, in acceptance of these products by the users there is much to be gained from cooperation. There is, therefore, there is a need to promote both exchange of experience and joint research and marketing efforts. International organizations could have an important catalytic role to play in this respect.

(e) Further work and development implications

124. In order to provide a sound basis for national and international policies with a view to increasing the competitiveness of natural products with environmental advantages, it would be useful for the Standing Committee on Commodities to keep under constant review the developments concerning the issues identified in this study. Further analytical work in the UNCTAD framework could be undertaken in two directions, with a commodity and a country focus. There seems to be considerable scope for technical cooperation as well.

125. With regard to the commodity focus, a limited number of products or product groups could be selected and in-depth analyses could be undertaken regarding opportunities for and constraints to, their increased utilization and trade, and the implications for developing countries. Because of the sheer size of their actual or potential markets and the paucity of related information on trade and development aspects, reusable and recycled materials and biomass fuels are obvious candidates in this respect. Specific aspects of organic production and trade in organically grown products, such as certification, principles and costs

of certification, also merit attention in this context.

126. Work should proceed with a country focus on other products such as natural agricultural inputs, non-wood forest products and products made of agricultural waste. This should include the analysis of implications of increased production and exports of environmentally preferable products on the development prospects of specific countries. It should also aim at providing information to assist the developing countries in better assessing their potential in this area and identifying the bottlenecks. Least developed countries and countries in Africa seem to merit priority attention in this respect, e.g. in terms of exchange of experiences with developing countries which are relatively advanced in the production and export of natural products with environmental advantages.

127. Technical assistance could include, apart from assistance in terms of analysis and policy development on a country basis, the organization of round-table meetings on specific products, which would bring together public and private sector representatives of the producer and consumer countries as well as the NGO and academic communities. The purpose would be to increase the producers' and consumers' awareness of opportunities and bottlenecks in respect of these products, to expand the information base and to improve direct contacts. These meetings would seem to be of the highest value for products relatively less well known by the general public.

Notes

1. Although "environmentally preferable" is the most appropriate term, "environmentally advantageous" and "environment-friendly" are also used interchangeably in this study.

2. In the context of discussions on environment-related trade measures, a similar distinction is made in terms of process and product standards.

3. Reference can be made to one particular type of input: energy. In most life cycle analyses, a production process is considered as more environment-friendly when the energy use is lower. However, the environmental characteristics of energy are determined by the way it is generated. For example, hydroelectric or agro-based fuels have different environmental impacts from fossil fuels. Therefore, energy use, undifferentiated by source, cannot uniformly be considered as unfriendly to the environment.

4. There are also important environmental impacts at the distribution and marketing stages such as that caused by transportation. Thus, products produced at places near the markets have an advantage in this respect over those produced far away. This study does not focus on this stage of the life cycle although it may be of considerable importance in some cases.

5. Wiemann, J., "Green protectionism - a threat to third world exports? The case of Indian leather and textile exports facing tighter environmental standards on the German/European market", mimeographed, September 1993, quoting certain opinion polls.

6. Cairncross, F., Costing the Earth, the Challenge for Governments - the Opportunities for Business, Harvard Business School Press edition, 1993, pp. 191-192.

7. Salzhauer, A. L., "Obstacles and opportunities for a consumer ecolabel", Environment, vol. 33, No. 9, p. 10.

8. International Environment Reporter, 6 April 1994, p. 318.

9. The reuse of goods and materials is an extension of their utilization period through the design of long-life goods and the introduction of service loops to extend an existing product's life by repair, reconditioning or technical upgrading.

10. Recycling is the processing of materials collected and separated from waste to produce marketable goods.

11. According to various life-cycle analyses for reusable clothing, for instance, far more resources are used by consumers in washing, drying and ironing the clothes than in their re-manufacturing/recycling. This is even true for polyester fibres. J. Nash, M.D. Stoughton, "Learning to live with life cycle assessment", Environmental Science and Technology, vol. 28, No. 5 (May 1994), p. 236A.

12. The recycling of ferrous scrap leads to energy savings of 25-65 per cent; the complete recycling of one ton of flat steel products substitutes for 1.5 tons of iron ore and 0.5 tons of coke; recycling of ferrous scrap leads to 30 per cent lower air emissions than treatment of pig iron and about 60-70 per cent lower emissions into water. UNCTAD,

"Enhanced recuperation and recycling: implications for primary commodity producers in developing countries - the case of ferrous scrap versus iron ore", (UNCTAD/COM/43), Geneva, 10 June 1994, p. 6.

13. Pushed beyond a certain level, paper and board recycling leads to the production of sludge whose sheer volume (in Canada, for example, one ton of recovered paper yields about 0.66 tons of sludge) and composition (broken fibre, fines and ink, semi-solubles such as starch and coatings, and non-solubles, such as fillers) make its disposal very difficult. On the other hand, large-scale paper and board recycling reduces the demand for new wood-fibres, giving commercial woodland owners less incentive to maintain their forests. S. Nilsson, Environmental Impacts of Waste paper recycling: a Feasibility Study, Earthscan Publications, London, 1993; G. Elliot, "Trade implications of recycling of newsprint", paper prepared for the OECD Workshop on Life-Cycle Management and Trade, Paris, 20-21 July 1993, p. 5; OECD, Recovery and recycling of packaging material: trends and industry impact, final report of the Ad Hoc Working Party on Pulp and Paper, DSTI/SI/IND/PP(92)4/REV3, Paris, 9 November 1993, p. 26.

14. Loss-making recycling schemes are numerous. S. Fairlie, "Long distance, short life: why big business favours recycling", The Ecologist, vol. 22, No. 6 (November/December 1992), p. 280). However, environmental costs associated with the production of virgin materials are not included in their prices either.

15. UNCTAD/COM/43, op.cit.

16. International Environment Reporter, Washington, D.C., 9 February 1994. Social charges for employers in Western Europe can add up to 60 per cent of a young employee's salary. International Environment Reporter, Washington, D.C., 1 December 1993, p. 891.

17. In Argentina, IBM recycles three quarters of its waste because local facilities do not meet its self-imposed tough requirements for waste disposal. International Environment Reporter, Washington, D.C., 19 May 1993, p. 368.

18. The question to be answered for each commodity in this respect is: Is the growth of primary commodity demand generated by quick economic expansion, in particular in countries such as China, India, Mexico, Indonesia and Viet Nam, sufficient to compensate for or override the part of demand met by secondary materials?

19. As for copper, for instance, the recycling rate is estimated at 50% for all developed countries, 38% for North America, 27% for Japan, 85% for Western Europe, and 45% for South-East Asia for 1991-92.

20. Our interest in this study is in biomethanol made from biomass.

21. Calculated from United States Department of Agriculture, "Emerging technologies in ethanol production", 1993, and "Bush fuels support by backing ethanol", Financial Times, 7 October 1992.

22. Some authors reject the idea that higher fossil fuel prices will help the introduction of biofuels because this perspective underrates the reaction of fossil fuel interests. They also recall that the

technologies used to produce alternative fuels are constantly being upgraded. Moreover, the influence of the strong corporate interests at stake in this matter should not be neglected.

23. "New uses to rescue EC oilseeds", World Commodity Report, 11 March 1993.

24. Ibid.

25. Comparable terms used include "ecological" and "biological".

26. FAO "Agrovoc Multilingual Agricultural Resources", 2nd ed. 1992.

27. United States Department of Agriculture, Report and Recommendations on Organic Farming, Washington, 1980.

28. These effects are likely to be eliminated in any case, as a result of strict standards and very careful testing.

29. Hamm, U., "Marketing strategies for organic products in China", mimeographed, 1994. C. Haest, "growing as partners into the 21st century", mimeographed, 1994.

30. Financial Times 30 April 1993 International Trade Centre, "Dissemination activities for coffee - an exporter's guide", 1993, p. 7.

31. Hamm, op. cit., pp. 4-5. Haest, op. cit., p. 44.

32. Press release of Krav (Kontrollföreningen för Ekologisk Odling), not dated.

33. Interview with chocolate manufacturers.

34. Aruoba, Celik, "Analysis of probable impact of EU ecolabelling program and related criteria on Turkish textiles and garments exports to European markets". Paper prepared for the Workshop on Ecolabelling and International Trade, Geneva, 28-29 June 1994.

35. Haest, op. cit.,p. 32. Wong, Jennifer, "Organic coffee: gearing up for a high-quality product", APROMA/Bimonthly Review, No. 26, 1993 p.28. UNEP, "Benefits of diversity - an incentive toward sustainable agriculture", various chapters. International Cotton Advisory Committee, "Organic cotton growing", attachment II to SC-N-404, 26 May 1994.

36. Hamm, op. cit., p. 6

37. Haest, op. cit.

38. van Dam, J.E.G., van Vilsteren, G.E.T., Zomers, F.H.A., Shannon, W.B., Hamilton, I.T. Increased Application of Domestically-produced plant Fibres in Textiles, Pulp and Paper Production, and Composite Materials. Prepared on behalf of the Commission of the European Communities DG XII, not dated, p. 8.

39. FAO, Committee on Commodity Problems, Intergovernmental Group on Hard Fibres, twenty-fifth session, "Environmental improvement possibilities in hard fibre operations of producing countries", CCP: HF 91/9, June 1991. Braungart, M., Engelfried, J., Hansen, K., Mulhall, D., Neumann, M., Jute and Polypropylene: Environmentally Intelligent Products?

Comparative Impact Assessment, Hamburg, October 1992.

40. FAO, Committee on Commodity Problems, Intergovernmental Group on Jute, Kenaf and Allied Fibres, twenty-eighth session, "Developments in regulatory measures affecting packaging", CCP: JU 92/8, August 1992.

41. Ibid. Information Note on Degradable Plastics. CCP: JU 92/4, June 1992.

42. Harsch, J. New Industrial Uses, New Markets for U.S. Crops: Status of Technology and Commercial Adoption, prepared for United States Department of Agriculture Cooperative State Research Service, Office of Agricultural Materials, August 1993, p. 58.

43. van Dam, J.E.G. et. al., op. cit., p. 46.

44. Ibid., p.94.

45. Ibid., p. 40.

46. Sen Gupta, A.K. "Geotextiles: opportunities for natural-fibre products" International Trade Forum, January-March 1991, p. 12.

47. GADSA Limited London, Investing in Rubberwood Processing: Opportunities, Constraints and implications of Horizontal Integration for the Rubber Industry, background paper No. 5, prepared for the Workshop on Global Development of the Rubberwood Industry, Kuala Lumpur, 23-24 September 1993, p.12.

48. In the Philippines, for example, by the Forest Products Research and Development Institute, and by the Forest Research Institute of Malaysia.

49. UNIDO, The potential role of rubberwood in the forest economy of rubber producing developing countries, background paper No.2, prepared for the Workshop on Global Development of the Rubberwood Industry, Kuala Lumpur, 23-24 September 1993, p. 9.

50. ITC, A study on the rubberwood industry in Malaysia, Background paper No. 1, prepared for the Workshop on Global Development of the Rubberwood Industry, Kuala Lumpur, 23-24 September 1993, p. 30.

51. Indufor, Oyd, - Rubberwood: A study of world supply potential, background paper No. 3 prepared for the Workshop on Global Development of the Rubberwood Industry, Kuala Lumpur 1993, p. 49.

52. Government of the Philippines, "Technology transfer/commercialization of selected cocowood utilization techniques", project proposal to the International Tropical Timber Organization, PD 17/92 Rev. 4(1).

53. UNIDO, op. cit., p.4.

54. The last figure is bound to rise as log extraction in Sabah and Sarawak is reduced.

55. ITC, A study on the rubberwood industry in Malaysia, mission report by Dr. Lew Wing Hing submitted to the Workshop on Global Development of the Rubberwood Industry, Kuala Lumpur, 23-24 September 1993. Background paper No. 1, p. 2.

56. Panayotou, T. "Introduction: multiproduct forest management - a key to sustainability?", in International Tropical Timber Organization (ITTO), Status and potential of non-timber products in the sustainable development of tropical forests, Proceedings of the international seminar held at Kamakura, Japan, 17 November 1990, p. 3.

57. Gentry, A.H., "Tropical forest diversity vs. development: obstacle or opportunity?", in ITTO, op. cit., p. 67.

58. May, P., "Measuring sustainability: forest values and agropastoral expansion in Brazil", prepared for the International Expert Meeting on Sustainable resource management and Resource Use, Noordwijk, the Netherlands, 3-4 June 1993.

59. Panayotou, T., op. cit., p. 4.

60. Sayer, J.A., "Using non-timber products to support forest conservation programmes", in ITTO, op. cit., p. 39.

61. Gentry, A.H., op. cit. p. 65.

62. Dove, M.R., "A revisionist view of tropical deforestation and development", Environmental Conservation, v. XX (1), Spring 1993, p. 23.

63. This part has benefited extensively from J.W. Clay, and C.R. Clement, "Selected species and strategies to enhance income generation from Amazonian forests", prepared for FAO, 1993.

64. National Research Council, Neem: Tree for Solving Global Problems, Washington, D.C., 1992, pp. 1-2.

65. FAO/WHO Codex Alimentarius Commission, Joint FAO/WHO Food Standards Programme, "Consideration of biologically or organically produced foods", prepared by the Government of Canada, Alinorm, 91/37, annex II.

66. National Research Council, op. cit., p. 15.

67. Israel, D.C., Trabajo, F.M.C., and Nayve, C.M., "The production, utilization and trade of environmentally preferable products in the Philippines", prepared for UNCTAD (forthcoming).

68. In this respect, see "The effects of the internalization of external costs on sustainable development", report by the UNCTAD secretariat, TD/B/40(2)/6, 7 February 1994.

69. Agricultural Outlook, July 1994, p. 14.

70. For a list of such databases see B. Ancel, and S. Srivesta, "Market information at your fingertips", International Trade Forum, No. 4/1993.