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Medicinal plants and conservation in São Tomé

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The study reported in this paper examined the use of plants as medicines by people on the island of São Tomé (Gulf of Guinea). A description of the uses and preparation of the 53 most commonly used plants was noted, the collected plant material was subsequently identified at the Royal Botanic Gardens, Kew. The source of the majority of plants was domestic gardens and to a lesser extent disturbed forest close to settlements. The low human use of natural resources within the primary and advanced secondary forest areas has positive implications for the proposed conservation policies, since the protection of these areas would create little conflict with human use of the natural resources within these vegetation types. Several recommendations are made on how the modern medical system in São Tomé might be improved by integrating into it traditional medicine.

Keywords: ethnobotany, São Tomé, medicinal plants, conservation

Introduction

Conservation and resource use

It is becoming widely accepted that the existing traditional economic use of natural resources should always be considered when formulating conservation strategies. A direct dependence upon the surrounding natural resources, often developed over millennia, is vital for the basic needs of food, medicine and shelter of many people around the world. If no viable alternatives are given, this relationship must be maintained in a sustainable manner to allow human needs to be met whilst conserving the natural environment.

The wealth of plant life useful to peoples within threatened tropical and sub-tropical ecosystems is a strong contemporary justification for their conservation. The destruction and degradation of high diversity ecosystems not only erodes traditional contact which local people have with their native floras, but also reduces the chances of discovering many new economically useful plants.

Plants as medicines

Medicinal plants are particularly important as an integral part of traditional therapy of local peoples and as a possible source of valuable phytochemicals for the Western pharmaceutical trade. Despite the increasing adoption of Western-style medical practice by developing countries, plants still represent the main source of primary health care. In some countries up to 90% of therapy is confined to medicinal plants (Penso, 1980).

Reasons for this continued widespread use of medicinal plants are numerous. Modern medicine in developing countries is generally of a poor standard and hampered by lack

of funds and infrastructure. Drugs are expensive and often unavailable, hospitals lack the proper equipment, and facilities are inaccessible for many people living away from urban centres where these facilities tend to be concentrated. As a result, many people continue to rely on traditional medicinal practice, using plants which by trial and error over a period of time have proved to be safe, effective, cheap and readily available.

Documenting medicinal plants

To obtain a clear view of the relationship between people and their natural environment and to suggest sustainable management options, it is necessary to gather data such as the type, source and quantity of resources used, their importance within the cultural context and alternatives if the resource is scarce and needs to be conserved for the preservation of genetic diversity and future benefit.

There are several other complementary reasons why it is important to document medicinal plants. The traditional use of a plant may be an indication of the presence of chemicals valuable to medical progress. It would be difficult to systematically screen each of the approximately 275 000 species of plants in the world for potentially valuable chemicals. Therefore, indigenous knowledge of medicinal plants serves as an important pointer to the species which might contain the significant chemicals. Presently, more than 75 compounds derived from higher plants are found in modern medicine (Dev, 1989). These include common drugs such as morphine, codeine, papaverine, diosgenin and aspirin. Many of these compounds are still extracted from their botanical source.

However, traditional knowledge is under threat. A long and intimate association with their floras has enabled indigenous peoples, through trial and error, to create systems of effective traditional medicine. With the advent of modern education and cultural Westernization, this empirically acquired knowledge is being lost, especially amongst the younger generations (Schultes, 1986, 1989). Since it is generally the older generation that holds much of the traditional knowledge, which is passed on orally, it is at risk of disappearing in the near future.

By documenting traditionally used plants, and selecting those that are safe, effective and easily available or cultivated, these plants may be integrated into modern health care systems. A joint UNICEF/WHO study investigating the health needs of the developing world came to the conclusion that only by combining traditional with modern systems can health care be truly effective and affordable for low income groups in the developing world (Farnsworth, 1980).

Examples of how this integration might be achieved include the establishment of a medicinal plant nursery within a hospital or carrying out a basic training programme aimed at domestic users which supports more effective home-based primary health care. As the population already has a tradition of using the indicated plants, such schemes are likely to succeed.

Health care and medicinal plant use in São Tomé

In the Democratic Republic of São Tomé and Príncipe (Gulf of Guinea), the use of plants as medicines is common, particularly as a primary health care measure. The country suffers from similar restraints in its contemporary health care to those found in many other developing countries. Most of the existing medical facilities are managed by international aid organizations but, through lack of funds, hospital conditions are often sub-standard and there is a chronic shortage of medication.

The island of São Tomé is relatively small (854 km^2) and many people live in small rural settlements, which were once part of larger *roças* (plantations). The latter are often in isolated areas with a very poor transport infrastructure. Only 69% of the rural population have access to health services (UNDP, 1992). This is due to the difficulty such people have to reach better equipped hospitals which are concentrated in the urban areas of the north, and they will only do so when illness is apparently very serious.

São Tomé and Príncipe differs from many other countries with a long-established traditional use of medicinal plants in that, for historical reasons, the population has had a relatively short period of interaction with the local flora. The islands were first discovered by the Portuguese in the late 15th century (sometime between 1469 and 1472), at which time they were uninhabited. By 1485 and 1500 the first settlements were established on São Tomé and Príncipe islands, respectively (Flegg & Synge, 1980). São Tomé was first a staging-post of the slave trade from Africa to the Americas, and a little time later established a plantation economy which was heavily dependent upon slave labour and became a major producer of sugar, cocoa and coffee production. By 1550 two-thirds of the island was under cultivation, probably one of the first in the world with such an extensive system of tropical agriculture for export (Exell, 1973a).

Slavery was abolished in the mid-19th century. The plantation labour force was then replaced by contract labour mainly from Cabo Verde, Angola and Mozambique (Flegg and Synge, 1980), a system which remained in operation up until the country's independence in 1975. The result is a highly heterogeneous population, many of which are first- or second-generation immigrants.

Flora of São Tomé

A.W. Exell (1944, 1956, 1973a) compiled the only complete list of the flora of São Tomé. Liberato and Espirito Santo (1927–1982) began a systematic review by family, but were not able to complete the series. Further botanical surveys are needed urgently, particularly as much of the primary vegetation in the central areas of the island remains intact but it is likely to become threatened with economic expansion, particularly within the agricultural sector.

According to Exell, the flora of São Tomé consists of 763 species, 556 of these being indigenous. The great affinity of the Santomean flora with that of the West African coast indicates that the original plant population is derived from the continent, as opposed to the surrounding islands (Exell, 1944, 1973b). Of the total number of native species, 19.4% are endemic. It is likely that low levels of competition, homogenous populations of species and less contact with other related species has resulted in a flora with many reproductively isolated species which have hybridized on the mainland (Exell, 1956).

São Tomé island has 207 introduced species, a relatively high number, and this is due to the rapid settlement of people that followed the island's discovery. Many plants were brought into the country as export crops, ornamentals, shade plants for cocoa, and local food plants (Exell, 1973a). One example of the latter is the breadfruit (*Artocarpus incisa*), brought into São Tomé in the early 19th century as a cheap and year-round source of food for the plantation slaves. Breadfruit is now a staple food for the Santomean population and grows spontaneously in secondary regrowth forest as well as being cultivated. Many other plants were introduced accidentally. Presumably the existence of

many South American weeds is due to the importation of coffee and cocoa seeds from Brazil in the 19th century (Exell, 1944).

The study

Roseira (1984) compiled one of the few existing ethnobotanical records of the Santomean flora. Espirito Santo (1969) published a small account from information gathered during his botanical collections. The poverty of ethnobotanical records encouraged further investigation into this vital aspect of understanding natural resource use by local people in the country.

Objective and methodology

The objective of the present study was to gather preliminary ethnobotanical information on plants used for medicinal purposes by people on the island of São Tomé. The survey was carried out over the three months of June to September 1990, which coincides with the driest period of the year, locally called *gravana*. Several different settlements were visited around the island. Apart from the urban area of the capital, São Tomé city, all of the visited settlements are situated in old plantations, often near or in secondary regrowth forest of differing ages and disturbance. The primary forest areas situated in the central region are completely uninhabited, probably due to the rugged terrain and difficulty of access, making them unfavourable for agricultural activities.

The information was collected by way of informal interviews. Each individual was asked what plants he or she used for medicinal purposes, and for each plant the following descriptors were recorded: vernacular name, use, part of plant used, preparation, application, and where the plant was found. The plant was then photographed, collected and pressed for later botanical identification.

Target informants

Old people ($\geqslant 50$ years of age) were the main informants of the study. Although most people, old and young, were able to name and explain the uses of several more commonly used plants, old people had the greatest knowledge.

Local healers called *massagistas* were the second important informant group. They use treatments that are mainly of an external nature by applying a concoction or decoction of plant material on the relevant part of the body. The *massagistas* practise their therapy at a community level and often do not demand payment. Many collect their own plant material from nearby forests, with which they are very familiar.

Only one *curandeiro* was consulted during the study. *Curandeiros* use witchcraft and mysticism combined with plant therapy, and always demand remuneration for their services, and therefore are concentrated in urban areas. Due to the secrecy of their activities, a longer period of interaction would have been required to gain enough confidence in a relationship to acquire useful information.

Results and discussion

A total of 93 plants with medicinal uses were documented over the period of the study. The most commonly and consistently used of these plants (53) were collected and subsequently identified and voucher specimens deposited at the Royal Botanic Gardens,

Kew. Table 1 lists the plants by their scientific name, their medicinal purpose, the part of the plant which is used, the preparation and application procedures of the ensuing plant remedy, and source type. Observations such as other important non-medicinal uses of the plants are also included.

Vernacular names, preparation and use categories

A difficulty frequently encountered in the study was that one species may have several different vernacular names. It was found that most plants in the study had at least two names, one Portuguese and the other in the *crioulo* dialect. The plants were recorded by their most commonly used vernacular name (see Table 2). It was also noted that the same plant would occasionally have different names according to its stage of growth. For example, *Vernonia amygdalina* was named *libo mucambú* during its herbaceous stage of growth and *libo da terra* in its woody stage. To counteract these problems, emphasis was placed on asking a number of interviewees about the same plant and collecting several specimens on different occasions under their direction.

Preparation of the plant material for medicinal use can take different forms. Infusions seemed to be the most common method of preparation. For external afflictions, a solution of palm oil was frequently used. Alcohol was also used as a solvent, particularly in medicines which would be consumed over time, such as vermifuges and aphrodisiacs. Concoctions of different materials were put into a bottle together with the local cane spirit or any other high proof alcohol.

A single species of plant was often applied to a wide range of different problems. For example, *Voacanga africana* is used in São Tomé for menstrual pain, small wounds and as a laxative, while *Trema guineensis* is used against venereal disease, diarrhoea and prenatal pain. This is common in many traditional medicine systems. For example, in Mozambique, *Chenopodium ambrosoides* has been documented as a vermifuge, emenagogue, stimulant, antispasmodic, abortifacient and to be effective against abdominal pains, diarrhoea, and eczema (Jansen and Mendes, 1991). However, it is known that the activities of different chemical constituents are enhanced by different factors, such as preparation, dosage, part used, etc. (Iwu, 1993).

The categories of ailments in this study were recorded as they were perceived by the users. They are not necessarily in conformity with Western medical terms. Therefore, the category of 'fevers' or 'abdominal pains' takes into account a wide range of specific illnesses. However, since the availability of professional diagnosis and treatment is so limited, the people must rely upon their own interpretation of the disease. According to Croom (1983), "some disorders may have no counterpart in other cultures because all illness is, at least in part, culturally defined". This applies to the influences of magical beliefs integrated into traditional medicine. Although mysticism is not an overwhelming part of São Tomé's culture, it is believed that certain combinations of bodily aches are attributed to *mal olhar*, or evil glance, of an undesirable person, and this is cured through massages of *Vernonia amygdalina* and other plants. Children are often given alcoholic concoctions to frighten away evil spirits and spells.

It is worth mentioning *calulu*, which is the national dish of São Tomé and is considered a tonic as well as the local culinary delicacy. The *Calulu* is a stew consisting of fish or meat and is spiced with an assortment of medicinal and highly nutritious plants. Ailing people are given *calulu*, and it is often eaten to 'build strength'. Some of the vegetable ingredients of the *calulu* are: *Achyranthes aspera*, whose leaves are considered

Table 1. Medicinal plants used in São Tomé

Family	Name	Use	Part	Preparation and application	Source type	Notes
Acanthaceae	*Acanthus montanus*	asthma	leaves	infusion	DOM	
		abdominal pains	leaves	cold infusion		
	Brillantaisia sp.	measles	leaves	bathe in decoction	FHERB	
		small wounds	leaves	bathe area in decoction		
Aloeaceae	*Aloe humilis*	stings and burns	leaves	rub on area	DOM	
Amaranthaceae	*Achyranthes aspera*	small wounds	leaves	squeeze juice on affected areas	DOM	Leaves – *calulu* ingredient
		anaemia	leaves	ingest		
Annonaceae	*Annona muricata*	rheumatism	leaves	infusion	CROP	
		headache	leaves	chop, mix with palm oil and anoint head		
	Monodora myristica	abdominal pain	seeds	chew on seeds	FTREE	Seeds sold in market
		worms	seeds	*C. ambrosoides* + *C. papaya* + garlic + cane spirit; administer one spoonful a day		
Apocynaceae	*Rauvolfia* sp.	abdominal pain	bark	infusion	FTREE	
	Voacanga africana	menstrual pain	bark	cold infusion	FTREE	
		small wounds	leaves	squeeze leaf juice on affected area		
		laxative	bark	infusion		
Begoniaceae	*Begonia baccata*	abdominal and menstrual pain	root	infusion	FHERB	Leaves – *calulu* dish
Boraginaceae	*Heliotropium indicum*	ulcers	leaves	crush with palm oil; apply on affected area	DOM	
Burseraceae	*Santiria trimera*	wound and abcesses	bark	crush into powder; apply on affected area	FTREE	

Table 1. *Continued*

Family	Name	Use	Part	Preparation and application	Source type	Notes
Caricaceae	*Carica papaya*	purgative	fruit	ingest	DOM/	Leaves:
		worms	flowers	infusion	CROP	preserve meat
			seeds	masticate		
		jaundice	bark	infusion		
Chenopodiaceae	*Chenopodium ambrosoides*	worms	leaf	infusion or eat with salt	DOM	
Combretaceae	*Terminalia catappa*	diarrhoea	bark	infusion	CROP	Ornamental tree
Compositae	*Ageratum conyzoides*	worms	whole plant	infusion	DOM	
		colds	roots	+ *C. ambrosoides*; infusion		
		impotence	roots	+ *C. ambrosoides*; infusion		
	Elephantopus mollis	diarrhoea	young leaves	infusion	DOM	
		toothache	young leaves	masticate		
	Mikania chenopodifolia	urinary tract	leaves	infusion	FHERB	
		venereal disease	leaves	crush with cold water, sieve and ingest		
	Struchium sparganophora	aches	leaves	add oil and rub on area	DOM	Leaves – *calulu* ingredient
	Vernonia amygdalina	fevers	leaves	infusion	DIST	
Crassulaceae	*Bryophyllum pinnatum*	swelling and bruises	leaves	chop and apply	DOM	
Cucurbitaceae	*Momordica charantea*	fevers, worms	whole plant	infusion	FHERB/ DIST	
Euphorbiaceae	*Alchomea cordifolia*	diarrhoea	leaves and roots	infusion	DIST	
		haemarrhoids	leaves	crush with salt and soot, add water, apply to area		

	Euphorbia prostrata	jaundice	whole plant	infusion	DIST	
	Jatropha curcas	purgative	leaves	infusion	CROP	
	Ricinus communis	fertility	leaves	infusion	CROP	
		burns and eczema	seed oil	apply to affected area		
Graminiae	*Cymbopogon citratus*	colds	leaves and roots	ingest infusion	DOM	
	Olyra latifolia	urinary tract	root	+ cane spirit	DIST	
	Setaria megaphylla	diuretic	root	infusion	DIST	
Hypericaceae	*Harungara madagascarensis*	laxative	bark	ingest infusion	FTREE	
		'gives blood'	bark	bathe in infusion		
Labiatae	*Leonotis nepetifolia*	abdominal pain and urinary problems	root	infusion	DIST	
		eczema	leaves	mix with palm oil and rub on area		
	Ocimum gratissimum	abdominal pain	leaves	infusion	DOM	
		flatulence	flowers	infusion		
Lauraceae	*Cinnamomum zeylandica*	contraceptive	bark	daily infusion	CROP	Plantation shade tree
Leguminosae	*Cassia podocarpa*	abdominal pain	leaves and roots	infusion	DIST	
	Pentaclethra macrophylla	fractures and dislocations	bark	massage	FTREE	
	Senna occidentalis	abdominal and menstrual pain	leaves and roots	infusion	DIST	Roasted seeds used like coffee
		itchiness	leaves	rub on area directly or as an infusion		

Table 1. *Continued*

Family	Name	Use	Part	Preparation and application	Source type	Notes
Meliaceae	*Toona ciliata*	fevers	leaves and bark	infusion	DIST	
		aches	leaves and bark	massage		
Moraceae	*Artocarpus incisa*	high blood pressure	leaves	infusion	CROP	Fruit: staple food
		diabetes	leaves	infusion		
	Ficus kamerunensis	eye inflammation	leaves	drip cool infusion into eye	FTREE	
Murtaceae	*Eugenia uniflora*	intestinal pains	leaves	infusion	FTREE	
	Psidium guajava	dysentery	young leaves	infusion	DOM	
			green fruit	ingest		
		bad breath and toothache	leaves	masticate		
Oxalidaceae	*Oxalis corymbosa*	sore throat	whole plant	crush and ingest with salt	DIST	
Passifloraceae	*Passiflora foetida*	jaundice	leaves	infusion	FTREE	
Piperaceae	*Piper umbellatum*	abdominal pains	roots	infusion	FHERB	Leaves - *calulu* ingredient
Runiaceae	*Cinchona* sp.	malaria	bark	infusion	CROP	
		abdominal pain	bark	infusion		
	Morinda lucida	bruises and wounds	leaves and roots	massage of infusion or add alcohol and massage	FTREE	
		fevers	leaves	crush with coconut oil and ingest		
	Psychotria peduncularis	jaundice	leaf	cold infusion	FHERB	
		fevers	leaf	infusion three times a day		

Sapindaceae	*Allophyllus africanus*	abdominal pains and	leaves, roots, and bark	infusion	FTREE	Branches used to make cooking utensils
		diarrhoea	bark, roots			
		aphrodisiac	bark	+ *P. umbellatum* + *P. peducularis*; infusion		
	Paullinia pinnata	purgative	leaves	infusion	FHERB	
		chest pains	roots	chew		
		relaxant and sleeping agent	leaves	infusion		
Solanaceae	*Solanum macrocarpon*	strengthen body	leaves	infusion	CROP/ DOM	Fruit: cooked as food
Sterculiaceae	*Sterculia acuminata*	stimulant and appetite suppressant	seeds	ingest	FTREE	Seeds sold in market
		abdominal pains	bark	infusion		
Ulmaceae	*Trema guineensis*	venereal disease	bark, leaves and roots	infusion	FTREE	
		diarrhoea	bark, root	infusion		
		pre-natal pain	bark	infusion		
Umbelliferae	*Centella asiatica*	earache	leaves	squeeze juice into ear	DIST	
	Eryngium foetidum	cough	root	infusion	DOM	
		abdominal pain	leaves	crush and infusion		

DOM = cultivated/ encouraged on domestic level; DIST = occurring in disturbed areas; CROP = cultivated as a crop; FTREE = forest tree; FHERB = forest herb.

Table 2. Vernacular names

Family	Botanical name	Vernacular name
Acanthaceae	*Acanthus montanus* (Nees.)T. Ands	cundu de muala ve
	Brillantaisia sp.	mamlêblê
Aloeaceae	*Aloe humilis* L.	babosa
Amaranthaceae	*Achyranthes aspera* L.	folha ponto
Annonaceae	*Annona muricata* L.	sapo-sapo
	Monodora myristica (Gaerth) Duval	iôbo
Apocynaceae	*Rauvolfia* sp.	cata pequena
	Voacanga africana Stapf	cata grande
Begoniaceae	*Begonia baccata* Hook. f.	folha bôba vermelha
Boraginaceae	*Heliotropium indicum* L.	folha galo
Burseraceae	*Santiria trimera* (Oliv.) Aubrev	pau óleo
Caricaceae	*Carica papaya* L.	mamoeiro
Chenopodiaceae	*Chenopodium ambrosoides* L.	matruso
Combretaceae	*Terminalia catappa* L.	caroceiro
Compositae	*Ageratum conyzoides* L.	folha malé
	Elephantopus mollis Kunth	folha budo
	Mikania chenopodifolia Willd.	mato cana
	Struchium sparganophora L.	libo d'agua
	Vernonia amygdalina Del.	libo mucambú, libo da terra
Crassulaceae	*Bryophyllum pinnatum* (Lam.) Oken	folha damina
Cucurbitaceae	*Momordica charantia* L.	stlofi
Euphorbiaceae	*Alchornea cordifolia* (Schum. and Thonn.) Muel. Arg	bengue
	Euphorbia prostrata Ait.	folha formiga
	Jatropha curcas L.	folha grão
	Ricinus comunis L.	mamonó
Gramineae	*Cymbopogon citratus* (DC.) Stapf	folha gabão
	Olyra latifolia L.	impialá
	Setaria megaphylla (Steud.) Dur and Schinz	uagá-uagá
Hypericaceae	*Harungara madagascarenis* Lam.	pau sangue
Labiatea	*Leonotis nepetifolia* (L.) R.Br.	pinicane
	Ocimum gratissimum L.	mikôkô
Lauraceae	*Cinnamomum zeylandica* Garc.	pau canela
Leguminosae	*Cassia podocarpa* Guill. and Perr.	folha zaia
	Pentaclethra macrophylla Benth.	moandim
	Senna occidentalis (L.) Link	maioba
Meliaceae	*Toona ciliata* M.J.Roem.	cedrela
Moraceae	*Artocarpus incisa* L.f.	fruta-pão
	Ficus kamerunensis Mull.	mussundá
Myrtaceae	*Eugenia uniflora* L.	pitangueira
	Psidium guajava L.	goiaba
Oxalidaceae	*Oxalis corimbosa* DC.	madringueiro
Passifloraceae	*Passiflora foetida* L.	maracujá do mato
Piperaceae	*Piper umbellatum* L.	folha bôba branca
Rubiaceae	*Cinchona* sp.	pau quina
	Morinda lucida Benth.	grigô
Rubiaceae	*Psychotria peduncularis* (Salisb.) Steyern.	alho d'obô
Sapindaceae	*Allophylus africanus* P. Beauv.	pau três
	Paullinia pinnata L.	corokô
Solanceae	*Solanum macrocarpon* L.	makêkê
Sterculaceae	*Sterculia acuminata* Palis.	coleira
Ulmaceae	*Trema guineense* (Schum.) Ficalho	pau cabra
Umbelliferae	*Centella asiatica* L.	folha viola
	Eryngium foetidum L.	celo sunzon maia

to contain anti-anaemic properties, *Struchium sparganophora*, believed to relieve bodily aches by its external application, and the leaves of *Piper umbellatum* and the endemic *Begonia baccata.*

Evaluation of therapeutic effectiveness

As stated earlier, one major reason for documenting medicinal plants is that the use of the plant may be an indication of effective phytochemical activity which may be invaluable for creating more efficient traditional systems and/or as a contribution to modern medicine. Relatively few plants have been screened for their chemical properties as it is a time-consuming and expensive task. For the purpose of this paper, a literature search of existing investigations into the chemical constituents of the documented plants was conducted. This section briefly reviews some of these existing studies, in order to evaluate the rationality of their use.

It was found that the use of many plants in São Tomé conformed with the chemical justification whilst others did not. The latter were often plants whose characteristics and morphology suggested that they might influence the purpose for which they are used. The distinctive blood-like orange sap from *Harungara madagascarensis* is thought to 'give blood' when the tree's bark is massaged into the patient. The ear-shape of the leaves of *Centella asiatica* might lead to its application against ear aches. In a review of the uses and active properties of this latter plant in Asia (Emboden, 1986), there was no reference to any therapeutic effects on earaches. Instead, it was found to be effective against leprosy by dissolving *Mycobacterium leprae* capsules and aiding in the rehabilitation of mental retardation in children.

In this study many plants, particularly those most commonly used, conformed with their application. A study on the chemical constituents of *Solanum macrocarpon* revealed that this plant contains high levels of crude protein; the leaf containing 2.4% and the fruit 1.4% (Gbile and Adesina, 1988). In São Tomé, the population recognizes its high nutritional value, and both fruit and leaf are eaten to 'strengthen the body'.

The young leaves of *Psidium guajava* are used consistently as a remedy against diarrhoea and dysentery, not only in São Tomé but throughout the tropics. The young leaves of this plant have a strong inhibitory effect on bacteria of the *Salmonella*, *Serratia* and *Staphylococcus* genera, which may be present in cases of diarrhoea with bacterial causes (Aguiar *et al.*, 1984).

The efficacy of *Alchornea cordifolia* when used against diarrhoea in Santomean traditional medicine may be due to action against intestinal bacteria. The anti-bacterial property was assumed to stem from the tannic acid present in the plant (Schneider and Kubelka, 1989). A strong correlation between polyphenol content and anti-bacterial activity was found when used against two species of bacteria.

In São Tomé, not only is the fruit of *Carica papaya* an important food, but it is used as a purgative. Fresh meat is wrapped in the leaves to tenderize and preserve it. Both these actions are due to the proteolytic enzyme papain (Iwu, 1993).

Sources of medicinal plants in São Tomé

By examining the source of the resource used, an idea could be gained of the existing conflicts between their utilization and conservation needs. During the interviews, the informants were asked where the plant was found and, wherever possible, were requested to show the individual plants from which they obtained their material. Using this in-

formation together with observations on their habitat, the plants were grouped into five broad categories of source type: those which are grown or encouraged in a domestic environment, those cultivated as a crop, those occurring in areas subjected to human disturbance such as derelict land and roadslides, and those growing in secondary forest of varying stages of development. This last category was further subdivided according to whether the plant was a tree or herb (see Table 1).

It was found that approximately two-thirds of the documented plants came from a non-forest source, that is, they were either cultivated or found in areas relatively close to human settlement. Thus the majority of plants used for medicinal purposes were not coming from forest regions which fall inside the current conservation proposals for São Tomé.

The largest proportion of the documented plants (27%) were cultivated for domestic use in pots or gardens around the home. These were used as the most immediate form of primary health care. Possibly as a result of their widespread application, it was found that fairly consistent descriptions of their use were given. Examples of plants used domestically are *Chenopodium ambrosoides* (vermifuge), *Bryophyllum pinnatum* (swelling and bruising), *Psidium guajava* (diarrhoea) and *Ocimum gratissimum* (abdominal pain).

Of the plants which have been introduced into the country for cultivation as a crop, some have evolved secondary medicinal uses such as *Carica papaya*, *Annona muricata* and *Psidium guajava*. *Terminalia catappa*, a tree common throughout the tropics, was introduced into São Tomé as an ornamental, particularly along coastal areas of the island since it grows well on sandy and saline substrates. The large seeds are eaten by children and an infusion of the bark is used against diarrhoea. *Cinchona* sp. was once cultivated on higher slopes in the Monte Café area as a source of quinine but, with the present predominance of synthetic anti-malarial drugs these plantations have been abandoned. However, local people still use an infusion of the bark as a primary measure against malaria and also for abdominal pains.

Also of importance are spontaneous herbs and shrubs commonly growing near or in settlements and disturbed areas (21% of documented plants), as they are accessible to the human population without requiring cultivation or care. These included weeds such as *Euphorbia prostrata* (jaundice) and *Leonotis nepetifolia* (abdominal pain and urinary disorders), and wayside shrubs such as *Vernonia amygdalina* (fevers) and *Alchornea cordifolia* (diarrhoea).

The remaining third of the documented plants occurred in forests. Since no plants were noted to be exploited directly from primary forest areas, 'forests' are defined as being secondary in the context of the source types of this study. These forests were situated relatively close to settlements. Forest trees with medicinal properties are best known by *massagistas*, or a very few of the older people. They use specific trees in the forest, usually the same individual each time, from which to collect their materials. Examples of such trees are *Rauvolfia* sp. (abdominal pain), *Voacanga africana* (menstrual pain, wounds, laxative) and *Allophyllus africanus* (abdominal pain, diarrhoea, aphrodisiac). A number of these forest trees were left standing when the land was cleared to make way for plantations, acting as shade trees for crops such as cocoa.

With such high levels of endemism found on the island (19.4%), it would be expected that a proportion of plants used by local people were specific to São Tomé. However, it was found that only one of the documented plants is endemic and the majority enjoy a wide global distribution or have been introduced from other areas of the world (see

Table 3). This finding supports the idea that, due to the historical processes of human settlement, little scope had been allowed for a relationship to develop between the Santomean people and the native flora. The predominant use of common and exotic species suggests that the native genetic resources are not being threatened by excessive harvesting for medicinal purposes.

Conclusions

Integrating traditional and modern systems

From the few examples illustrated above, it is likely that many plants already in use in São Tomé have genuine medical efficacy. It might be possible to greatly improve the efficiency of the present modern system by integrating some of these into the existing medical system on the island, particularly for immediate primary health care purposes. Since the four hospitals on the island are the central health care base for the Santomean population, nurseries of medicinal plants could be set up within them to ensure a ready and constant supply of material. The costs incurred by the establishment and maintenance of such a scheme would give rapid returns: the need for expensive medication would be considerably reduced, and be replaced by a long-term local solution. This type of project is not new; similar schemes are running successfully in Fortaleza in northeast Brazil (Matos, 1989).

Medicinal plants might also be used to better the lives of the Santomean population by including their improved use in any future health care programmes aimed at public education operating on the island. The advantage of the country's short history and diverse cultural roots is that it has inhibited the development of a strong central tradition. This might facilitate the acceptance of new practices.

Conserving São Tomé forests

In São Tomé, the main source of medicinal plants are those cultivated domestically or as crops, and those found in recent regrowth vegetation types, normally at a short distance from the settlements. The primary forest areas and secondary forest at an advanced stage of recovery surrounding the primary forest in the central region are generally little exploited for their products, except for occasional small-scale hunting for wild pigs and monkeys. Presumably, the lack of a long standing presence and small size of the present Santomean population coupled with the inaccessibility of the native forest is responsible for its low use. Although there is scope for further investigations into other types of resource use, studies so far indicate that the conservation of the remaining forest on the island does not come into conflict with natural resource use in any significant manner. The recommendation made by the Bureau pour le Développment de la Production Agricole (BDPA, 1985), and reiterated by other specialists (Jones and Tye, 1988; Interforest, 1990; Jones *et al.*, 1991; Atkinson *et al.*, in preperation) to establish a core *Zona Ecologica* with a surrounding secondary forest buffer zone would appear to be appropriate.

Considering that it is the surrounding regrowth vegetation, rather than the core primary forests, which will be the first to be engulfed by potential agricultural expansion or an increase in demand for wood, the official demarcation of this buffer zone would be greatly beneficial to people who rely on plants within the area for medicinal

Table 3. World-wide plant distribution

Botanical name	Distribution
Begonia baccata Hook. f.	1
Rauvolfia sp.	2
Santiria trimera (Oliv.) Aubrev.	2
Bryophyllum pinnatum (Lam.) Oken.	2
Cassia podocarpa Guill. and Perr.	2
Pentaclethra macrophylla Benth.	2
Ficus kamerunsis Mull.	2
Sterculia acuminata Palis.	2
Brilliantaisia sp.	3
Monodora myristica (Gaerth) Duval	3
Voacanga africana Stapf	3
Morinda lucida Benth.	3
Psychotria peduncularis (Salisb.) Steyern	3
Acanthus montanus (Nees)T. Ands.	4
Vernonia amygdalina Del.	4
Alchornea cordifolia (Schum. and Thonn) Muel Arg.	4
Ricinus comunis L.	4*
Setaria megaphylla (Steud) Dur and Schinz	4
Harungara madagascarensis Lam.	4
Ocimum gratissimum L.	4*
Toona ciliata M.J. Roem.	4*
Allophyllus africanus P. Beauv.	4
Solanum macrocarpon L.	4
Heliotropium indicum L.	4, 5
Artocarpus incisa L.f.	4, 5*
Paullinia pinnata L.	4, 5
Trema guineensis (Schum.) Ficalho	4, 5
Olyra latifolia L.	4, 6
Mikania chenopodifolia Willd.	4, 6
Terminalia catappa L.	5*
Cymbopogon citratus (DC.) Stapf	5*
Cinnamomum zeylandica Garc.	5*
Annona muricata L.	6*
Carica papaya L.	6*
Euphorbia prostrata Ait.	6
Eugenia uniflora L.	6*
Psidium guajava L.	6*
Oxalis corymbosa DC.	6
Passiflora foetida L.	6
Cinchona sp.	6*
Eryngium foetidum	6
Achyranthes aspera L.	7
Chenopodium ambrosoides L.	7*
Ageratum conyzoides L.	7
Elephantopus mollis Kunth	7
Struchium sparganophora L.	7
Momordica charantia L.	7
Jatropha curcas L.	7*
Leonotis nepetifolia (L) R. Br.	7
Senna occidentalis (L.) Link	7
Aloe humilis L.	7*
Piper umbellatum L.	7
Centella asiatica L.	7

Endemic to 1: São Tomé; 2: West Africa; 3: East and West Africa; 4: Tropical Africa; 5: Tropical Asia; 6: Tropical America; 7: Pantropical or cosmopolitan; * Introduced. (Adapted from Exell 1944, 1973a)

purposes. The buffer zone would act as an 'extractive reserve' allowing people to harvest the forest products required without damaging the forests' integrity.

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