

CONSERVATION OF CROP WILD RELATIVES: A SRI LANKAN EXPERIENCE IN COMMUNITY PARTICIPATION

M Wijeratne* and KHKL Piyasiri

Department of Agricultural Economics & Extension, Faculty of Agriculture, University of Ruhuna, Sri Lanka

Accepted: 10th June 2016

ABSTRACT

Sri Lanka is considered as a hotspot of biodiversity as most its forests are rich in different Crop Wild Relatives (CWR). CWR include wild relatives of crop ancestors and other species. In fact, they are a critical source of genes for resistance to diseases, pests and stresses such as droughts, floods and temperatures. However, most of the CWR are increasingly at a risk. This investigation focused on one important wild plant species- *Kapuru Kurundu* (*Cinnomomum capparucoronde* Blume). And the main objective is to establish conservation policies while integrating community's participation. The investigation has been carried out in the surrounding villages of *Kanneliya* forest reserve located in the Southern Province Sri Lanka. A series of case studies were conducted with the farmers of surrounding villages. The PRA (Participatory Rural Appraisal) tools were employed and informal discussions were also conducted. Observation visits were made to demarcate the existing plants. Results reveal that community is used to extract the plant, especially as an indigenous medicine directly for toothache, ointments, bronchitis, rheumatism, snake bites, breakages and fractures. In fact, bark oil contained eugenol and root oil was rich in camphor. Further, results disclose that certain illegal groups extract the plant and trade for commercial purposes. This warranted an urgent programme for conservation. Hence, *in-situ* and *ex-situ* conservations were started in *Kanneliya* forest reserve. Moreover, community conservation groups were strengthened in the surrounding villages to mitigate illegal removal, and conserve *Kapuru Kurundu* plant.

Key words: CWR, conservation, participation, PRA tools

INTRODUCTION

Ecological resource management is well emphasized in development programmes. Further, issues pertaining to this theme have attracted the scientist and conservationists throughout the world. Sri Lanka is considered as a hotspot of biodiversity as most of its forests are rich in different Crop Wild Relatives (CWR). CWR include wild relatives of crop ancestors and other species (Biodiversity International, 2006). In fact, they are a critical source of genes for resistance to diseases, pests and stresses such as droughts, floods, and temperatures. However, most of the CWR are increasingly at a risk. They are threatened to habitat loss through the destruction and degradation of natural environments, deforestation, urbanization or converting their habitats to other development activities. As the, CWR provide a sig-

nificant socio-economic value to the communities, they are tended to rapid exploitation, especially by the people living in adjoining areas of forest reserves.

Cinnamon (*Cinnamomum verum*) is one of the important export crops in Sri Lanka. It has earned USD 132 million in 2013 (Central Bank, 2013). In 2013, this crop has accounted approximately for 60 percent of foreign exchange earnings of export crops excluding major crops, tea, rubber and coconut. The CWR of *Cinnamomum verum* are existing in Sri Lanka. The CWR,- *Cinnamomum camphora* is an introduced plant while other seven species are endemic to the country. It was reported that the endemic *Cinnamomum* species are encountered to a serious threat. The cultivated species, *Cinnamomum verum* is well regarded as a spice and also use for medicinal

*Corresponding author: mahindaw@agecon.ruh.ac.lk

purposes. The wild relatives are also show such values to a varying degree. This is the main reason for human exploitation. Table 1 demonstrates the Red Listing Status of the Wild Cinnamon species.

It was reported that *Cinnamomum capparum coronde* is confined to a very limited locations such as KDN (Kanneliya - Dediya-gala - Naki-yadeniya) complex, Sinharaja Forest Reserve, Gilimale - Erathne, Gongala, Ensalwatte, Walankanda, Kalugala and Haycoaks (Kumarathilake *et al*, 2010) and further has encountered to a serious extraction by the communities as it demonstrates significant socio-economic value. However, community awareness of its social-economics value is very limited (Wijeratne *et al*, 2010) Hence, this study aimed at identification of indigenous knowledge pertaining to socio-economic value of this ecological resource, and further, establishes conservation polices. In fact, ultimate goal of the investigation is to launch awareness programmes for the surrounding villages of particular forest reserve integrating local knowledge to conserve this ecological resource.

MATERIALS AND METHOD

The study location

For the investigation, a specific location was selected where *Cinnamomum capparum coronde* is existing. The *Kanneliya - Dediya-gala - Naki-yadeniya (KDN)* forest complex is located in the southern part of Sri Lanka, about 35 km north-west of *Galle*. The total area of the forest in the *KDN complex* is 10,139 ha. The *Kanneliya* forest reserve is the largest of three conjoined forests, which is about 5,306 ha in extent. The entire area of the *Kanneliya* forest reserve has been identified as the Conservation Reserve and Man Biosphere reserve. The extent of the forest in *KDN complex* is shown in table 2.

The floristic region of the *KDN complex* is considered as an area of exceptional endemism, as 17 percent of the wet zone low land endemic flora is confined to this range of forest. The region has been identified as one of the most floristically rich areas in the South Asia. Despite the heavy logging, *Kanneliya* has retained its high bio-diversity value and in terms of bio diversity per unit area, it rivals the *Sinharaja* - the world heritage forest. Bio diversity assessment in *KDN* recorded 319 woody species of which 52 percent are endemic, 22 percent are classified as endangered, 27 percent valuable and 45 percent are in the rare category. Some 220 faunal species with 19

Table 1: Red Listing Status of the Wild Cinnamon species

Species	Global Red Listing Category	National Red Listing Category
<i>Cinnamomum dubium</i>	Least Concern - LC	Not Threatened -NT
<i>C.ovalifolium</i>	Vulnerable - VU	Indeterminate - I
<i>C.capparum coronde</i>	Endangered - EN	Highly Threatened - HT
<i>C.litseaefolium</i>	Critically Endangered - CR	Threatened - T
<i>C.sinharajanse</i>	Critically Endangered - CR	Threatened - T
<i>C.rivulorum</i>	Critically Endangered - CR	Threatened -T
<i>C.citrodorum</i>	Critically Endangered - CR	Highly Threatened - HT

Source: Kumarathilake *et al*, 2010

percent endemic have been recorded from the *KDN* and adjacent forests.

There are 78 villages surrounding the *KDN* forests. More than 50 percent of the households in most of the villages receive *samurdhi* income support as they are below the government recognized poverty line. The rural economy of the villages around the *KDN complex* is based primarily on tea and paddy smallholdings. The economies of villagers living around the forest are at least primarily dependent on the forest for both timber and non-timber forest products. Medicinal plants, fuel wood, poles and posts are the most frequently used forest products by the villagers. Table 3 illustrates the surrounding villages (DS divisions) of *KDN* forest complex.

Primary Data Collection

The field investigation executed during May to December 2009 period. A series of informal discussions has been conducted with farmers who are dealing with *Kapuru Kurundu*. A considerable amount of information was collected with respect to existence of the crop. Further, a series of workshops were executed with identified community members who are benefiting from *Kapuru Kurundu*. Next, a series of participatory Rural Appraisal (PRA) techniques were conducted including social and resource map, transect walk, preference ranking and focus group discussions with the surrounding villages of *Kanneliya* forest reserve.

Table 2: The extent of the forest in *KDN complex*

Forest	Dense (ha.)	Forest Sparse forest (ha.)	Forest Plantation (ha.)	Total (ha.)
<i>Kanneliya</i> FR	5,108	168	29	5,306
<i>Dediyagala</i> FR	3,306	198	-	3,504
<i>Nakiyadeniya</i> FR	1,300	29	-	1,329
<i>KDN complex</i>	9,714	395	29	10,139

Source: *KDN* forest complex - conservation management plan, 1995

Table 3 :The GS divisions surrounding the *KDN complex*:

GS Division No	GS Division	Population (No)	Area (ha)
224 A	<i>Koralegama</i>	710	239
225	<i>Panangala East</i>	635	316
225 B	<i>Gallalanda</i>	534	238
225 C	<i>Panangal North</i>	422	180
226	<i>Hiniduma North</i>	2254	387
226 A	<i>Hiniduma South</i>	1018	98
226 C	<i>Malhathawa</i>	730	437
227	<i>Tawalama North</i>	1209	384
227 A	<i>Batahena</i>	449	167
227 B	<i>Tawalama South</i>	1027	355
228	<i>Malgalla</i>	1447	647
228 A	<i>Thalangalla</i>	355	165
228	<i>Thalangalla West</i>	367	130
229 B	<i>Weerapana West</i>	768	209
229 C	<i>Opata West</i>	877	222
229 E	<i>Opata South</i>	1225	198
229 G	<i>Weerapana South</i>	1257	207

Source: Southern Provincial Council, 2001

RESULTS AND DISCUSSION

Morphology of the plant

Cinnamomum capparum coronde Blume is a tree evergreen plant. Bark gray (or brown) furrowed and leaves often aromatic. Leaves alternate, infrequently opposite. Leaf blade with (1-3) primary veins (or infrequently pin-

nately veined), papery to leathery. Inflorescences appearing when mature leaves are present, axillary, panicles. Flowers are bisexual. *Cinnamomum capparum coronde* appear phonetically more closer to the accessions followed by the cluster including *Cinnamomum citriodorum*, *Cinnamomum ovalifolium* and *Cinnamomum litceaefolium*. In most instances, the wild species of cinamomum are mixed with cultivated cinamomum and marketed.

Extraction of the plant

It was revealed that a range of CWR of cinnamon is existing in Sri Lanka as indigenous species. This study observed that the extraction of *Cinnamomum capparum coronde* prevailing in surrounding villages of *Kanneliya* forest reserve. The community members informed that certain illegal groups are geared for this activity. The study identified the main villages where such activities are prominent. They are *Welankanda*, *Dediawela*, *Ensalwatta*, and *Weerapana*.

The PRA activities highlighted the significance of identification of *Wal Kurundu* (CWR) types, granting special reference to *Cinnamomum capparum coronde*. In fact, the members were unable to recognize these types from mature plants. However, when bark is removed, *Kapurum Kurundu* gives a strong aroma and they could feel the specific smell.

Present conservation methods

Participating in conservation methods, the members reported that in each village there are conservation committees to protect the forest reserves. In fact, there are about 15 such committees. These committees can be activated to *in-situ* conservation of *Cinnamomum capparum coronde*. The officials of the *Kanneliya* forest reserve have started an *ex-situ* conservation by propagating the plant by seeds collected from the forest.

Potential uses and economic value

Eugenol is the major constituent in stem bark oil as well as the principal constituent in oil extracted from the leaves of *Cinnamomum capparum coronde*. Camphor is the major component in its root-bark oil. The bark, smelling of nutmeg or cloves is sold in Colombo as a medicine. *Cinnamomum capparum coronde* is directly using for local medicine, for toothache, ointments, bronchitis, rheumatism, snake bites, breakages and fractures. In addition Eugenol and other chemicals use for western medicine, industrial purposes, pesticides *etc.* If *Cinnamomum capparum coronde* is able to cultivate commercially, extraction of high amount of Eugenol and export to the world market is possible.

The market study indicated that *Akuressa* area is popular for cinnamon market. The share of '*Wal Kurundu*' types claims only 1-2 percent of the trade. The traders could identify '*Wal Kurundu*' but in the recent past, they have not handled such types.

National Information Systems of CWR

Cinnamomum capparum coronde is already added to National Information Systems of CWR. Effective and efficient information management is the root cause of any conservation programme. Such effort increase awareness about the plant including identification of the crop by morphological characteristics, natural distribution, population *etc.* Inclusion of such data to CWR information system provides the structure which can be accessed or mapped onto a data model, and further novel data can be added according to importance of the crop. Such information can be used by scientists and breeders to design and implement programmes to improve *Cinnamomum capparum coronde*. Further, modification to existing conservation plan can also be undertaken. This information system must be easily reachable to public. Effectiveness of access and use of the information systems

are necessary to support conservation of this ecological resource, *Cinnamomum capparum coronde*.

Enhanced capacity and *in-situ* conservation

In-situ conservation means 'on-site conservation' of ecological resources. It is the process of protecting an endangered plant or animal species in its natural habitat, either by protecting or by defending the species from predators. The conservation of eco-systems and natural habitats are important in any environmental conservation plan. Further, the plan should assure maintenance and recovery of viable populations of species in their natural surroundings.

Conservation of crop wild relatives is mainly based on *in-situ* conservation. This involves the protection of natural eco-system. Before establishment on *in-situ* conservation of *Cinnamomum capparum coronde*, it is important to identify the natural habitat of the crop, and estimate the populations. Those locations can be named as conservation areas of *Cinnamomum capparum coronde*. Planting materials can be distributed to cultivate in these areas to increase population of the plant. A person or a group of community members with knowledge on every aspects of *Cinnamomum capparum coronde* should be appointed in each conservation site to monitor the conservation strategy.

The importance of participatory management planning in, *in-situ* conservation

As stated in the national forest policy, the forest department has recognized the need for the involvement of the local people in forest management, planning and implementation of conservation programmes. This policy has already been put into practice in the management of KDN, *Sinharaja* and *Knuckles* forests. The management plan for KDN was formulated in 1995. Conservation of bio

-diversity including rare and threaten species, conservation of soil and water resources, enhancement of quality of life for local people and sustainable flow of goods and services from the forest in order to provide economic opportunities for local people are the main objectives of the management plan.

The following are the basic principles which serve as the basis of the management plan.

Effective recognition of interdependence of communities and forests.

Local people to be involved effectively in planning and management.

Local people should be benefitted from the forest products.

Negative impacts of uses to be minimized.

Traditional uses and knowledge have to be accommodated in conservation programmes

Support local community organizations in forest management.

Zoning the forest

The zoning system adopted in the KDN forest complex is resource based, whereby forest resources are classified according to their need for protection, requirements for management interventions, and ability to accommodate community use. Different zones are managed for different objectives. The Protection Zone (PZ), Traditional Use Zone (TUZ) Cultural Zone (CZ) and Buffer Zone (BZ) are the zones classified.

The management objectives of different zones are as follows:

Protection Zone - Conservation, research, education and recreation

Traditional Use Zone - research, tradi-

tional use, rehabilitation

Cultural Zone - Preservation of religious and cultural values

Buffer Zone - Physical, biological and social buffer area (outside the forest boundary)

The management strategies

The key management strategies should be oriented to following aspects.

Restore or rehabilitate the natural forest.

Preserve the remaining areas of primary forest.

Involve local people and recognize traditional knowledge effectively in all aspects of management.

Use local forest goods and services principally for local benefits.

Promote non-extractive economic activities based on forest resources.

Promote traditional use of forest products focusing on conservation.

Carry out research in order to improve forest management capability.

Use the forest as an educational resource.

Ex-situ conservation

Ex-situ conservation is the conservation and maintenance of samples of living organisms outside their natural habitat, in the form of entire plants, seeds, pollens, vegetative propagules and tissues or cell cultures. This approach supports or reinstating wild populations and habitats through population management, applied research, education and display. *Ex-situ* collections of living organisms (living collections, seeds, pollen, vege-

tative propagules, and tissue or cell cultures) need to be managed according to strict scientific and horticultural standards to maximize their value for conservation purposes.

Implementation of public awareness about *Cinnamomum capparum coronde*

Awareness is need for conservation of plant genetic resources (PGR) especially concerning on crop wild relatives. Awareness of crop must stress the importance of the crop and its conservation, economic values, social implications, bio-diversity, contribution to crop improvement *etc.* Implementation of awareness programmes can be launched to improve community awareness of *Cinnamomum capparum coronde*. It will help to increase knowledge about this endangered plant. Such will limit over extraction, and further develop conserve attitude the plant.

Distribution of planting materials among the people

Distribution of planting materials among the people is a successful method to increase the population of *Cinnamomum capparum coronde*. At present, the *kanneliya* forest management is propagating this plant by seeds collected from the forest, and distribute seedlings among the community.

CONCLUSION

The Cinnamomum capparum coronde is a highly threatened species confined to few locations of the low country wet zone rain forests in the country, including *Kanneliya* forest reserve. Plant shows significant social-economic value, especially because of Eugenol and camphor. As a result, communities tend to exploit the entire plant and use as a local medicine. Realizing the decrease of population the conservation methods were established as *in-situ* and *ex-situ* methods. Moreover, awareness programmes were

launched in surrounding villages of *Kanneliya* forest, and conservation techniques were also applied with community participation.

REFERENCE

- Central Bank of Sri Lanka (CBSL) 2013 Ceylon Bank of Sri Lanka Annual Report, Central Bank of Ceylon, Colombo, Sri Lanka.
- Bio diversity International 2006 Crop Wild Relatives. A UNEP/GEF publication, Rome Italy, pp. 25.
- Kumarathilake DMHC, Senanayake SGJN, Wijesekara GAW, Wijesundara DSA and Ranawaka RAAK 2010, Extinction Risk Assessment at the Species Level: National Red List Status of Endemic Wild Cinnamon Species in Sri Lanka. *Tropical Agricultural Research*. 21: 247-257.
- Southern Provincial Council 2001 Official records, Southern Provincial Council, Galle, Sri Lanka.
- Wijeratne M, Mahaliyanaarachchi R, and Gunaratne LHP 2010 Conservation and Utilization of Crop Wild Relatives of Sri Lanka. Department of Agriculture. Book of Abstracts 2010: 26-27.