January 2020

POLICY BRIEF - 30

Valuation of Biodiversity – An Ecological Economic Perspective

MG Chandrakanth[1] and GK Hiremath[2]

Introduction

According The UN Convention on Biological Diversity (CBD) "Biodiversity—short for biological diversity—means the diversity of life in all its forms – the diversity of species, of genetic variations within one species, and of ecosystems. The importance of biological diversity to human society is hard to overstate. An estimated 40 per cent of the global economy is based on biological products and processes. Poor people, especially those living in areas of low agricultural productivity, depend especially heavily on the genetic diversity of the environment."

Considering the huge value of agricultural biodiversity into the global economy, in itself is the *prima facie* case for access and benefit sharing (ABS), since farm women and farmers have been richly contributing towards maintaining agribiodiversity in different agroclimatic / agroecological zones. The purpose of this policy brief is to highlight the issues involved in valuation of agricultural biodiversity for policy implications.

Agricultural biodiversity

According to Eyzaguirre and Dennis[3], "Agricultural biodiversity (including genetic diversity) is valuable to farmers for both commercial and non-commercial use. It sustains agricultural systems, ensures productivity, minimizes risks, attenuates shocks, provides insurance against volatile and imperfect markets, increases resistance and resiliency of ecosystems, and provides social and cultural values. The diversity of plant genetic resources generates public benefits by conserving genetic traits and supporting healthier ecosystems. The ability of the poor to access and use genetic resources has implications for farmers' productivity, livelihoods and farm ecosystem health, in both the short- and long-term timeframes."

Neglected and Underutilized Species (NUS)

NUS[4] are "those species with under-exploited potential for contributing to food security, health (nutritional / medicinal), income generation, and environmental services." (Jaenicke and Hoeschle-Zeledon 2006). Agricultural Biodiversity in general has recognizable use values with wide market and hence market takes care of reflecting the use values. Hence for field crops, fruits, fodder, fuel, fiber, flowers, which are in the market, as long as the market is wide, recognizable by consumers, the use values reflect most of the TEV (total economic value). In Agricultural biodiversity, the NUS have special importance, due to niche market and sometimes face 'missing market' or 'no market' at all. According to Padulosi[5] the features of NUS are: abundant locally, but are globally rare; scant information and knowledge about NUS, their extent of use is limited compared to their potential; are important in local consumption and production, are highly adapted to agro-ecological niches, marginal areas; ignored by policy-makers and excluded from R&D agenda; usually are wild species, ecotypes and land races; their cultivation and use is based on indigenous knowledge; they are not taken care in ex situ gene banks; are characterized by fragile seed supply. Emerging opportunities over the last few years for 'minor' crops (particularly those underutilized or neglected) signal a new attention of the public opinion on biodiversity and its sustainable use along with an increasing interest of the public and private sector towards 'new' crops, 'new' uses and new markets."

Issue 1: Efforts of the farmers in propagating agri-biodiversity – how to value these efforts

In the case of agri-biodiversity, unless farmers put effort to propagate, the diversity cannot sustain. Hence farmers' efforts in propagation cannot be underestimated. Farmers' efforts to propagate is a function of the price they receive

1 Prof. M.G. Chandrakanth, Director, Institute for Social and Economic Change, Bengaluru
2 GK Hiremath, Professor and Head of Agricultural Economics, UAS Dharwar (Retd)

3 Eyzaguirre, P. & Dennis, E. 2003. The impacts of collective action and property rights on plant genetic resources. www.capri.cgiar.org/pdf/GReyzaguirre.pdf

4 Jaenicke, H. & Hoeschle-Zeledon, I. (editors). 2006. Strategic framework for underutilized plant species research and development, with special reference to Asia and the Pacific, and to Sub-Saharan Africa. International Centre for Underutilised Crops (ICUC), Colombo, Sri Lanka, and Global Facilitation Unit for Underutilized Species (GFU), Rome, Italy. http://www.underutilized-species.org/Documents/PUBLICATIONS/gfu_icuc_strategic_framework.pdf

5 Padulosi, S., Hoeschle-Zeledon, I. & Bordoni. P. 2007. Minor crops and underutilized species: Lessons and prospects. In: N. Maxted, E. Dulloo, B.V. Ford-Lloyd, J. Iriondo, S.P. Kell and J. Turok (editors). Crop wild relative conservationand use. CAB International, Wallingford, UK.

Editor: S. Manasi

Pic 1: Arecanut plant yielding the arecanuts at knee height for facilitative harvest in Tumkur KVK

Pic 2: Biodiversity indicating cultivation of pepper in coffee estates of Kodagu under shade tree cultivation

if the crop / produce is marketed, if not, is a function of 'use value'. In such cases, the cost of substitute if any, can be approximately taken as a value of the agri biodiversity. However, substitute may not be a perfect substitute, and accordingly this approach also suffers from limitations.

Issue 2: Valuing seeds

The seed production especially of vegetables, flowers, fruits, is an expensive venture. In addition, the information on value added in the process of seed / plant multiplication is not transparent. For instance, the Ranibennur-Haveri area even to this day, in commercial seed production, has assured market. Due to non-transparency, the parentage of seed material is not available or not disclosed, which further complicates the issue. According to the Biological Diversity Act, 2002, Chapter I, section 2 (f), 'commercial utilization' refers to end uses of biological resources for commercial utilization such as drugs, industrial enzymes, food flavors, fragrance, cosmetics, emulsifiers, oleoresins, colors, extracts and genes used for improving crops and livestock through genetic intervention, but does not include conventional breeding or traditional practices in use in any agriculture, horticulture, poultry, dairy farming, animal husbandry or bee keeping. Here, the difficulty is again in transparency of the seed industry in bringing out the information on what activity is conventional breeding and what activity is not. Until this information is available, it is difficult to find out the value of non-conventional breeding in seed industry. Given that ABS is a disincentive for the seed industry, to declare the extent of non-conventional breeding, it is challenging to estimate the value added in seed industry. The seed sector from public research is usually products of non-commercial research and that of private research are products developed with commercial intent.

Issue 3: Bioresource dependency: on germplasm for specific traits

The use value may be captured from market price plus a weightage on endemism, landraces (unique genes that were stewarded over centuries) and available through ex-situ collections (viz., NBPGR and other CGIAR centers). The International Treaty on Plant Genetic Resources has two ways of capturing value from users of germplasm from CGIAR centers – (1) a higher percentage of gross returns to be paid to a benefit sharing fund for commercial varieties, (and free access for non-commercial research) or (2) a lower percent of gross returns for any access that normalizes for non-commercial or commercial intent. This is now increasingly being practiced by several ex-situ collections to align with ABS policies and obligations.

Issue 4: Market price does not reflect the true economic value of agribiodiversity for NUS since information is the key for value addition

Information is the key issue in agriculture biodiversity leading the market, since the producer – farmer, middlemen, and the consumer need to be aware of the 'use values' of biodiversity to appreciate the full value as reflected through market price. In the absence of 'proper', 'right' information with producer(s) and consumer(s), the interface (middlemen) make heavens denying the producer (farmer) his/her due share and the consumer, his/her due price in the market. In the case of NUS, the market price, if it exists, does not reflect the total economic value, due to market failure, since the market does not appreciate the full value of the NUS. For example, *Sida cordifolia*. *Sida spp* is a common weed of Kerala. The roots of this weed possess properties to strengthen nerves. The market price of *Sida* roots does not reflect the immense health property of the roots. The *Sida* roots are boiled with milk and sesamum oil to obtain the Ksheera Bala Oil commonly used in 'pancha karma' treatment to revitalize the nerves and to some extent address paralysis[6]. Market price is not a true reflector of the total economic value of *Sida*. In such cases, part of the cost of alternative treatment can be taken to reflect the market value. For example, if the alternative medicine (say Allopathy) would have charged say Rs. 30,000 including hospitalization (if any) for an ailment, and the treatment using Sida sp would cost only Rs. 3000, then the value of Sida sp could go up 10 times.

Issue 5: Even Use values are not completely known / documented

While 'use values' as reflected in the market price are the easiest to capture, if the market is unaware of the 'use' value, then either the use value does not exist or is a low reflection of use. Existence value, a 'non use value can be considered after use value. Another value, the option value is the willingness to pay for conserving a resource irrespective of its use, similar to paying insurance premia as willingness to pay for something in future. This is especially true for NUS. Different types of

[6] The senior author suffered from vocal cord paralysis in 1995, which was cured by Nasya from Ksheerabala oil effectively, while all other systems of medicine had no solution, except to rest voice for 5 years, the nasya treatment effectively cured vocal cord paralysis in six months.

NUS are used in different communities and regions due to cultural, social, non-food uses and values of NUS (http://www.underutilizedspecies.org/Documents/PUBLICATIONS/promoting_vc.pdf). A comparison of market price of a unit of *Phyllanthus emblica* (Amla) with a unit of oranges, it is clear that Amla has ten times more vitamin C than oranges, but receives price much lower than oranges. Thus, the market does not capture even the 'use values' properly[7].

Issue 6: Valuation at market prices, economic prices and natural resource values

The crop protection products including pesticides, fertilizers, pest resistance varieties etc. are chiefly research with commercial intent, including technologies such as Bt cotton. The valuation at market prices includes subsidies offered on fertilizers and plant protection chemicals. The valuation at economic prices excludes the subsidies offered. The valuation considering GHG emissions will add the cost of GHG emissions from crop varieties (especially irrigated crops). The valuation considering the nitrogen fixation in leguminous crops will need to consider the value of nitrogen fixed. The values considering economic prices can be even lower by more than 50 percent of the values at market prices due to the subsidies offered in different crops. If valuations considering GHGs are considered, they can be further lower. If the cost of irrigation water (mainly groundwater) is considered, the values / cost of cultivation can substantially be higher, since the cost of cultivation estimates be conducted by the Directorate of Economics and Statistics / Commission for Agricultural Costs and Prices of GOI or the Farm management study units of the State Governments do not properly account for the cost of groundwater irrigation.

Issue 7: Horticulture products - ornamentals

Considering Horticultural products - ornamentals - a large part of market is controlled by private sector companies. Obviously transparency suffers. For example value addition in Byadagi chilies due to extraction of oleoresins. The farmers deserve the portion of the profits from oleoresins as per the Biodiversity Act. Here pricing of oleoresins would also depend upon the international prices as a substantial portion may be exported. One source of information about costing is from the returns filed by manufacturers to the (Annual survey of Industries) returns from which all the information regarding use of raw material, final product, prices can be obtained. However, the credibility of information supplied need to be validated with other sources of information.

Issue 8: Bioresource dependency

Bioresource dependency on germplasm especially from wild and exotic species which have high demand in international markets is a challenging issue in valuation. There may be several examples of bioresource dependency with potentials such as Garcinia, *Syzigium cuminii*, Isabgol and so on. Considering *Garcinia cambogia* which has HCA http://www.garciniacambogiaindia.in/ (hydroxy citric acid) with reducing obesity properties[8], pricing in the domestic and international market becomes crucial, since the market will not recognize the immense benefits and reflect them in domestic price. Sometimes, the value will be reflected in international price, since for domestic consumers obesity may not be an issue, while it may be the major issue in international markets, as in the case of Garcinia.

In mango season, eating jambu phala (black berry, *Syzigium cumini* https://en.wikipedia.org/wiki/Syzygium_cumini can help to remove ill effects of eating mangoes especially for those suffering from diabetes[9]. The phytochemical and medicinal properties are well documented http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3609276/. But this fact may not be known to consumers and obviously would underprice jambu phala (jamoon) in relation to mangoes. Thus, the market is myopic in recognizing the medicinal properties of Jamoon Vs Mango, similarly Amla Vs Oranges, jackfruit Vs jackfruit seeds, jamun Vs jamun seeds. The market is wider for mangoes, but not as wide for jamoon; wider for oranges but not as wide for Amla, wider for jackfruit, but not as wide for jackfruit seeds, wider for jamun, but not as wide as for jamun seeds. If one kg of oranges is Rs. 50, one kg of Amla is also around Rs. 50, but one kg of Amla has 10 times ascorbic acid than one kg of oranges, which the market does not recognize. Similarly for Jamoon (jambu phala) the price ranges from Rs. 100 to Rs 300 per kg, while the price of Mango is Rs. 50 to Rs100 per kg. However, the medicinal properties of Jamoon are par excellence compared with Mango. This even escapes the attention of the highly literate consumers[10].

Food products/ flavorings - primarily controlled by private sector companies

Food products / flavorings, are largely controlled by private sector, with distinct value addition and supply chains to understand with whom to negotiate with for benefits to be shared with state or community. This is irrespective of whether the market is perfectly competitive or imperfect. In the case of biodiversity value added, oligopolistic markets (a few sellers, large number of buyers) are a rule, where product differentiation and selling effort (advertisement etc) plays a major role compared with price competition.

Issue 9. Efforts of farmers in maintaining agribiodiversity in Devara kadu is not included in costing anywhere

The role of coffee planters in maintaining / sustaining Devara Kadu (sacred groves) in Kodagu have gone unnoticed all along, since

---

[7] I remember my mother late Smt Gowramma used to pick Vishnu kranthi, Purusha rathna, which were weeds near my home and used to cook sambar and used to say they are very good for health (which aspect, I forget).

[8] The following health benefits are documented : Visible Results; Proven effectiveness (it is about three times more effective than other products when consumed for the same period of time); Weight loss is achieved in the most natural way. It is extracted from naturally occurring substances; Faster weight loss; No major side effects; Boosts Immunity; Reduces overall food-intake naturally by suppressing hunger; Reduces bad Cholesterol, reducing heart risks thereof; Increases Good Cholesterol; It also helps the brain to produce more amount of serotonin which is known to enhance mood levels to a considerable extent.

[9] Smt Gowramma (mother of the first author) used to indicate :As jamoon to mangoes, is jackfruit seeds to jack fruit

[10] Yesterday I bought 1.5 kgs of jamun fruits from a roadside cart puller, which were not looking so good @ Rs. 200 per kg. During the purchase, at least five customers asked the lady cart puller, why the price is Rs. 200 (very high?) and can you not give for less! I told each one of them that, my consumers surplus is high and am prepared to pay even up to Rs. 250 or more, since we can get two products in one go – the jamoon fruit useful for urinary problems and the jamoon fruit seed, useful for diabetics. I was able to convince one out of five customers, who purchased a mere 100 gms! This is the fate of urban literate customers who bargain heavily for produce with great medicinal value, while pay what ever is asked by the printed cartons of allopathy medicines.

Devara Kadu – shade tree coffee – ecological diversity – Iyenmane – Karona Kadu are naturally knit in kodagu coffee culture[11]. In areas especially Uttara Kannada and Dakshina Kannada, farmers maintain a great degree of biodiversity on their farms sometimes dominated by arecanut cropping system. This is also influenced by the Nagabanas. Thus, the costing as reflected in the Annual Survey of Industries or any other secondary source of information cannot capture the weightage for endemic species and landraces - as it is also provided for in the Plant Variety Protection and Farmers Rights Act.

Similarly, contribution of bio-diverse planting practices (e.g., host plants, inter-cropping, soil-biodiversity enriching practices) on pollination, pest control, and in turn, crop productivity, system resilience and stability eschew the valuation.

Issue 10: Poor proportions of ABS

Volumes are written on ABS, however, policy recommends a modest percentage of 0.1% to 0.5% of (the annual gross exfactory) sale of product as ABS[12], which is just ten to fifty paise out of Rs. 100. The economic justification for such a low proportion of ABS is not transparent. Given the increasing wage rates in non-farm sector which is resulting in withdrawal of labor from agriculture and primary sector activities, such a poor ABS cannot attract even the marginal farmer or marginal labourer to sustain his/her practice. Given the general apathy towards plant based medicines, the volume of trade in plant based products itself is poor and hence those who contribute to conservation, get a raw deal in the process.

Issue 11: ABS is a flow similar to Depreciation in the case of assets - needs to be the basis

Depreciation considers apportioning the value of a fixed resource / asset over the life of the asset / resource. By convention 10 years are life of an asset and therefore (1/10=) 10% per year is the depreciation. In ABS, life of a generation of population needs to be considered for flow of information. Usually a generation is 25 years and thus ABS can at least be 1/25 = 4% per year. Hence 4% of the profits or 4% of the purchase price can be ABS, as price is the major determinant of profits. Thus, the ABS, should first raise the share with sound economic basis from the present recommendation to at least 4 % considering generation as the life. Depreciation is for stock resources to represent the flow every year. Similarly ABS is for flow resources, since information is a stock which has to spread to flow among users by word of mouth and other means.

Issue 12: ABS shares need to be revised for formal and informal markets

The raw material market is an informal market (dealing with unregistered persons / individuals), where a higher proportion (1% to 5%) of price is the ABS, while the manufactured material market is a formal market where a low proportion of 0.1% to 0.5% of the value of the product is recommended. The transaction cost of collecting ABS in informal market is also higher compared with formal market, which is a registered industry.

Policy suggestion

In the case of biodiversity resources, services, markets are myopic masking the true use values in market price due to information asymmetry, asset specificity and market failure. Even the market wage rate masks transaction costs in gathering / harvesting biodiversity not reflecting information cost involved in locating / sourcing raw materials involving climbing trees, harvesting amidst risk of thorny plants, snake bites, wild animal attacks and the like. Thus, consideration of market price as reflection of use value does not offer justice to the hard work of conservators, gatherers, farmers, villagers. At present the access and benefit sharing (ABS) of 1% to 5 % of the purchase price of raw materials which is an informal market is not justified. Similarly, the low ABS of 0.1 % to 0.5% for final products which is a formal market is not justified as manufacturing results in value addition when compared with raw material values. Therefore the policy pertaining to ABS needs a thorough review to revise, restructure, rework the ABS in agribiodiversity incorporating at least the use values, and in phases the non use values.

---

[11] http://www.toenre.com/downloads/2004_coorg_sacred_grove_article_MGC_MBhat_Accavva.pdf

[12] Ministry of Environment and Forests and Climate Change (National Biodiversity Authority) Notification, New Delhi dated 21st Nov 2014 which prescribes such a low proportion. P. 11

Institute for Social and Economic Change
Dr. V K R V Rao Road, Nagarabhavi PO, Bangalore 560072
Phone: 23215468, 23215519, Fax: +91-80-23217008; Web: http://www.isec.ac.in