Beekeeping for Sustainable Development

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Abstract: Reduction in the global agriculture productivity is challenging to the policymakers of the world. While the role of bees in the promotion of sustainable development is widely considered. This research paper explored the role of beekeeping towards achievement of United Nation's Sustainable Development Goals (SDG's). Beekeeping has potentially contributed towards 15 out of 17 SDG's and more than 20 targets. This research paper focuses on the role of beekeeping in Sustainable Development.

Key words: Beekeeping, apiculture, policymakers, productivity, sustainable development goals.

01. Introduction: Beekeeping is a non-land based activity which doesn't compute with other resources in the area (FAO 1990). It helps the human life through a variety of assets. Bees feed on nectar and collect pollen from flower. The nectar is converted into honey with the help of different enzymes. Gums and resins are collected from the secretion of plants or the injured parts of the plants which are used for capping filled, unfilled cells and nest making. Bees are the only live stock which doesn't compute with other animals with capacity to harvest nectar pollen. Beekeeping also enhances the productivity of crops through the process of pollination and have significant role in ensuring food security. The role of honeybees in pollination of crops is 80%. Honeybees improve the quality of fruits, vegetables and yield of seed crops.

Beekeeping activity requires very little capital to start up. Men as well as Women can easily practice it with the help of little and less labour. It will be proved attractive to unemployed youths and people with disabilities. In this way beekeeping provides an employment for different members of the community by naturally available resources. Women can also easily start this activity which will be resulted into women empowerment. The best and favourable period for beekeeping is starts with October-November or with the advent of spring season. However it can be carried out throughout year with proper rearing techniques, food management and migration of bee boxes. Although for ecosystem balance it is preferable to plant a special species of bee flora plants and migration of colonies to different floral belts.

2. World scenario of beekeeping: For making comprehensive study the world view and global activity of beekeeping can't be ignored therefore this study makes a very extensive scope and therefore study has been made of the global economics of beekeeping and honey production. Therefore it covers the total annual production of honey in the entire world. It has brought to notice that, the countries which have very influential dominance in the business of honey by acquiring the figure of trade of top exporters and top importers of the world.

The following table no.01 summarizes the world's average production of natural honey and bee wax.

Table No. 01

World's average production of natural honey and bee wax:

Year	Natural Honey	Beeswax
1961	678759	31898
1971	771154	38610
1981	934522	47043
1991	1241181	47594
2001	1241533	57674
2011	1615914	64887
2018	1850868	69633

Source: FAO statistics

Table 01 shows the average production of natural honey and bee wax during the period from 1961 to 2018. In every decade the production of natural honey and bee wax is consistently increasing. There is tremendous growth of 172.68 % in production of natural honey over 57 years. While bee wax production shows growth of 118% during the same period. Compared to total natural honey production between the year 1961 and the recent year of 2018 that has increased from 678759 tons to 18,50,868 tons. The overall rise in honey production happens to be nearly 03 times and percentage rise happens to be 366%.

The total world's bee wax production for the year 1961 was 31898 which have increased in the year 2018 to 69630 which is about double and percentage rise is 458%. Thus the annual output of both natural honey and bee wax shows a consistent and continuous trend of rise. That proves all over the world a very large number of people are getting attracted to this new lucrative activity. Surely honey and wax production are becoming attractive business opportunities all over the world.

Table No. 02

Continent wise natural honey production in the world (1961-2018)

Continents	1961	1971	1981	1991	2001	2011	2018
Oceania	25458	25075	27138	28626	28889	20229	32310
South America	38680	35957	56896	83955	127040	149240	163435
Northern America	173759	158873	208691	219689	191311	179650	190382
Africa	66172	78873	88513	133558	121554	156696	200700
Europe	278299	313992	328894	410731	311107	376017	426380
Asia	94430	156413	222409	362631	459631	732071	835643
Total	**678759**	**771154**	**934522**	**1241181**	**1241533**	**1615914**	**1850868**

Source: FAO statistics

Table No.02 reveals that the Asia's rank being first over the period of 1961 to 2018 in the production of natural honey. As on 2018 Asia produces 8,35,643 tones of natural honey which is more than 50% of world's total production of 18,50,868. This data can be presented in the following graph…

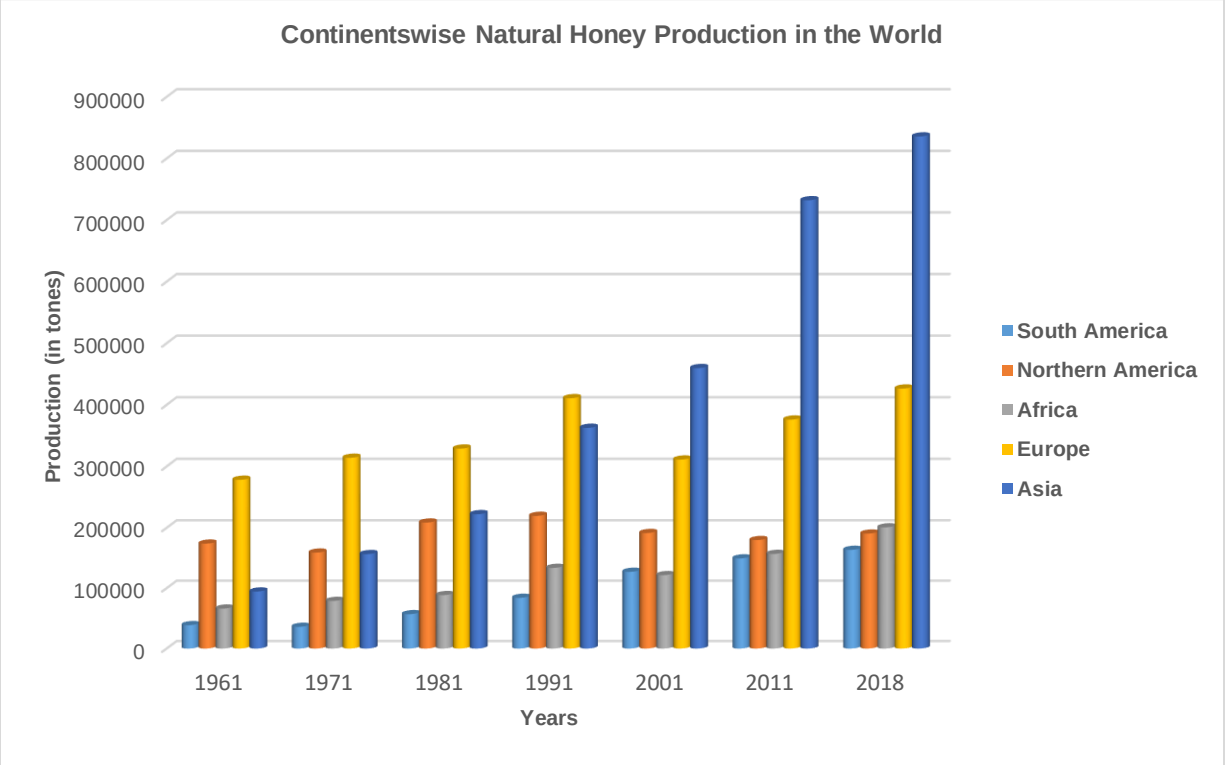

Table No.03

Continents wise Beeswax Production in the World (1961-2018)

Continents	1961	1971	1981	1991	2001	2011	2018
Oceania	327	337	473	573	565	569	562
Europe	1834	1708	1654	2536	4422	3593	3906
South America	3409	4093	3719	5916	7810	8470	8782
Africa	7115	8133	8193	9045	13664	15994	16639
Northern America	7883	6646	11985	6195	4974	5292	5028
Asia	11330	17693	21019	23329	26239	30969	34716
Total	31898	38610	47043	47594	57674	64887	69633

Source: FAO statistics

Table No.03. shows Asia leads in the production of bee wax from 1961 to 2018. For 2018, Asia produces 34716 tonnes of bee wax which is approximately 50% of world's bee wax production. The continents Africa and Nothern America ranks sequencly after Asia.

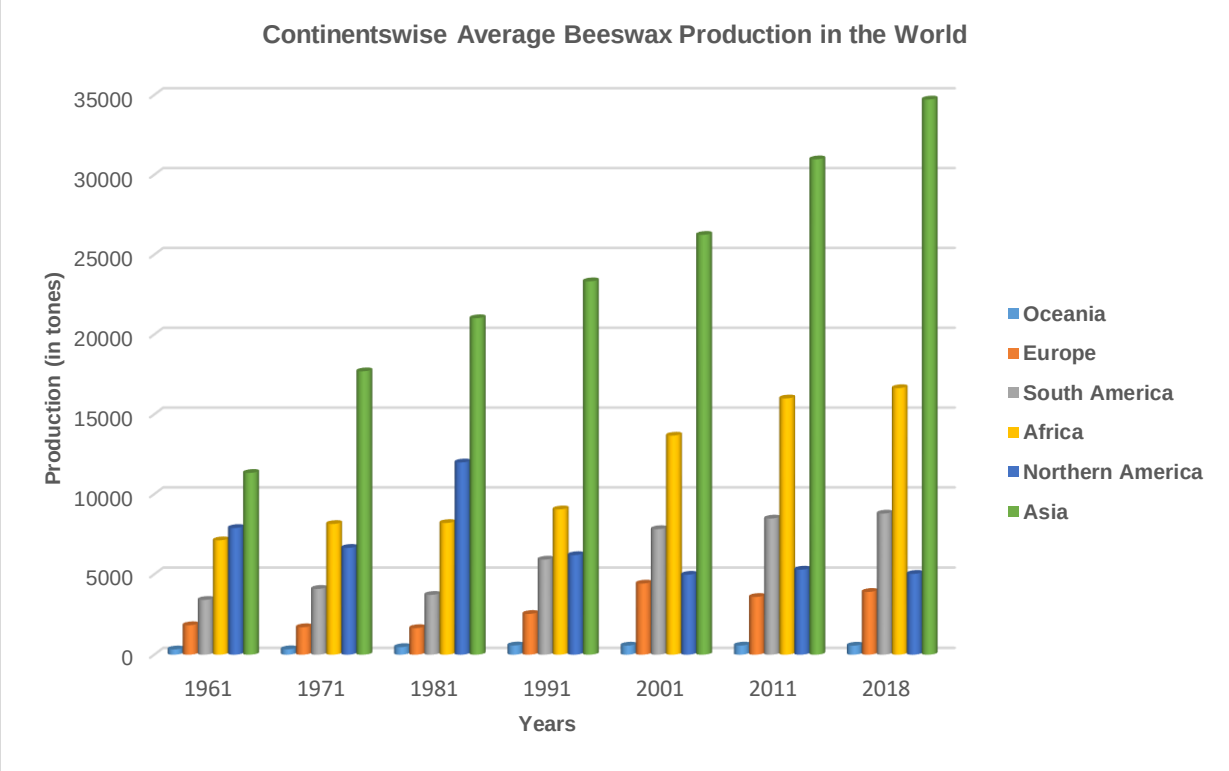

Table No. 03 shows average production of bee wax production in different continents over the period from 1961 to 2018. Asia ranks first with the highest average bee wax production of 23614 tons. Africa, Northern America, South America sequence stands later one. The continent Oceania stands last with a 487 tones of bee wax.

According to the U.S. Department of Agriculture (USDA) in 2014 there were 2.74 million colonies producing honey and production of honey is increasing year after year. Still shortage of honey is reported on the international honey market therefore honey production i.e. bee-keeping is a great business opportunity throughout the world. (USDA, 2018). To increase the productivity of crop and labor there is a need to search new resources of income generation based on agriculture which help to increase the productivity of crop and labor too. Dairy farming, fishery, poultry, sericulture etc. are the agro based activities which helps Indian farmers to generate additional source of income. These agro based industries increase only the productivity of labour. The manufacturing of honey popularly known as 'apiculture' or 'beekeeping' is a means via which the productivity of labour as well as crop can be increased. All over the world, current transformation in agriculture if linked with honey production i.e. apiculture/beekeeping activity will offer a wide scope for income generation from beekeeping. Due to apiculture the productivity of agricultural crop will increase up to 200 per cent. Till now only 10 per cent of the existing potential has been utilized. For instance, India has a potential to keep about 120 million bee colonies that can provide self-employment to over 6 million rural and tribal families.

3. Beekeeping for Sustainable Development: Sustainable Development Goals (SDG's) are formulated to achieve the inclusive development of human being by maintaining the ecosystem balance by 2030 through achieving 189 targets and more than 250 indicators (UN 2015). Honey bees produce valuable products including honey without computing with other activities of agriculture and forestry. Honey bees pollinate the flowering plants. Honeybees pollinate vegetables and trees and play important role in promoting agriculture and forestry. Beekeeping holds a great potential to contribute in poverty reduction and environmental protection including forest conservation. Honey and bees have been considered as NWFP (Non-Wood Forest Product). Beekeeping is compatible with 'Global Development' under the World Trade Organization (WTO) regime. Beekeeping is related with natural environment. Apicultural Operations can be operated within the Mediterranean tropics, marked by high bio-diversity with tribal groups.

The following table no. 04 summaries the role of beekeeping in achieving sustainable development goals.

Table No. 04

Role of beekeeping in sustainable development goals

Sustainable development goal (SDG)	Contribution of beekeeping to achieve SDG targets	Supporting literature
1.No poverty	1.1 Beekeeping offers economic diversity as an income source. 1.4 Beekeeping helps to build resilient livelihoods for poor and vulnerable peoples. 1.5 Beekeeping potentially providing equal access to economic and natural resources for both men and women.	Bradbear, 2009; Amulen et al. 2019; Pocol and McDonough 2015
2.Zero hunger	2.2 It enhances the nutritional value of fruits, vegetables, and seed. 2.3 Bee pollination increases crop yield.	Klein et al. 2007; Kleijn et al. 2015; Potts et al. 2016a; Stein et al. 2017; Klein et al. 2018
3.Good health and well being	3.8 Bee products provide safe and affordable medicinal Sources. 3.4 Bee products used in traditional and modern medicine to treat non-communicable diseases such as cancer through strong bioactive compounds. 3.9 Bee pollination potentially contributes to the growth and diversity of plants that are important for improved air quality.	Bradbear, 2009; Brockerhoff et al. 2017; Pasupuleti et al. 2017; Sforcin et al.2017; Kocot et al. 2018; Easton-Calabria et al. 2019;
4.Quality education	4.3/4.5/4.5 Vocational training for keeping bees can enhance equal opportunities for employment, training and entrepreneurship amongst men, women and indigenous people (with traditional knowledge)	Pocol and McDonough 2015; Mburu et al. 2017; Ekele et al. 2019
5.Gender equality	Keeping bees as a hobby or being involved in beekeeping can enhance opportunities for women's involvement in economic, 5.a social and political decision-making processes even in communities that deprive women of property rights	Pocol and McDonough 2015; Mburu et al. 2017
6. Clean water and sanitation	6.6 Bee pollination may contribute to growth and diversity in water-related ecosystems, such as mountains and forest. Appropriate a forestation efforts may provide new resources for commercial bee operations whilst potentially contributing to regional water supply	Brockerhoff et al. 2017; Creed and van Noorwijk 2018
7. Affordable	7.2 Bee pollination improves production for oilseed	Romero and Quezada-

and clean energy	crops used as bio-fuel such as sunflower, canola and rapeseed	Eua´n 2013; Halinski et al.2018; Perrot et al. 2018
8. Decent work and economic growth	8.1 Improved agricultural production from bee pollination may contribute to the gross domestic product (GDP) of nations. 8.6 Beekeeping can diversify livelihood opportunities for men and women in rural areas and 8.9 support nature-based tourism initiatives.	Arih and Korosˇec 2015; Mazorodze 2015; Pocol and McDonough 2015; Stein et al. 2017; Quezada-Eua´n2018;Vinci et al. 2018
9. Industry innovation and infrastructure	9.b Bees are an element of nature that inspires human innovations (e.g., airplane design and computer algorithm development) and new honey-related products.	Xing and Gao 2014; Zhang et al. 2015; Sahlabadi and Hutapea 2018
10. Reduced inequality	10.1 Improved livelihoods from beekeeping and the contribution of bee pollination towards GDP can support sustainable income growth for lower income groups 10.2 beekeeping can potentially contribute to promoting inclusive social, economic and institutional development	Carroll and Kinsella 2013; Tomaselli et al. 2014; Mburu et al. 2017
11.Sustainable cities and communities	11.6 Bees can be useful in monitoring air quality in urban areas, as pollination of urban flora can support improved local air quality. 11.7 Bees can enhance pollination and self-sustainability of urban gardens and public open spaces.	Lowenstein et al. 2015; Van der Steen et al. 2015; Hausmann et al. 2016; Stange et al. 2018; Zhouet al. 2018
12.Responsible consumption and production	12.3 Bee pollination can contribute to reducing food waste by improving visual aesthetics of food (shape, size and colour) and increase shelf life. 12.b Beekeeping can be marketed as sustainable tourism for regional development.	Klatt et al. 2014; Lemelin 2019
13. Climate actions	13.3 Use of bees and bee products for environmental monitoring can improve understanding of climate impacts on the environment	Van der Steen et al. 2015; Smith et al. 2019
14. Life below water	14.4 Bees can potentially contribute to improved production of plant-based sources of compounds commonly found in fish. Overharvesting of fish can be managed by promoting production and consumption of alternative plant-based nutrient sources.	Amjad Khan et al. 2017
15. Life on land	15.5 Bees contribute to biodiversity by pollinating flowering trees and plants 15.1 beekeeping can contribute to forest conservation. 15.9 Incorporating beekeeping in local planning processes may support reforestation activities which can result in poverty reduction and sustainable regional development.	Senapathi et al. 2015; Minja and Nkumilwa 2016; Chanthayod et al. 2017; Klein et al. 2018; Mudzengi et al. 2019

Beekeeping is the important component of agriculture and rural development. It provides nutritional intake and ecological security to rural communities. It will also provide economic source of income to tribal, landless farmer and unemployed people. It is an income generating as well as employment generating activity. It is non-land based activity which doesn't compute with other resources in the environment.

4.Conclusion: Beekeeping **play a major role in achieving the United Nations Sustainable Development Goals**. Pollinators are essential **to feed a growing world population** in a sustainable way (Objective 2) and to maintain biodiversity and an **active and productive ecosystem** (Objective 15). Bees and pollinators help to create environments with **greater resilience**. Beekeeping offer new jobs, especially for small farm owners, helping to meet their growing demand for **nutritious, healthy and safe foods** (Objectives 1 and 9).

The reduction in the bee colonies, and its possible repercussions, can also lead to an increase in the levels of malnutrition and non-communicable diseases, worsening human health problems worldwide (Objectives 3 and 13). Last but not least, through pollinating activity bees can ensure increase in agricultural yields (Objective 8).

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