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NEAR EAST FORESTRY AND RANGE COMMISSION

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Good Governance of Forests and Rangelands : Pillar of Food Security

EXPERIENCES OF NEAR EAST COUNTRIES ON UTILIZATION AND PROCESSING OF NON-WOOD FOREST PRODUCTS: CASES OF GUM ARABIC, BEE-HONEY, PISTACHIOS, ROSEMARY AND STONE PINE

1. Forests and rangelands in the Near East Region (RNE) have significant protective and productive functions and as such offer many opportunities to contribute to the economic, environmental and social development of the region. As such, they can contribute to poverty alleviation and the enhancement of the well-being of people living in the vicinity of forest and of the country at large.

2. Protective functions of forests, trees and rangelands in RNE encompass their safeguard of watersheds; protection & fixation of soil; shielding of agricultural systems; habitat for livestock & wildlife and shelter to human settlements.

3. Productive functions of forests, trees, shrubs and rangelands in the region include provision of wood and non-wood products (NWFPs). Wood products include lumber, sawn timber, industrial wood, building poles, firewood, charcoal and wood products such as paper, plywood and boards. NWFPs on the other hand include a wide range of products such as browse & range material; ivory; bush meat; bee-honey & wax; gums, resins & latex; silk; bark derivatives such as cork, cinnamon & tanning material; fruits, nuts & seeds such as almonds, pistachios & pine seeds together with medicinal, aromatic & culinary herbs such as basil, rosemary and thyme.

OBJECTIVES OF THIS NOTE

4. This secretariat note, intended to be the first in a series, has the purpose to:

a) highlight the environmental benefits of some NWFPs in NEFRC member countries,
b) their socio-economic benefits in general and their contribution to the livelihoods and food security of the rural poor in the countries where they are produced in particular,
c) reflect on countries' experiences in development and maximization of benefits from NWFPs

5. It portrays five commodities that represent the geographic diversity and extent of NWFPs in RNE; namely Bee- honey in Yemen, Gum Arabic in Sudan, Pistachios in IRI, Rosemary in Tunisia and Stone Pine in Lebanon.

6. For each product a number of aspects are highlighted[1]. These include: definition of product; nomenclature of trees, shrubs or herbs, involved in production; brief history of country's involvement in the product and main production areas in the country; ecological classification & nature of plant formation where product is produced; resource ownership; sustainability of production; methods of production; who is involved, role of small producers, community organizations and large scale producers; research & extension activities on the product /resource; processing; institutional/legislative & socio-economic aspects; recognized measurable environmental and other benefits to communities & the country; marketing & trade; usage of product in country & worldwide and volume (tons) and value (US$) of trade.

BEE-HONEY IN YEMEN

7. Bee honey (BH) is a sweet food made by bees of the Genus Apis, using nectar from flowers. BH gets is sweetness from the mono-saccharides fructose and glucose, and has approximately the same relative sweetness as that of granulated sugar.

8. Several kinds of BH are produced in Yemen which carry the names of forage plants on which bees feed or locations where they are produced. The most commercially known and valuable are Du'ani and Juranai from Al-sidr (*Ziziphus spina christi*) produced in Hadramaut and Shabwa Provinces respectively and Salum from Salum (*Acacia ehrenbergiana*) in Tihama.

9. Four subspecies of honey bees (HB) bees are known in Yemen: Indigenous Yemeni sub-species *Apis mellifera jemenitica* , two varieties in Sogetra: *A. carnica* and *A.m. fasciata*, Italian variety *A.m. ligus*tica and Egyptian variety *A.m. lamarckii*. All varieties are adapted to the environment through continuous mobility and natural selection.

10. Bee rearing and honey production in Yemen dates back to the 10th Century BC when prosperous Yemen was famous for its incense and honey. Honey trade continued to rank fourth in old Yemen. The predominance of BH production lasted up to the 1970s when the sector deteriorated due to the spread of Varroa and Nosema diseases and lice together with bacterial, fungal and viral diseases. The government intervened then through projects to protect bees and enhance honey production. Projects included the introduction of modern bee hives (B Hi) from Egypt and Syria. In 1998 the Ministry of Agriculture & Irrigation (MAI) and through German support staged the Yemen-German Honey Project with the aim of extension, training, introduction & dissemination of modern hive techniques.

[1] Based on reports by national consultants:
- Bee-honey: Gameel Abdel Samad Al Emad, Yemen;
- Gum Arabic: Sayeda Ahmed A. Khalil, Sudan;
- Pistachio: Mustafa Jafari and Simin Raisi Zadeh, Islamic Republic of Iran;
- Rosemary: Ahmed Bergaoui, Tunisia;
- Stone Pine: Fady Asmar, Lebanon

11. All 21 Governorates and ecological zones of Yemen are known to produce BH. However the most productive ones are Hardamaut, Abien, Shabwa, Ebb, Taiz, Lahaj, Hudeidah and Hijja.

12. Several traditional agro forestry systems exist in the different ecological zones of Yemen. These systems represent a form of integration of woody species with crop cultivation or animal rearing, which increases overall revenue and protects soil productivity. The indigenous species most commonly used in these traditional agro forestry systems are: *Acacia negrii, A. tortilis, Cordia abyssinica, Dobera glabra, Ficus vasta, Tamarix nilotica*, and *Z. spina-christi*. Recently, Yemenite farmers have started to introduce fast growing exotic species used as shelterbelts and for the fixation of sand dunes in Tihama and Maareb. The most commonly used exotic species are: *Azadirachta indica, Cononcarpus lancifolius, Melia azedaracht, Parkinsonia aculeata, Prosopis chiliensis*, and *P. juliflora*.

13. Resource ownership is tied to land tenure. The latter is 80% private ownership by individuals, 15% by private institutions and 5% by the State. People of Yemen have for centuries been concerned and involved in building dams and irrigation systems which deeply entrenched the practice of settled agriculture and Bee-keeping (BK). The number of B Hi and keepers are perpetually on the increase. Records of the MAI indicate that aperies have increased from 106911 producing 178 tons in 2000 to some 1 239 692 producing 2486 tons in 2009.

14. Traditional BK methods in Yemen use a long, thin hive-box hollowed from a log. Modern hive boxes based on the same principle are wooden 80-100 cm long and 12x12 cm in cross section. The front has a hinged door with V-shaped bee entrance and the rear closure is plugged and sealed with mud. This can also be of pottery pipes made in three sections and supported on a metal frame, enabling the hive to be opened in two points in its length.

15. In all these B Hi the queen and brood (larvae and developing queens) inhabit the front of the hive while the honey combs (HC) naturally built by the bees in parabolic shape, are suspended longitudinally for maximum ventilation and cooling. The HC is extracted through the rear of the hive which is sealed with mud and thus easily opened, causing minimum disturbance to the brood inside.

16. Apiaries are kept in banks of 10-100 hives, stacked 3-4 rows high on a metal stand covered with grass or similar cooling material, which in turn is covered with blue plastic sheet.

17. Bee keeping in Yemen has originated and remains in the hands of individuals and families in the country side: Some of them adopt bee keeping as a mainstay occupation while the majority practices it as a part-time job together with agriculture or petty trade. There are several Bee Keeper Associations but they are not effective.

18. Agricultural, Forestry Research & Extension are the prerogative of the MAI through Agricultural Research Corporation and General Administration of Forests, Range & Desertification Control.

19. After honey maturation, bee keepers undertake various stages of processing:

- HC harvesting and collection in special utensils,
- Mature combs (85% wax sealed) are packed in stainless steel containers. Some are sold as honey chunks,
- Manual honey separation or through sun heating. In some modern aperies electric centrifuges are used,
- Separation of wax from honey,
- Packing of honey in glass or plastic containers of 1, 7 or 14 kgs.

20. In 2008 total population of Yemen was 22.1 million increasing at 3.1% per annum of whom 74% were rural living in areas devoid of basic services and where 46.6% were living on less than 2 US$ /day. 45% of population in BK areas were living on less than 2 US$ /day. In a 1999 survey 25 and 75% of BH were owned by poor and better to do families respectively. 13 and 78% of BH production is marketed by poor and better to do families respectively.

21. The most important benefit of honey bees is cross pollination of plants effecting biodiversity and nature balance. Some 88 000 BK making up 500 000 families live in Yemeni country side for whom bee pollination increases field and horticultural crops by 20-30% particularly for such crops as palm dates, coffee, grapes, mangoes and cotton.

22. After HB processing, producers sell directly to consumers, retailers or export agents. Some market their produce direct to agents in Arab countries especially during marketing festivals such International Village in Dubai or Autumn Expo of Kuwait.

23. BH is widely used as food and medicine. 70% of BH produced in Yemen is locally consumed and 30% exported. Total honey production in the last few years is estimated at 2400 tons at an estimated value of US$ 45 million of which some 800 tons are exported to Kingdom of Saudi Arabia, United Arab Emirates, Kuwait, Bahrain, Qatar, Jordan, Egypt, Syria and other countries for a value of about US$ 11million.

GUM ARABIC IN SUDAN

24. Gum Arabic (GA) is the term originally given to exudates which ooze out when stems or branches of the Hashab tree (*Acacia senegal*) are injured (tapped). GA came to be defined by international regulatory bodies as the dried exudates from the trunk and branches of *A. senegal* or *A. seyal*, of the family *Leguminosae.* However, gum from the latter tree Talh (*A. seyal*) is more friable than and inferior to Hashab gum. The old definition confines GA to the exudates of *A. senegal* and closely related species.

25. Overall GA production spans nine states: W. Darfur, N. Darfur, S. Darfur, N. Kordofan, S. Kordofan, White Nile, Sennar, Blue Nile and Gadaref.

26. Gum producing trees thrive in low and high rainfall savanna of central Sudan in association with *Balanites aegyptiaca* and *A. mellifera* . The most common associated grasses are *Aristida pallida, Eragrostis tremula* and *Cenchrus biflorus*.

27. GA is produced in a typical land use practice that prevailed in Kordofan, western Sudan as shifting cultivation with or without bush-fallow. The A. senegal agroforestry system is practiced as a means of restoring the soil fertility and promoting GA production. Traditional A. senegal-based agroforestry system is recognized and considered one of the most successful forms of natural forest management in the tropical drylands and regarded as sustainable in terms of its environmental, social and economic benefits. Agroforestry with GA based on indigenous knowledge associated with gum production system acquired by farmers in the gum belt communities over long time, and the system is sustainable as long as it is maintained along its cycles.

28. GA trees are managed with agricultural crops such as sorghum (*Sorghum bicolor*), pearl millet (*Pennisetum typhoideum*), groundnut (*Arachis hypogaea*), sesame (*Sesamum indicum*) and karkadeh (*Hibiscus sabdariffa*). This agroforestry system allows a period of 10-15 years for restoring the soil fertility after a short period of arable cultivation.

29. About 87% of the land allocated to gum production is privately owned, the rest is owned by the Government. Gum orchards owned by GA farmers organized in producer associations is estimated at 600 000 ha.

30. In spite of periodic drought spells and civil strife in the gum belt, Sudan sustained the production of sought quantities and quality of GA at reasonable prices through various forest policies and management plans.

31. Gum production encompasses two stages:

i. Gum tapping and collection: Gum hashab is collected after tapping, whereas gum talha is collected as a result of natural exudation. Traditional methods of tapping were replaced with a specially designed tool. After injury, tears of gum form on the exposed surfaces and are left to dry and harden. After five weeks the first collection of gum is made, with further collections from the same trees at approximately 15–day intervals until the end of February, up to five or six collections in total.

ii. Post–harvest handling: Cleaning and sorting is undertaken by the producer and subsequently by large traders after sale in auction markets.

32. GA producers, small village traders, GA associations, and GA companies are collectively involved in organizing production. A complete protocol of regeneration, tapping, collection, grading, initial processing and marketing has been elaborated for GA by Sudanese farmers, foresters and businessmen.

33. In recent years research on GA has been developed to include improvement of production, marketing, tree physiology, specifications, ecology and environment of GA. Forests National Corporation annually disseminates extension programs through States offices for local communities, Gum Producer Associations, producers, farmers and other GA dependants.

34. Gum processing is undertaken by private sector companies. It encompasses several activities, most important of which are:

a) Grading: The international gum trade has come to recognize three grades of raw gum: 1. *Hand Picked Selected* (HPS): raw un-broken or chipped globules of clean GA, 2. *Cleaned grade gum*: broken or chipped gum lumps with no limit on the granule size. 3. *Dust*: GA by-product from screening/grading or cleaning processes.

b) Processing: 1. *Kibbled gum*: Mechanically broken granules of gum with a maximum size of 14 mm and a minimum size of 3mm and a range of 8mm. 2. *Mechanical powder*: White powder of mesh size inferior to 200 microns resulting from mechanically crushing 3. *Spray dried*: White powder of mesh size inferior to 100 microns, which results of a process by which raw gum is dissolved in water, centrifuged to remove impurities, pasteurised and sprayed in hot air to evaporate water.

35. Local communities (women and men) are involved in the production process from tree tapping to collection, cleaning and grading. Forests National Corporation initiated the idea of GA associations to develop the production. The total number of registered associations is about 1481 with membership of 1,881,800.

36. Throughout the last centuries gum was produced by individual producers and exported by private sector companies. In 1969 a public Liability Company; the Gum Arabic Company was established and was granted the concession as the sole exporter of raw gum. The concession was removed in 2009 and a regulatory body was established; the Gum Arabic Board (GAB). GAB is sovereign regulatory body for GA and responsible for establishing effective monitoring system, organizing local markets, state strategies, policies, directives & rules, follow-up execution of policies with government or private institutions. In 2010 GAB established the Gum Arabic Stock Exchange (GASE) to guarantee the production, funding, quality control and marketing.

37. Environmental, socio-economic benefits of GA are incalculable: The gum belt acts as a natural barrier to protect more than 40% of the total area of Sudan from desert encroachment. The belt is a natural habitat for a wide variety of flora and fauna. The belt is the resource base for most of Sudan's production of staple cereals, cash crops and livestock. It is estimated that six million people nation-wide depend on GA for income. GA plays an important role as major source of foreign exchange, accounting for 13.6 percent of the annual non-oil export income.

38. Sudan was known as a source of GA since ancient Sudanese and Egyptian civilizations that used gum in the treatment of their sick, mummification of their dead, painting of temples and dying of clothes. Early in the 18th century, Arab traders took GA from Red Sea and Mediterranean ports to Europe hence the name. GA was the leading source of revenue and source of foreign cash earnings for Sudan until the introduction of cotton in 1920. Current annual cash earnings from GA export are around US$80 million.

39. As early as 2000 BC GA was used by Ancient Egyptians in food, adhesives and paint. Locally GA is used in soft drinks, laundry starch, and in plastering. The world demand for GA is because of its unique properties as an emulsifier for citrus oils in fruit based drinks and cola type drinks, thickener, binder, cosmetics, drugs, sweets, chewing gum, stabilizer and adhesive. Other uses are in confectionery, pharmaceutics and photography. Of late GA has become a food ingredient and a major component of health foods because of its high content of soluble fibres and low caloric value.

40. Sudan commands over 80% of the world's GA production and trade. The major consumers of the gum are West European countries and the United States of America. However, minor amounts go to Japan and countries from the Far East. The main countries that import GA are; United Kingdom, Japan, France, Italy, Germany, Denmark, Belgium, Spain, Greece, Netherlands, Portugal and Ireland.

PISTACHIOS IN THE ISLAMIC REPUBLIC OF IRAN (IRI)

41. The Pistachio is a relatively small tree mostly grown in the arid parts of the world close to 30th parallel latitude. It grows from sea level (e.g. Attica, Greece) to an altitude of 1800 meter above sea level (e.g. Kerman, Iran). The combination of latitude and altitude provides enough chilling hours in winter and long hot and sunny summer conditions to produce a viable crop.

42. Pistachios bear laterally on one-year-old wood. This causes an alternate bearing habit, so prominent in pistachio production with extensive commercial consequences.

43. The pistachio of commerce is the only edible species among the 11 species in the genus *Pistacia*; all are characterized by their ability to exude turpentine or mastic. Several are referred to as pistachios, but the name is generally reserved for the edible nut of commerce. Its Latin name is *Pistacia vera L.* A member of the family *Anacardiaceae*, it is related to the cashew, mango, poison ivy and oak, pepper tree and sumac. Other Pistacia species include *P.terebinthus, P. palaestina, P. lentiscus, P. chinensis , P.afghanistania* and *P. atlantica.*

44. Pistacia plants are shrubs and small trees growing to 5–15 m tall. The leaves are alternate, pinnately compound, and can be either evergreen or deciduous depending on species. All species are dioecious, but monoecious individuals of *P. atlantica* have been noted. The genus is estimated to be about 80 million years old. It may require more than 200 years for trees to reach 1m diameter and trees up to 2 m in diameter are known. Trees exceeding 50 cm are rare in most areas and in some areas trees are harvested by the time they reach 30 cm.

45. Pistachio cultivation spread into the Mediterranean world where it has continuously prospered in Syria, Turkey, Greece and Sicily. Pistachios were already well known in Late Antiquity. Since 1970s, pistachios have become a commercial crop in many countries which fall

around the 30th parallel north and south of the equator. These regions include: California, North Africa, New South Wales in Australia, South Africa, Argentina and Chile.

46. The individual pistachio nut grows in fruit clusters of multiple nuts. Botanically, they are drupes. All drupes consist of three parts; an exocarp, a fleshy mesocarp (together called hull) and an endocarp (shell) that encloses a seed (kernel). In pistachios the seed is consumed, rather than the mesocarp as in stone fruit.

47. Commercial cultivars vary in how consistently they split open. Each pistachio tree averages around 50 kg of seeds, or around 50,000, every two years. The trees begin to bloom with the arrival of warm weather in late March. The male pollinates the female via the April winds, and the shell of the nut is fully developed by mid-May. Before June ends, the seed inside the shell has begun its rapid expansion and by the first of August, the seed has filled the shell. The nuts, splitting at the seams, are usually ready to be harvested beginning September.

48. Pistachios are a rich source of vitamins and minerals, fiber, antioxidants and unsaturated fat for a healthy diet. A serving size of pistachios provides more nutrients than most other nuts and snacks.

49. There have been numerous studies highlighting the health benefits of pistachios. FDA published a statement in 2003 approving that scientific evidence suggests that eating 1.5 ounces per day of pistachios, as part of a diet low in saturated fat and cholesterol, may reduce the risk of heart disease. Pistachios may help curb less-than-ideal levels of LDL "bad" cholesterol, according to another study published in 2008. In research at Pennsylvania State University, pistachios in particular significantly reduced levels of low-density lipoprotein (LDL cholesterol) while increasing antioxidant levels in the serum of volunteers.

50. The principal producing area in Iran is Kerman province, which is located in the arid southeast. Extensive plantings are located in the vicinity of Rafsanjan, Anar, Kerman, Sirjan, Zarand, Shahr-e-Babak, Ravar, Rayen and others cities (Kerman total of 209000 hectares and 137000 tones crop dried in-shell basis production in 2010) also Khorasan-e-Razavi, Yazd, Fars, Khorasan-e-Jomoobi, Semnan, Sistan-o-Baluchestan, Makazi, Esfahan, Qom, Qazvin, Tehran and other provinces in Iran (Subtotal Iran of 292000 hectares and 210000 tones crop dried in-shell basis production in 2010).

51. Ownership of pistachio orchards, pistachio industry and export & imports business mainly belong to private sector as individual farmers or companies.

52. A recent study of distribution, age gradation and diameter classes of Pistachio shrubs in plantation and wild indicated the long term sustainability of production in IRI.

53. Most of the production is from orchards that account for 53% of world planted area, but there are a few places, such as in the Zagros Mountains, where wild Pistachio (*P. atlantica*) persists in natural and extensively managed semi-natural stands. Wild Pistachio, known as Baneh in Iran, is the most economically important species for rural people in areas of natural forests.

54. The pistachio industry in Iran is made up of three main sectors: farming, post harvest processing and trade.

55. The trees are planted in orchards, and take approximately seven to ten years to reach significant production. Production is alternate bearing meaning the harvest is heavier in alternate years. Peak production is reached at approximately 20 years. Trees are usually pruned to size to make the harvest easier. One male tree produces enough pollen for eight to twelve nut-bearing females.

56. Pistachios have been cultivated in Iran for thousands of years. Commercial cultivation of pistachios in Iran started expanding about one hundred years ago. The upward trend of production has continued ever since. It is estimated that the amount of pistachios produced in Iran rose from around 2,000 tons in 1950s to about 25,000 tons in 1975. The average nationwide production in the closing years of the millennium exceeded 150,000 tons.

57. At present, around 150,000 farmers harvest the crop from about 290,000 hectares of pistachio orchards nationwide; more than 70% of the production is coming from small scale producers (those who manage orchards of 2 hectares or less). Currently, annual pistachio production capacity is around 280 000 metric tons. All pistachio orchards in Iran are hand-harvested. Average annual yield of bearing Iranian pistachio orchards is 800 kg per hectare. Individual farms may produce from 300 to 3000 kg per hectare.

58. It is hoped that new plantings in areas with abundant water resources by corporations rather than individuals would, in future, open the way for establishment of modern, industrial scale orchards. Iran Pistachio Association is already promoting such initiatives through the Model Pistachio Orchard Project.

59. According to the external shape of the pistachio it is divided to four or five major groups: Jumbo, Round, Long, Kernel and Closed Pistachios.

60. Research on pistachio production in Iran was started in 1960 by the two departments of plant protection and horticulture in Rafsanjan city, the main pistachio growing area of Iran. In recognition of the importance of pistachio production in desert and arid areas of the country, the Iranian Pistachio Research Institute (IPRI) was established by combining the previous pistachio research departments and was complemented with four new departments in 1993. At the present time, there are six departments in the IPRI which are dealing with different aspects of pistachio production. Furthermore, there are six research stations under the supervision of the Institute in different pistachio growing regions of the country. The scientific staffs in the different departments and research stations comprise 35 researchers and 15 technicians.

61. The pistachio processing industry in Iran is gradually moving from traditional, low-capacity, home or farm based, sun-drying units towards specialized, industrial high-capacity plants utilizing hot forced air for drying. Traditionally, processing plants acted as service providers to the growers.

62. Currently, the largest industrial pistachio processing plant in the country has a capacity of 350 tons of fresh pistachios per day. Although the number of high-capacity plants is small, the total number of mechanized processing units is quite large and growing every year.

63. A typical modern Iranian pistachio processing plant processes freshly harvested pistachios as follows: weighing, unloading and sampling; hulling; water floatation tank; heated, forced air continuous pre-drying; adhering hull separation and removal; dryer and sun drying; mechanical separation of open-shell nuts from closed-shell nuts; mechanical sizing; picking conveyor belt and/or picking table and packing.

64. The average nationwide production in the closing years of the millennium exceeded 150,000 tons. Iran is the largest producer and exporter of pistachio with an annual production of some 300,000 MT.

65. The Ministry of Agriculture is responsible for horticulture issues. There are various policies and laws on forestry sector which cover the pistachio issue.

66. The Iranian Pistachio Association (IPA) is the national NGO responsible for development of the industry. It offers various services to its members with the aim of promoting their interests, as well as the interests of the Iranian pistachio industry as a whole, both within Iran and internationally.

67. Pistachio plantations have many socio-economic and environmental benefits. Some 1.5 million people depend on pistachio production for their livelihoods. Domestic consumption in 2010 was 30,000 tons.

68. Pistachio is a strategic commodity for IRI and is the major non-oil export item. 55% of world pistachio production and 60% of global exports are from Iran. Annual exports are in the order of 160 000 tons for a value of US$1.5 billion, largely to UAE, Hong Kong, Russia, Germany and Spain. Other producer and exporting countries include USA, Syria, Turkey and Greece.

69. Pistachio production in the world stood at 548,759 tons in 2002 with Iran ranking first with a production of 300,000 tons, the U.S. 127,000 tons Turkey 40,000 tons, Syria 39,208tons and China with 26,000 tons.

ROSEMARY IN TUNISIA

70. By definition, the name rosemary derives from the Latin “Rosmarinus” which literally means "dew of the sea" in an indication to the Mediterranean origins of this herb which is now planted throughout the world.

71. Known for its therapeutic virtues, Rosemary oil is used to facilitate bowel movement, calm coughs, stimulate the gall bladder and the breathing system, as well as to remedy stomach aches.

72. Rosemary (*Rosmarinus officinalis*) is a woody, perennial herb with fragrant, evergreen, needle-like leaves. It is a member of the mint family Lamiaceae, which also includes many other herbs.

73. *R. officinalis* is one of only two species in the genus Rosmarinus. The other species is the closely related but less commercially viable *R. eriocalyx*, of Tunisia. Named by the 18th century naturalist and founding taxonomist Carolus Linnaeus, it has not undergone much taxonomical change since. Its Arabic name is ‘’ Iklil’’.

74. Plant form ranges from upright to trailing; the upright forms can reach 1.5 m tall, rarely 2 m. The leaves are evergreen, 2–4 cm long and 2–5 mm broad, green above, and white below with dense short woolly hair. Flowering is common in mature and healthy specimens and occurs in summer in the north, but the plants can be ever blooming in warm-winter climates. Flower colors are variable, being white, pink, purple, or blue.

75. Since it is attractive and tolerates some degree of drought, it is used in landscaping, especially in areas having a Mediterranean climate. It is considered easy to grow for beginner gardeners, and is pest-resistant. Rosemary grows on friable loam soil with good drainage in an open sunny position. It grows best in neutral to alkaline conditions with average fertility. Rosemary is easily pruned into shapes and has been used for topiary. When grown in pots, it is best kept trimmed to stop it from growing wild. It can be propagated from an existing plant by clipping a shoot 10–15 cm long, stripping a few leaves from the bottom, and planting it directly into soil.

76. Tunisia is a Mediterranean country where many aromatic plants (AP) such as Rosemary, *Myrtus comminus, Thymus capitatus* etc grow naturally. Rosemary constitutes a durable biological product used in pharmaceutics, cosmetics and food etc.

77. Because of its economic, environmental and social values, Rosemary was highly regarded by the Ministry of Agriculture (MoA) which has invested considerably in its protection and rational use through research, planning and development, production, regeneration and valorization of the produce.

78. Rosemary is a perennial plant (chamaephyte) that usually grows in the guarrigue type of vegetation and under forests of pine (*Pinus halepensis*), *Tetracnilys articulata* or *Juniperus* sp. It is found in various bioclimates from the sub-humid to the upper arid. But it is widely dominant in the semi- arid Mediterranean bioclimatic stage.

79. In Tunisia it's found in the centre of the country: Kasserine, Kairouan, Siliana and Zaghouan, and in the North-west: Le Kef. It is also found in small stretches in the North-east; the Medjerda valley, the Cap Bon and even in the south; Matmata.

80. Rosemary grows in Tunisia, naturally in "shrub" type formation which is characteristic of the Mediterranean climate. It is resistant to prolonged droughts. The plant association which characterizes the shrub formation in the garrigue is composed essentially of *R. officianalis, myrtus comminus, arbutus unedo, Erica arborea, pistachia lentiscus, cistus monspellensis* and *C. laurifolius*. In Tunisia, Rosemary is also planted but in restricted areas.

81. 90% of forests in Tunisia are State owned including 340.494 hectares (ha) occupied by Rosemary. Private owners own some 4 300 ha. MoA, General Directorate of Forests (GDF) and Forest Harvesting Agency (FHA) are responsible of management, protection and exploitation of the Rosemary resource in the country.

82. As most of the Rosemary areas belong to the State, MoA is responsible for its management and exploitation with the objective to keep sustainable production. GDF develops and implements an action plan based on two to five years rotation and according to the state of the resource. The whole area is divided into groups based on two, three and five year rotation. This method of controlled exploitation guarantees continuous regeneration of the Rosemary vegetation.

83. Forestry legislation in Tunisia obliges the GDF to ensure that the exploitation of the resources is done on a sustainable basis following the rotation system and adequate harvesting techniques.

84. Rosemary plant is used for many purposes:

- Leaves of rosemary are used fresh or dry in traditional Mediterranean cuisine. They can be used to make infusion.
- Upper parts of rosemary are used to extract essential oil for use in perfumes, pharmaceutics, and other cosmetic products

85. In Tunisia, the exploitation of Rosemary spans two periods; distillation period from March to June and drying period from March to September. The method of production is fixed depending on the end use of the plant

86. i) Use of fresh and dried leaves:

- For this purpose, the upper parts of the twigs and branches of 5mm diameter are collected. The twigs with leaves are dried in the shade.

ii) Use for extraction of essential oil;

- The extraction of essential oil is done following an old traditional way namely extraction by water vapor. The harvest (leaves and twigs) is placed in the "alembic" with a capacity of about 800 kg. When water is heated, the vapor goes through the vegetal matter taking with it the essential oil and passes in a tube swimming in cold water. The vapor condenses in a recipient where the essential oil less heavy than water is recuperated at the surface.

87. Companies, Non Government Organizations (NGO) and the private owners are involved in the production and business of Rosemary. Many activities were developed and jobs created in this system of production from exploitation of the green matter by the local population to extraction of essential oil by specialized distillers to transport, storage, trade and export by companies.

88. Exploitation of rosemary is organized by the DGF and the FHA following the elaborated action plan. The sale of right of exploitation on the State land is regulated by the forest law. The trade and marketing are regulated by the general country law on foreign trade.

89. Rosemary oil is a safety net for the local population. Its production generates for them an additional income of about 300 dollars US per worker per year. There are many stakeholders in the process of rosemary management, production and marketing. Among those we find public institutions, private companies, local population, NGOs, GDAs and the private sector.

90. The chain of rosemary has tremendous environment benefits for the country. Among these:

- Properly managed rosemary vegetation cover helps combat advance of desertification and protect soil against erosion
- The vegetation cover of rosemary and the associated species constitutes a habitat for rich biodiversity including rich wildlife
- Well conserved rosemary vegetation develops pollinators including bee keeping and production of biological products like bee honey

91. There are other recognized measurable benefits to rural communities and various strata of population. Among those benefits, it is important to mention:

- Employment opportunities to the local population. Thousands of jobs are created seasonally every year.
- Development and promotion of industrial and trade companies
- Contribution to the economy of the country including as source of foreign currency

92. In 2011, the cost of production of one (1 kg) of rosemary oil is about 28 dollars US. That includes harvesting of the product, handling, distillation, transport, storage, and trade.

93. The average of more than 90% of the national production is exported. The rest is consumed by the local market. The amount annually exported during the last few years averages 150 000 tons fetching US$ 3 million. It is largely exported to Saudi Arabia, France, Italy, Belgium, United Arab Emirates, and USA.

STONE PINE IN LEBANON

94. Stone Pine is one of the most important elements of the Mediterranean vegetation stages in Mount Lebanon. The impressive landscape of its forests, its distinctive shape and its edible seed (stone) contribute to the economic, social, cultural and environmental value of *Pinus pinea.*

95. Fruit of the stone pine (*P. pinea*) is commonly called pine nut in English, pignon in French and Sanawbar or boundok in Arabic (Boundok is also the Arabic name for hazelnuts).

96. Stone Pine (*P. pinea*) produces edible seeds, the pine nuts. The seeds of other pine species growing in Lebanon (*P. halepensis* and *P. brutia*) are not consumed in Lebanon. *P. pinea*, has been cultivated for its nuts for over 6,000 years, and nuts have been harvested from wild trees for far longer in the Mediterranean countries.

97. Depending on the species, pine nuts contain 10–34% protein, with Stone Pine having the highest content. They are also a source of dietary fiber. The nutrients are stored in the embryo in the centre. Although a nut in the culinary sense, the pine nut is a seed in the botanical sense. The shell must be removed before the pine nut can be eaten. Unshelled pine nuts have a longer shelf life if kept dry and refrigerated than the shelled nuts.

98. Pine nuts have been eaten in Europe and Asia since the Paleolithic period. They are a major component of the Lebanese cuisine and are added to meat, fish,
salads, vegetable dishes and sweets.

99. Throughout history, Stone Pine forests were over-exploited on a continuous basis by all the different invaders. During the period of the Ottoman occupation, and specifically between 1914 and 1917, and the French and British mandates that followed, large surfaces were harvested to cover the needs of the wars. Stone Pine Forests were almost entirely harvested and the slopes were left empty.

100. The majority of Stone Pine forests are located in the Metn (Mount-Lebanon) and Jezzine (South Lebanon). The largest number of pine nuts producers are found in the village of Ras el Metn.

101. Forests in Lebanon constitute an important natural resource. The main forest types widespread in Lebanon are *Quercus calliprinos, Q. infectoria, Q. cerris var. pseudo cerris, Juniperus excelca, Cedrus libani, Abies silicica, Pinus pinea, P. halepensis, P. brutia* and *Cupressus sempervirens*. The bulk of the forest area consists of Oak and Pine stands. In addition, the Lebanese forests contain a wide range of aromatic, wild, and medicinal plants.

102. Pine forests constitute the second largest type of forests (after oak-broadleaves) in the Lebanese landscape. Some 17,200 ha of the three pine species (*P. brutia, P. halepensis,* and *P. pinea*) are distributed in different bioclimatc stages, while the Stone Pine alone covers more than 46% of this surface (some 8,000 ha).

103. Woodlands (forests, other wooded lands and part of the other lands with trees) ownership in Lebanon is almost equally distributed between the private sector, public sector and religious communities, under several tenure systems. The users of the forest areas may not be the owners. Rentals, usufructs, customs and agreements are used to regulate this system. Forest workers, private rural companies or shepherds may be allowed to use the space under these usage systems. The ownership of Stone Pine forests follows the same pattern as the forests and other wooded lands.

104. Production of pine nuts from *P. pinea* forests remains one of the rare income-generating activities related to forests and other wooded lands. It would be affected by the open market strategies, mainly because of the high production costs and the competition by imported nuts. *P. pinea* stands are also affected by the uncontrolled urban sprawl, lack of labour, aging of trees and limited interest of the young generation in such an activity.

105. Most of the *P. pinea* forests currently existing in Lebanon are planted. A few single standing old trees are scattered in the landscape, in the villages, in the forests. In the absence of

any wood production, Stone Pine forests in Lebanon are the main type of forests with a primary production function.

106. Stone Pine tree starts to produce fruits (cones) around the age of thirty. It is a monoecious species, where female and male flowers are found on the same tree, but on different organs. The fertilized cone takes three years to reach maturity. During the first year, it is a small cone of up to 2 cm long; it becomes as large as a walnut during the second year; it reaches its full size during the third year. The cone reaches maturity during the fall of the third year after flowering. It is composed of brown scales, each containing two brown hard shelled seeds, covered with black dust. The pine nut is found inside the seed. Each tree bears at the same time cones of the three different growth stages.

107. After the cones are harvested between November and April, they are spread over a flat surface, under the sunshine, until they are fully opened. Then they are gathered and brought into the processing plant. They are put in a drum that separates scales and cones from the black seeds. Another drum breaks the black seeds and separates the tegument from the seed, the nut. A fan blows away the thin layer covering the seeds to reveal the beautiful white seed, the pine nut.

108. Plantation density of P. pinea in Lebanese forests is around 250-300tree/ha. At maturity and depending on the site, age and management trees produce between 15 and 750 kg of cones/year. Every 5 kg of cones produces 1 kg of seeds; every 5 kg of seeds produces 1 kg of pine- nuts.

109. Production cost varies with the density, management and interventions. Every 4 years the forest needs pruning; cleaning the undergrowth is done on a yearly basis; some farmers use fertilizers, mainly chicken manure to improve the growth and production. The average production cost would range between US$ 27 and 28 /kg.

110. Producers are organized in a syndicate, with around 530 members, both Lebanese and Syrians. Being organized, they are able to better protect the production and to exercise the appropriate pressure on the Government whenever it is needed.

111. Research and extension activities on Stone Pine remains limited, mainly because of the absence of a forest research institute and the absence of formal forest education.

112. In 2011, the whole sale price of pine nuts is US$ 40.00 /kg; the retail price varies between US$ 43 and 55, depending on the quality, size and cleanliness of seeds and on retail shop.

113. In order to protect national production from imported products (mainly from Turkey and Asia), the Ministry of Agriculture has imposed a tax policy of US $10/Kg of imported pine nuts. This tax policy increases the competitiveness of the national product.

114. According to the Syndicate of Producers of Pine Nuts, around 50,000 families depend on Stone Pine as their partial or major source of income. This involvement is spread over all the phases related to production, from forest management, weeding, cleaning, tree-pruning, and spreading of fertilizers to harvesting and processing.

115. There are around 100-150 processing units in the Mount Lebanon, mainly in the Metn area. The owners of the processing units buy the cones or the black seeds from producers in different parts of the country.

116. Processing units are usually family owned. They involve the participation of the family members (mainly women) and some external manpower. Being a delicate job, the final cleaning, sorting and packing is usually undertaken by women.

117. Like other types of forests, Stone Pine forests play a major role in the conservation of soil and water and in the provision of social and environmental products and services. In particular, they are known to be more fire resistant than other pine forests, mainly when they are properly managed. The landscape offered by Stone Pine forests is highly appreciated by Lebanese people and by foreigners who like to visit the regions where such forests grow.

118. Pine nuts are widely used in Lebanon, in the Middle-East and in all the Mediterranean Countries. It usually accompanies all kinds of dishes, meat, poultry, fish, vegetables and sweets. It is an important ingredient of many Mediterranean dishes. It is the main ingredient of the Italian Pesto (Pine nuts, basil leaves, garlic, Parmesan cheese and olive oil); a pine nuts ice cream is available in Italy.

119. According to the syndicate of producers of pine nuts in Lebanon, the yearly production is around 800 tons/year; according to data from the MOA the yearly production is around 600 tons/year.

120. Most of the production is consumed locally, or exported in small quantities by travelers while leaving Lebanon. It is only in 2010 that some 500kg were exported to the Gulf countries.

***Discussion and decision items*:**

121. Delegates may wish to provide their guidance and contributions to the following questions:

- Which additional NWFP are important in the region for their sizeable contribution to the livelihood and food security of the rural poor?
- What role for the NEFRC do members envisage regarding sharing of experiences at the regional level on the utilization, processing and marketing of these products?
- Should the NEFRC support the utilization, processing and marketing of these products? If so, through which means?