

The Cocoon and its application in the Middle-East

General

The Fanack team completed an analysis regarding the applicability of the Cocoon in a number of core countries in the Middle-East. It is an initial analysis based on geological, soil, meteorological and socio-economic data. The information taken from diverse sources on the Internet and supported by satellite images, proved to be very useful as a basis for the analysis.

The areas with the best opportunities for the engagement of the Cocoon have been determined by setting a number of criteria which were applied to the collected information. For example, the degree of soil development, minimum required rainfall and the presence of a rural infrastructure were considered as important criteria. In addition, the analysis included an assessment on typical activities where the Cocoon could be applied. It became clear that the most promising activities for applying the Cocoon are in the (re)-forestation of degraded areas, the upgrading of nature reserves, and in innovations for agriculture.

Country	Geographic Unit	Main rock types	Rainfall (mm/year)	Planting (re)-forestation/nature reserves	Planting for agriculture
Israel	Northern mountains	Chalk/limestone/marl/basalt	500-1100	Aleppo pines, oaks, terebint, and carob	Apples, pears, cherries and grapes
(same)	Western hilly area	Limestone/chalk/marl	500-700	Aleppo pines, terebint, and carob	Grapes
Jordan	Western highlands	Limestone/marl	300-500	Oaks, pine trees, pistachio	Olives, grapes, nuts
Lebanon	Western mountains	Limestone/chalk/sandstone/basalt	600-1400	Cedars, oaks, cypress, pine trees, willows, and juniperus	Grapes, olives, figs, citrus
West Bank	Central mountains	Limestone/marl	300-600	Pine trees, oaks	Olives, grapes, figs, nuts, mango
(same)	Western hilly area	Limestone/chalk/marl	500-600	Pine trees	Olives, grapes, figs, almonds
Gaza	Coastal area	Sand/loess/clay	225-450	Cypress	Olives, grapes, figs, almonds

Table 1: Promising areas for- and application of the Cocoon in 4 focal countries in the Middle-East

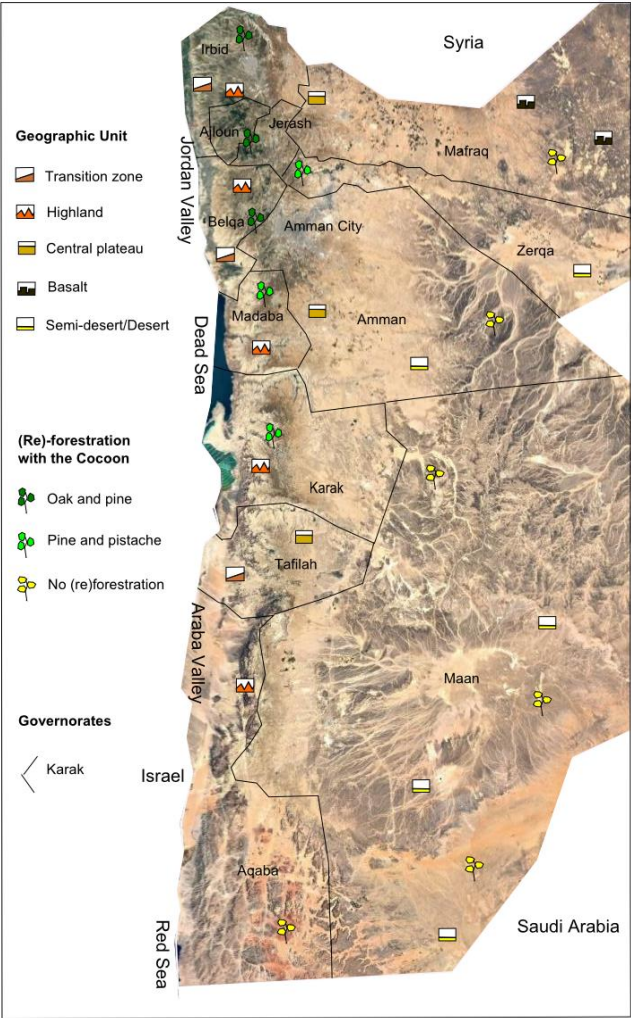
The most suitable areas for the engagement of the Cocoon are the northern and western parts of the mountain ranges and hilly areas in (most of the) investigated countries (see Table 1). For a large part these areas consist of limestones and chalky rocks where soils have developed locally. Additionally, these areas are characterised by reasonable amounts of rainfall in the winter season and drought during the summer. The Cocoon can be of great value in restoring and maintaining the original landscape by planting oaks, pine trees, cedars, cypresses, etc in areas designated for (re)-forestation

and nature conservation. The planting of trees - especially on terraces - enhances water management since more water is retained in soils and less water flows down water courses with the risk of eventually being wasted in lakes and wetlands where the water quality is poor.

More information regarding the applicability of the Cocoon for the focal countries Jordan and Lebanon has been compiled in the next sections of this report. There is no doubt that the Cocoon can play a prominent role in the Middle-East, not alone in the most promising focal countries, but also in other regions with sufficient rainfall for the development of useful nature and sustainable agriculture.

Jordan

Jordan is one of those Middle-East countries where the western highlands were originally covered with woodlands which have - almost - disappeared to a large extent as a result of human activities and climate change. In addition, the steppe area east of the highlands has lost much of its original vegetation. The map (see opposite Figure) of Western and Central Jordan shows that in the northwesterly highlands the Cocoon can play an important role in (re)-forestation projects, in particular where the planting of oaks and pine trees is foreseen. The young trees (seedlings) take advantage of the water stored in the Cocoon and irrigation is not necessary. More towards the east and in the central highlands there are also opportunities for pine trees, and for the planting of pistache trees and other types of vegetation. In the eastern desert area, there is hardly any scope for planting trees, using the Cocoon concept. Perhaps some depressions fed by groundwater (e.g. near springs) offer opportunities for tree planting, but only at a limited scale.



Re-forestation will primarily take place in the non-arable lands in the western highlands and adjoining steppe areas. For selected governorates of Jordan, the surface areas of these lands have been estimated in the range between 31,000 en 726,000 hectares (see Table 2). The number of hectares within these lands which are suitable for (re)-forestation and the engagement of the Cocoon, might vary between vary between 3,200 to 26,000. Suitability of the land depends on the development of soils or scope for the construction of terraces, and the assumption that sufficient amounts of rainfall are received. It is noted that the mentioned numbers are rough estimates that will have to be confirmed by further field investigations.

Agriculture is practiced in arable areas where soils have developed to such an extent that efficient plowing can take place and crops can be cultivated. These arable areas cover only a few percent of the total area of Jordan. Surface areas of these arable lands have been determined for governorates and range between 7,900 en 47,000 hectares (see Table 2). For the planting - on these lands - of olive trees, vineyards and nut trees without irrigation, the application of the Cocoon concept will be advantageous. The number of hectares possibly available for this application has initially been estimated at 10% of the acreage of arable land. In this respect one has to realize oneself that by far the largest share of the arable lands is used for the cultivation of rain-dependant cereals, and substantial areas are covered by fruit trees.

<i>Governorate</i>	<i>Arable area (hectares)</i>	<i>Partially suitable for agricultural tree planting without irrigation (hectares)</i>	<i>Non-arable area (hectares)</i>	<i>Partially suitable for tree planting for (re)-forestation without irrigation (hectares)</i>
<i>Irbid</i>	47,400	(4,800)	109,500	(8,400)
<i>Ajloun</i>	10,500	(1,100)	31,500	(3,200)
<i>Jerash</i>	7,900	(800)	33,100	(3,300)
<i>Balqa</i>	22,800	(2,300)	89,200	(6,500)
<i>Amman</i>	31,400	(3,100)	726,500	(16,400)
<i>Madaba</i>	12,500	(1,200)	81,500	(5,900)
<i>Karak</i>	30,500	(3,000)	319,000	(24,600)
<i>Other governorates</i>	148,600	(14,900)	7,177,500	(69,900)
<i>Total Jordan</i>	311,600	(31,200)	8,567,800	(138,200)

Table 2: Governorates with potential surface areas for the application of the Cocoon. Numbers between brackets need verification

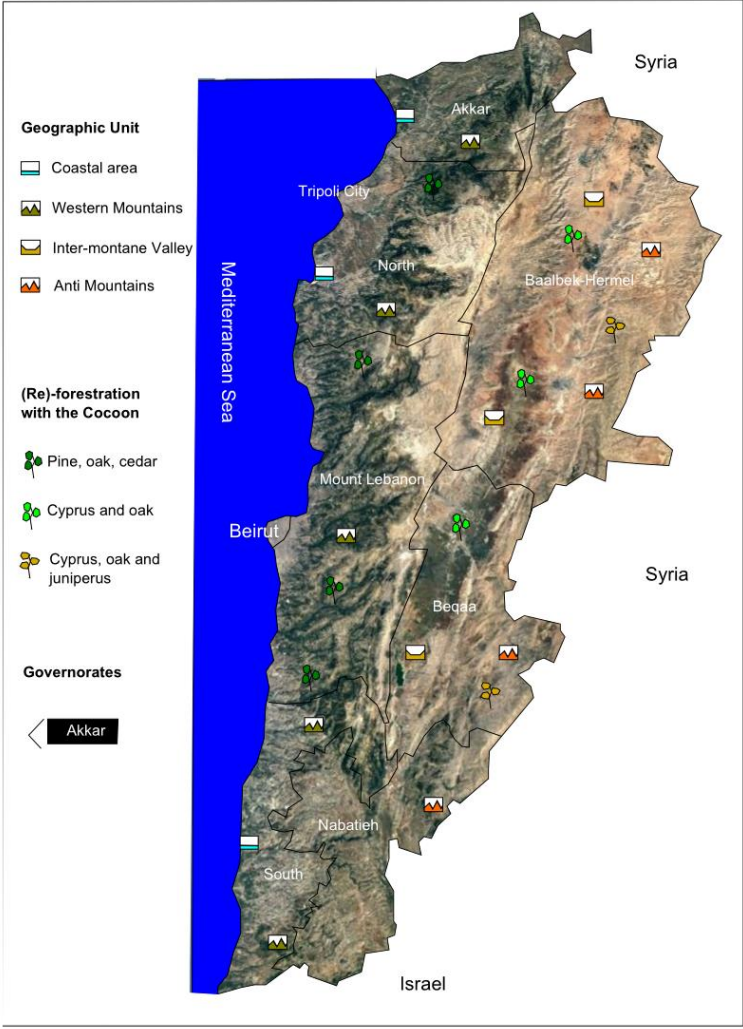
With regards to the application of the Cocoon in Jordan, the following conclusions can be drawn: 1) There is certainly scope for the application of the Cocoon, in particular for (re)-forestation in the western highlands of the country, 2) Re-forestation by planting oaks, pine and pistachio trees aims the partial restoration of the original vegetation of the country, 3) The surface area suitable for (re)

forestation in Jordan could be in the order of magnitude of 100,000 hectares, dependant on the results of further field investigations, 4) The Cocoon concept may also be applied in agriculture where the planting of olive trees, vineyards, and nut trees may profit from the instrumentation.

Lebanon

By origin Lebanon is a country with large forest areas resulting from substantial amounts of rainfall in the winter season. The areas are situated to a large extent in the western mountain ranges. Partly, the forest areas have degraded as a result of human activities and climate change. In addition, the Bekaa Valley and the so-called Anti Mountains easterly of the western mountain range, have suffered a reduction of the original flora. The map (see opposite Figure)

of Lebanon shows that in the western mountain range the Cocoon can be an essential asset in activities for (re)-forestation, in particular concerning the planting of pine trees, oaks, and cedars. The seedlings benefit from the stored water in the Cocoon, effectively eliminating the need for irrigation. In the Bekaa Valley and the Anti Mountains there are also opportunities for the planting of oaks, cypress, and juniperus.



Re-forestation will concentrate on the planting of trees in non-arable areas in the mountainous highlands. For the governorates with the most promising outlook for (re)forestation

in Lebanon, the surface areas of these lands have been estimated between 38,000 and 180,000 hectares (see Table 3). Also in the other governorates of Lebanon there are good opportunities for (re)-forestation. The number of hectares in the non-arable areas which are suitable for (re)-

forestation and the engagement of the Cocoon could range from 3,800 tot 18,000. Suitability of an area depends on sufficient soil development and opportunities for the construction of terraces. The quoted numbers are only rough estimates and should be confirmed by further investigations on site.

Agriculture is practised in arable areas where extensive soil development has taken place enabling farmers to plow and cultivate the land in a wider area. In Lebanon these arable lands occupy around 20 tot 30% of the total surface area of the country. Surface areas of such lands in a number of governorates have been estimated to vary between 18,000 en 40,000 hectares (Table 3). For the cultivation of olive trees, vine yards, fig- en nut trees on these lands where irrigation systems are usually not installed, the introduction of the Cocoon technology will be beneficial. The number of hectares that could be available for tree planting with the Cocoon has been estimated at 10% of the surface area of arable land. In this regard it is noted that the largest part of the arable areas is characterised by the cultivation of rain-dependant cereals, and large areas are also occupied by fruit trees.

<i>Governorate</i>	<i>Arable area (hectare)</i>	<i>Partially suitable for agricultural tree planting without irrigation (hectares)</i>	<i>Non-arable area (hectares)</i>	<i>Partially suitable for tree planting for (re)-forestation without irrigation (hectares)</i>
<i>Akar</i>	40,200	(4,000)	38,600	(3,900)
<i>North</i>	22,000	(2,200)	108,000	(10,800)
<i>Mount Lebanon</i>	17,900	(1,800)	177,900	(17,800)
<i>Other provinces</i>	198,000	(19,800)	404,600	(40,400)
<i>Total Libanon</i>	278,100	(27,800)	729,100	(72,900)

Tabel 3: Governorates with potential surface areas for the application of the Cocoon. Numbers between brackets need to be verified

Concerning the engagement of the Cocoon concept in Lebanon, the next conclusions are likely to be valid: 1) The combination of the high amount of rainfall in the winter and a pertinent dry summer season promotes the use of Cocoon technology for (re)-forestation, in particular in the western mountain ranges of the country, 2) Re-forestation by the planting of seedlings of the Aleppo pine, oaks, cypress, juniperus, and especially cedars, as the national pride of Lebanon, will stimulate the restoration of the original flora of the country, 3) The surface area which may be used for (re)-forestation in Lebanon may be in the order of magnitude of 70,000 hectare, depending on the outcomes of further field investigations, 4) The Cocoon may also be applied in agriculture where the planting of olive trees, vineyards, fig- and nut trees may benefit from the introduced technology.