

# Reforestation for environmental services as valued by local communities: a case study from Lebanon

Reforestation  
for  
environmental  
services

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Received 16 July 2019  
Revised 28 January 2020  
Accepted 17 October 2020

## Abstract

**Purpose** – Lebanon has been subject to important reforestation activities which resulted in the establishment of several cedars, pine and other mixed forest stands on communal lands. These stands are not designated for timber production but rather for nonwood forest products (NWFPs), landscape restoration and for environmental services. The study aims at valuating old reforested sites from the perspective of rural communities neighboring those reforested stands.

**Design/methodology/approach** – To assess the non-timber goods and services provided by these forest ecosystems, 13 reforested sites located in different regions in Lebanon were selected. The socioeconomic assessment was done using questionnaires distributed to locals that have close interactions with the neighboring forests; it included, among others, a double-bounded dichotomous contingent valuation (CV) related to their willingness to pay (WTP) for reforestation and forest management activities.

**Findings** – Results of the goods and services assessment revealed that the forests have multifunctional uses with ecotourism as a major activity in all forest types. The CV showed that 75% of respondents did express a WTP. Most of the respondents did so, thus giving a great importance to intrinsic values of the forests. Lower income did not negatively affect the WTP of respondents but rather age and the educational level did. Other factors such as forest type, forest surface and the biodiversity status of the sites did not have an impact on WTP.

**Practical implications** – These results are very informative for governmental policies seeking funds to perform reforestation programs for environmental objectives, involving local communities in co-funding these programs would help insure the sustainable conservation of reforestation sites.

**Social implications** – Despite their relative low income, poor communities are willing to pay to sustain forests and their ecosystem services.

**Originality/value** – It is the first time that a CV is used for ecosystem services regenerated from 50–60 years old reforested sites in a semiarid region, where trees are not planted for timber production. It is one of the few

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This work was supported by the Association for Forests, Development and Conservation (AFDC) through assistance in the field survey and in the selection of the forested sites. The work was realized as a thesis at the Lebanese University Master Program entitled “Biodiversity, Management and Conservation of Natural Resources.” This research did not receive any specific grant from funding agencies in the public, commercial or not-for-profit sectors.

*Declarations of interest:* none



Forestry Economics Review  
Vol. 2 No. 1, 2020  
pp. 97-115  
Emerald Publishing Limited  
2631-3030  
DOI 10.1108/FER-07-2019-0017

examples were lower income did not affect the WTP for forests providing environmental services on communal lands.

**Keywords** Reforestation, Socioeconomic assessment, Contingent valuation, Willingness to pay, Goods and services

**Paper type** Case study

## 1. Introduction

Lebanon is a small country in the eastern Mediterranean Basin. Forests have been historically supplying timber from its prominent coniferous trees to past civilizations of the Near East. However, the dependency of people on these resources led to the degradation of once extensively distributed forests. Reforestation programs were initiated at the starting of the 1960s under the “Green plan,” while timber production from conifer species was prohibited by law since 1996. Reforestation initiatives were carried out on communal lands, which were owned by village communities and managed by their respective municipalities. The purpose was to increase the total forested area to over 30% of the Lebanese territory through the establishment of mixed stands including conifer and hardwood trees (Talhouk *et al.*, 2001). Some of these sites are currently part of protected areas such as the Shouf Biosphere Reserve (SBR), while others are neglected. Forests in Lebanon cover around 13.4% of the country (FRA, 2005, 2010, 2015). Since the government has to address other priorities than reforestation, these initiatives are highly dependent on external financial resources from different donors and from the private sector. As the current legal framework prohibits timber exploitation, private landowners are reluctant to invest in tree plantations (Sarkissian *et al.*, 2017). Yet, Mediterranean forests are known to provide public goods and externalities such as watershed and soil protection, landscape and aesthetic services, climate and carbon regulation and non-timber forest products (Croitoru, 2007; Palahi *et al.*, 2008). However, in Lebanon, these were only ranked according to their importance (goods separated from services), but no economic value was estimated except for major products like pine nuts and charcoal (FRA 2005, 2010 and 2015) or by estimating the total economic value (TEV) in the SBR and the Jabal Moussa Biosphere Reserve (JMBR) (El-Jisr *et al.*, 2015; Karam, 2016).

Another investigation used mixed methods in a survey with landowners with three option choices: results-based loan, action-based grant and results-based payments. Qualitative examining revealed economic, social and legal repercussions that limited willingness to participate in the results-based contract option for planting forest trees on private land (Sarkissian *et al.*, 2017). These studies showed that it is pertinent to know if local communities value forest goods and services as a key step to understand if they are willing to mobilize their resources to sustain those reforestation initiatives on communal lands.

The basis of the economic valuation of ecosystems is the study of both goods and services provided by these ecosystems to society. The concept of TEV includes the sum of all the values of the goods and services provided by the ecosystem. In the absence of direct and indirect prices, hypothetical markets are created in order to get these values (Pascual *et al.*, 2010). The TEV takes into account both use and nonuse values of ecosystems (Boman *et al.*, 2001; Hein *et al.*, 2006). With the presence of nonuse values, stated preference approach is needed. Stated preference methods use hypothetical changes to simulate market and demands and changes in ecosystem services. The use of stated preference approach allows in reflecting more scenario variations, compared to real-world situations (Adamowicz *et al.*, 1998). Among the main types included in the stated preference methods is the contingent valuation (CV) method. CV consists in administering a questionnaire to people in order to know the willingness to pay (WTP) for an improvement in an ecosystem service or the willingness to accept (WTA) the loss of this ecosystem service (Pascual *et al.*, 2010).

Theoretically, the WTP and WTA should be similar; however, studies have shown that for similar ecosystem services, the WTA exceeds the WTP (Vatn and Bromley, 1994). CV provides results that are directly dependent on the hypothetical markets assumed for the suggested service (Mavsar *et al.*, 2014). Thus, CV can be used when market information is missing and is widely adopted in economic valuation of environmental goods (Georgiou *et al.*, 1997). According to Haab and McConnell (2002), the dichotomous or discrete CV is a format where the respondents are asked simple “yes” or “no” questions. Generally, the double-bounded dichotomous format is preferred since it avoids many biases that can occur in the CV method (Belete and Assefa, 2003). Moreover, the dichotomous choice format is used because it reduces cognitive burden on respondents since it uses real-life decision-making prices and can have high incentive compatibilities depending on the circumstances (Carson *et al.*, 2000). WTP has been applied for a wide array of environmental studies such as the payment for environmental public goods (Baumgärtner *et al.*, 2017), the behavior of forest landowners to embed voluntary forest conservation actions in their forest management plans (Rabotyagov and Lin, 2013) and payment for environmental conservation (Han *et al.*, 2011). In the Eastern Mediterranean region, WTP enabled the valuation of the impact of climate change on rangeland ecosystems (Fleischer and Sternberg, 2006). Nonetheless, these investigations target either landowners or citizens of big urban areas.

The aim of this study is to assess the goods and services provided by old reforested sites and to value their socioeconomic and environmental importance. This would help to assess the long-term socioeconomic value and cost-efficiency of reforestation plans and the possibility to autofinance these activities through the contribution of local communities. The results would also allow assessing the stewardship of neighboring communities for such initiatives. Hence, this investigation answers two questions:

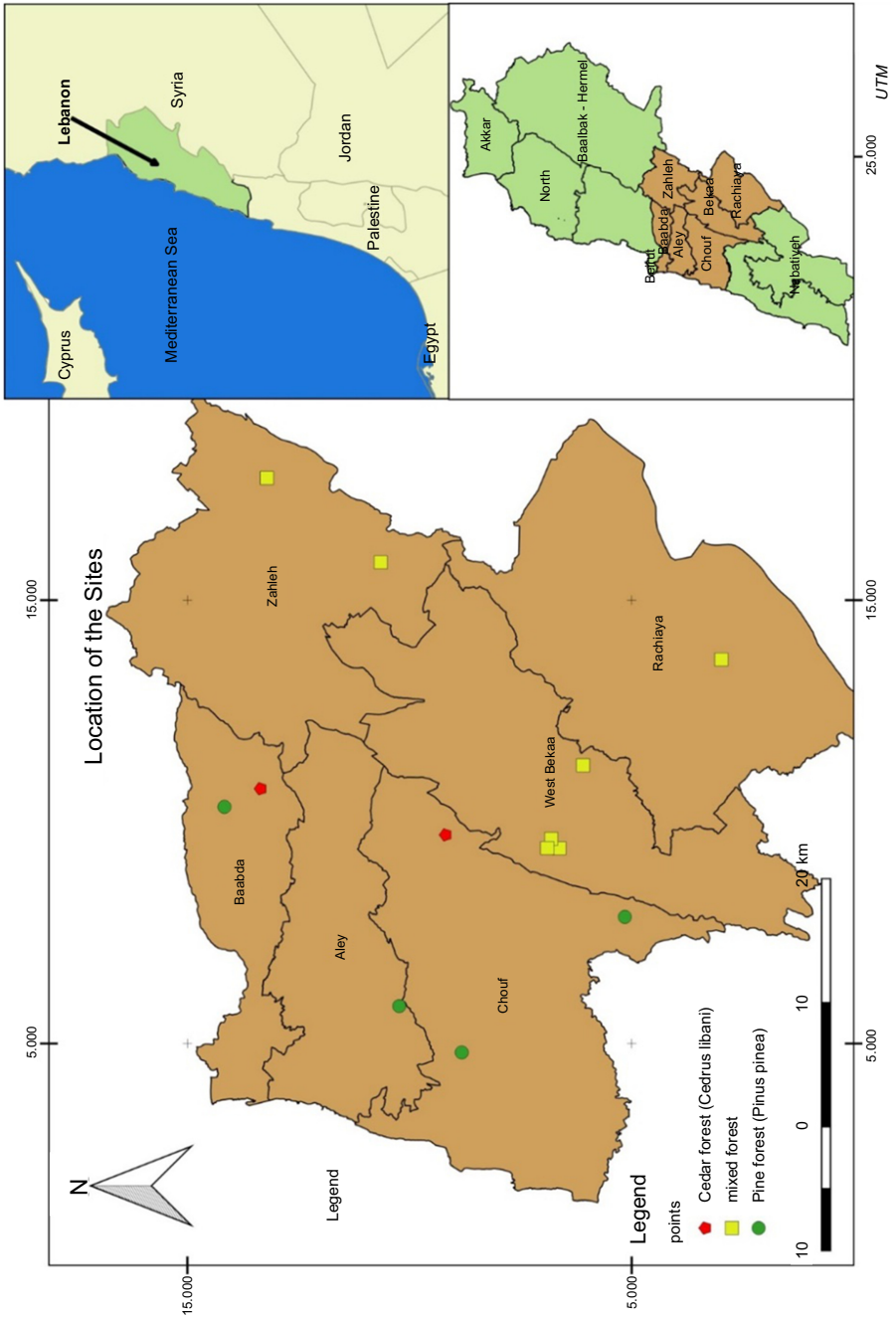
- RQ1. What are the main goods and services provided by old reforested sites as perceived by the neighboring communities?
- RQ2. Are the local communities willing to pay for the conservation and management of these sites to sustain those services?

## 2. Material and methods

### 2.1 The study area

A total of 13 reforested sites that were part of old reforestation activities that took place under the Green Plan were selected. The sites were distributed over different villages in different administrative districts as shown in Figure 1. Site selection took into consideration the following criteria: forest type and species composition, forest ownership, protection status and forest bioclimatic zones. Selected sites were representative of the diversity of these criteria along the country. Further, two sites included cedar forests (*Cedrus libani*), four sites included stone pine forests (*Pinus pinea*) and the remaining seven sites were mixed forests combining several types of native (*Cedrus libani*, *Pinus pinea*, *Pinus brutia*, *Cupressus sempervirens*, *Quercus calliprinos* and *Quercus infectoria*) and non-native species (*Cupressus arizonica*, *Pinus canariensis*, *Robinia pseudoacacia*, etc.)

The sites had different surface areas and were selected based on different altitudes and bioclimatic zones. Appendix 1 summarizes the geographic coordinates of each site including its area and the type of forest. All the selected sites are found on communal lands (owned by all the village population) except one pine site in Jisr Al Qadi village, that is, the property of a religious community. One site (Barouk) is within a United Nations Educational, Scientific and Cultural Organization (UNESCO) biosphere reserve, while other conifers are protected and not exploited for timber, while stone pine is generally exploited for pine nut production.



**Figure 1.**  
Locations of the  
selected  
reforested sites

## 2.2 Data collection

A questionnaire was developed and distributed to 253 respondents in 13 villages surrounding the reforested sites (see full questionnaire in [Appendix 2](#)). Surveys were filled to the extent possible with beekeepers, shepherds, hunters, plant collectors and guides to ensure that direct beneficiaries from the forest are included. Forest guards and local authorities were approached as well in order to validate managerial activities and get general information about the forest. In addition, respondents' panel included a wide category of people having different types of occupations that would be the larger public potentially benefiting from the forests. Hence, all respondents were adults and randomly distributed between genders. The survey was conducted between May and July of 2017.

The questionnaire objectives were (1) the assessment of the goods and services and the socioeconomic value of reforested sites through the identification of the main activities undertaken in the forests, followed by a valuation scenario in order to understand the importance value of the forests ([Mavsar et al., 2014](#)). (2) The estimation of the peoples' WTP for the conservation and management of the reforested sites and their expansion through further reforestation activities using the CV method was used to estimate the economic value of nonmarket goods or hypothetical markets in which people were asked to state monetary bids for this good ([Hanemann et al., 1991](#); [Venkatachalam, 2003](#)).

The detailed survey included combined general information about goods and services with a WTP question. The questionnaire also consisted of a multiple answer format and a double-bounded dichotomous choice WTP format ([Belete and Assefa, 2003](#)). General knowledge about the goods and services provided by the forests, socioeconomic and demographic information was collected from the respondents, in addition to the WTP question regarding the implementation of a management plan and the increase of the forest area that was proposed to the respondents.

The WTP section included ([Belete and Assefa, 2003](#)):

- (1) The stated scenario is a hypothetical description of the change that will occur in the good or the service or the program that will be implemented. It should be designed in a way that respondents are able to understand the context of the scenario ([Johnston et al., 2017](#)). While conducting the surveys, the valuation scenario was stated directly to the respondents. First, the baseline was described to the respondents mentioning the reforestation efforts in the 1960s, followed by the conditions under which the change will occur; in this study, the scenario included implementing a management plan in collaboration with the local communities for the already established old reforested sites to reduce the risks of reverse degradation, improve the landscape and increase the production of goods and services. The scenario also stated the possibility of expansion of these sites through the implementation of future reforestation activities, with a payment vehicle through the local authority (i.e. municipality, biosphere reserve management team or the religious committee).
- (2) A double-bounded dichotomous form was used in this study as shown in [Figure 2](#). In our case, first the respondent was asked if he/she has a WTP to implement the program. When the answer was "yes," a double-bounded dichotomous form was used, where the individual was asked if he/she would be willing to pay the stated amount of 30,000 LBP (equivalent to 20 USD during the survey period [1]); if he/she answered "yes," the amount was doubled to 60,000 LBP; if he/she answered "no," the amount was reduced to 15,000 LBP. The amount of bids for the WTP is based on the TEV per hectare of the SBR and the JMBR and the number of inhabitants around these reserves that are benefiting from their services (i.e. around ten persons per hectare) ([El Jisr et al., 2015](#); [Karam, 2016](#)).

- (3) The WTP question was followed by the understanding and certainty questions in order to comprehend the reasons behind expressing or not expressing a WTP.

Finally, socioeconomic and demographic information was collected regarding the age classes (20–40, 40–60 and above 60 years old), gender, education level (primary/secondary, technical and university), type of residency (permanent or summer resident) and income ranges (<1M, 1M–2M, 2M–3M, 3M–4M and >4M LBP).

### 2.3 The data analysis

The CV method was used to estimate all uses of the selected sites including direct and indirect services and nonuse values such as bequest and existence values.

The data were analyzed using XL-STAT statistical analysis software. Multiple answer questions were analyzed using multiple responses since respondents were allowed to tick all the options that applied to the question.

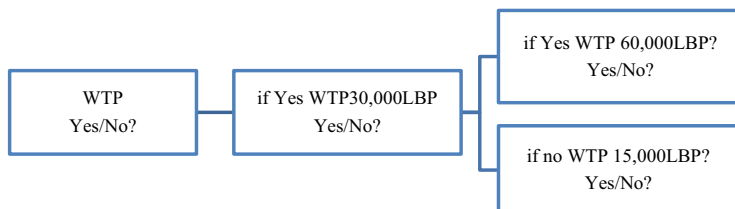
WTP was analyzed using bar charts, according to several factors including socioeconomic, potential biodiversity and surface area of the selected forests, forest type, etc. We used correlation and the principal component analysis to depict what factors affect the most the WTP.

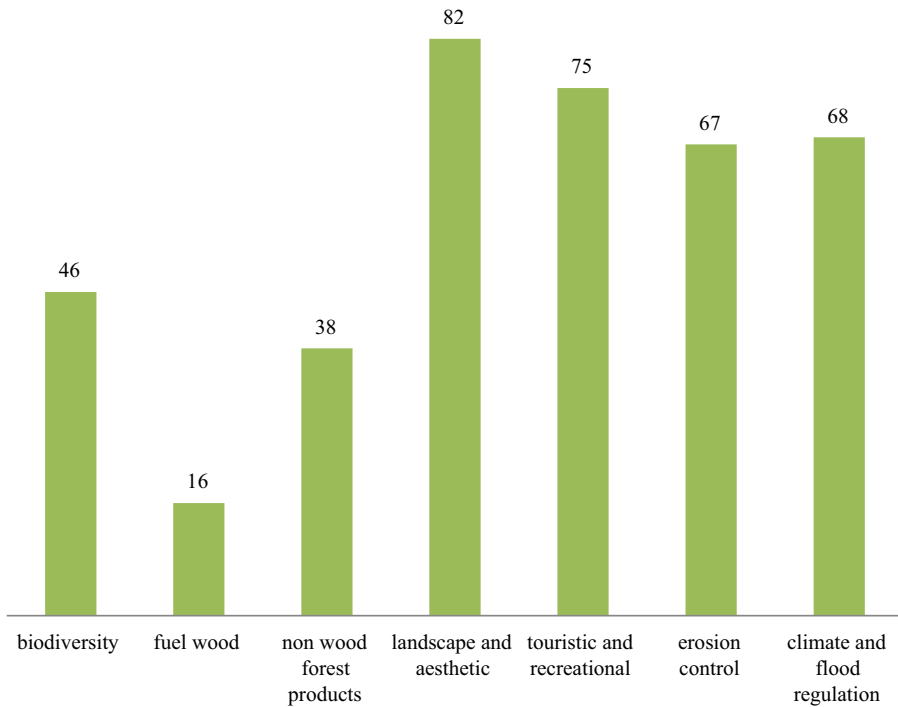
## 3. Results and discussion

In total, 253 people were interviewed, in which 66% were men and 34% were women. Of the respondents, 63 and 10% have attended primary and technical schools, respectively, and only 27% have reached university level in their studies. Regarding the distribution of the respondents' income ranges, only 7% earn more than 3 M LBP, while the majority get monthly wages below 1 M LBP. For more information about the socioeconomic features of respondents, please refer to [Appendix 3](#). [Figure 3](#) shows the importance value that locals attribute to the mostly cited forests including landscape/aesthetic and touristic/recreational services (respectively, 82 and 75% of the answers), even though not all selected reforested sites provide ecotourism services at the same level of importance. This confirms people's recognition for the added value of a forest landscape ([Sattout et al., 2007](#)). Roughly half of the respondents considered that the reforested sites have an intrinsic biodiversity value and that the loss of such ecosystems would have negative repercussion on biodiversity. They also reckoned the role of forested sites in regulating and supporting services like erosion control and climate/flood regulation. Ecotourism was the only income-generating activity that was mostly cited since these forests were not dedicated initially for the exploitation of wood and nonwood forest products (NWFPs) (except for pine nuts). It was also clear that goods (fuel wood and nonwood products) are less important in reforested sites. These activities are either prohibited (like timber exploitation and wood cutting) or accessible to a limited number of beneficiaries (i.e. NWFPs).

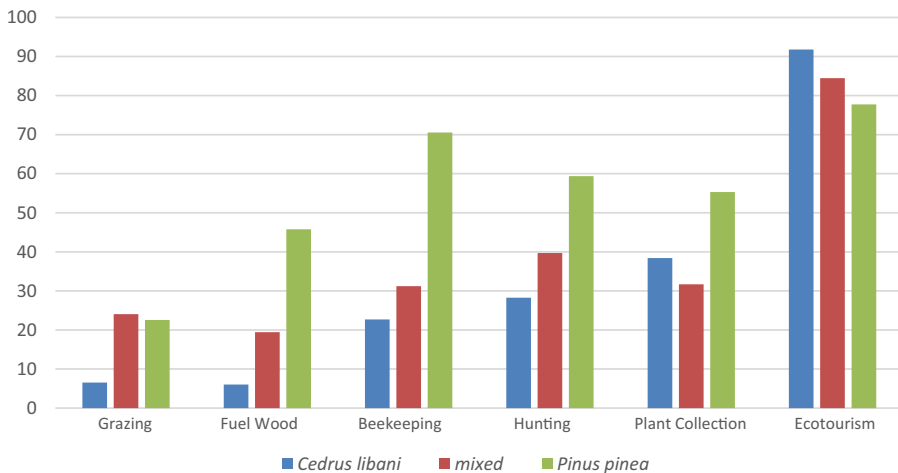
[Figure 4](#) illustrates the goods and services provided by the different types of forests selected for this study as seen by respondents. The chart revealed important variations between the goods and services provided by the selected forests. Ecotourism remains the major service in all forest types, mostly in cedar and mixed forests. Cedar forests seemed to provide important ecotourism services which is in line with the TEV that was calculated for

**Figure 2.** Double-bounded dichotomous form used for contingent valuation





**Figure 3.** Reforested sites' goods and services importance values as seen by respondents (in % of responses with multiple choices)



**Figure 4.** Goods and services provided by each forest type sites as seen by respondents (in % of responses with multiple choices)

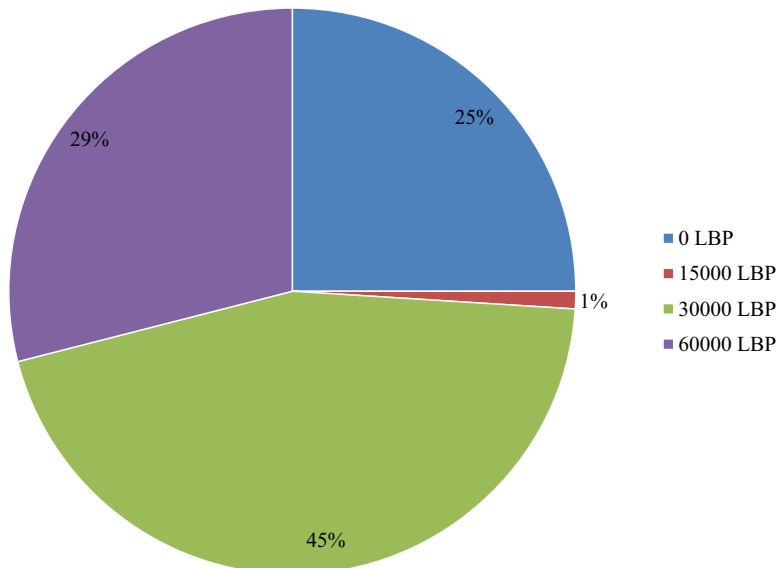
the SBR that includes the largest cedar forest in Lebanon (El Jisr *et al.*, 2015). Grazing and the removal of fuel wood are particularly low in cedar forests since these are mostly in protected areas. Stone pine forests exhibit a multiple functionality with significant provision of other goods and services in comparison to other forest types, while mixed forests have intermediate values in general. The diversity of goods and services provided is attributed to the high

biodiversity and the multifunctionality of Mediterranean forests (Palahi *et al.*, 2008). These findings confirm that when it comes to insuring the sustainability of the goods and services provided, it is important to take into consideration biodiversity in the management of these forests (Larrieu and Gonin, 2016).

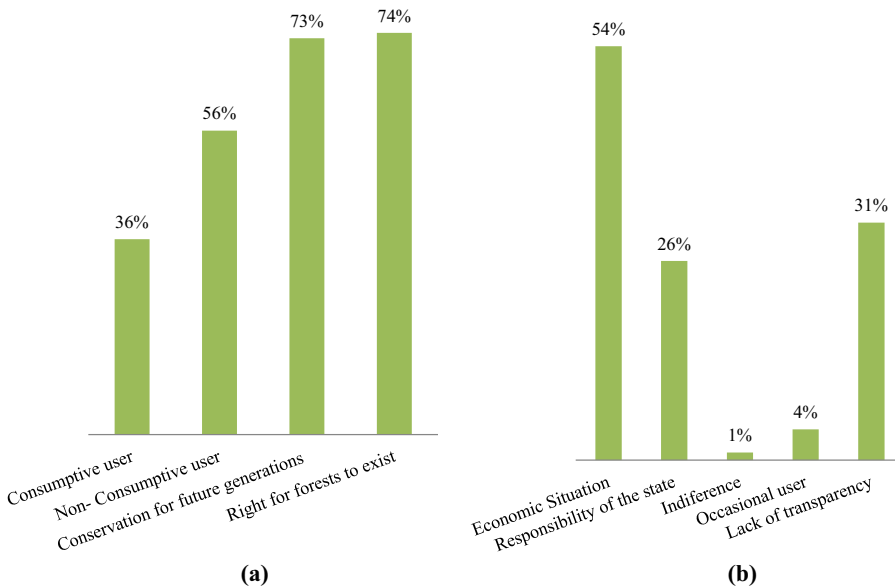
Figure 5 shows that 75% of the interviewees are willing to pay for forest management to sustain ecosystem services, where 45% of the respondents stated amount of 30,000LBP and 29% of the respondents doubled the stated amount. Only 25% did not express a WTP and rejected both bids. Reasons behind the WTP varied a bequest and nonuse value (right of forests to exist 74% and conservation for future generation 73%), direct use values (36%) and indirect use values (56%) as illustrated in Figure 6a. Causes of nonexpression of a WTP were mostly the economic situation of the respondent (54%) and the lack of transparency of the implementing bodies (31%) as shown in Figure 6b.

In the second step, we analyzed factors affecting the WTP. PCA results did not show any significant factor driving the WTP of respondents (Appendix 4). The forest type did not significantly affect the WTP among respondents, although variation existed among forest types (81% for cedar, 75% for mixed and 70% for pine forests) as shown in Figure 7a. Fewer people were willing to pay for pine forests, confirming that WTP is not exclusively linked to the type and number of services provided by these forests. Pine nuts extraction in communal lands is leased by the municipalities on a yearly basis, with one-third of the amount of the revenues used in a revolving fund for reforestation activities. This would explain the reluctance of the respondents to have a WTP as they consider that there is enough fund to sustain the forest management. WTP was expressed in other mixed conifer forest stands; in some areas, there is a certain concern toward the presence of the forest and that WTP is not only linked to the types of services provided by these forests but also to their landscape, intrinsic and regulatory values, legal protection of conifers and land ownership. This gives an important indication on the level of concern that people express toward these forests, regardless of their type.

WTP decreased with age, and significantly after 60 years (Figure 7b), which is attributed to the fact that elderly people are not income generating and have other priorities for their retirement. Regarding gender, there were no major differences witnessed between male and



**Figure 5.**  
Percentage of  
responses for the  
stated willingness to  
pay (in LBP)



**Figure 6.** Percentage of causes for expressing (a) a willingness to pay or (b) not expressing a willingness to pay

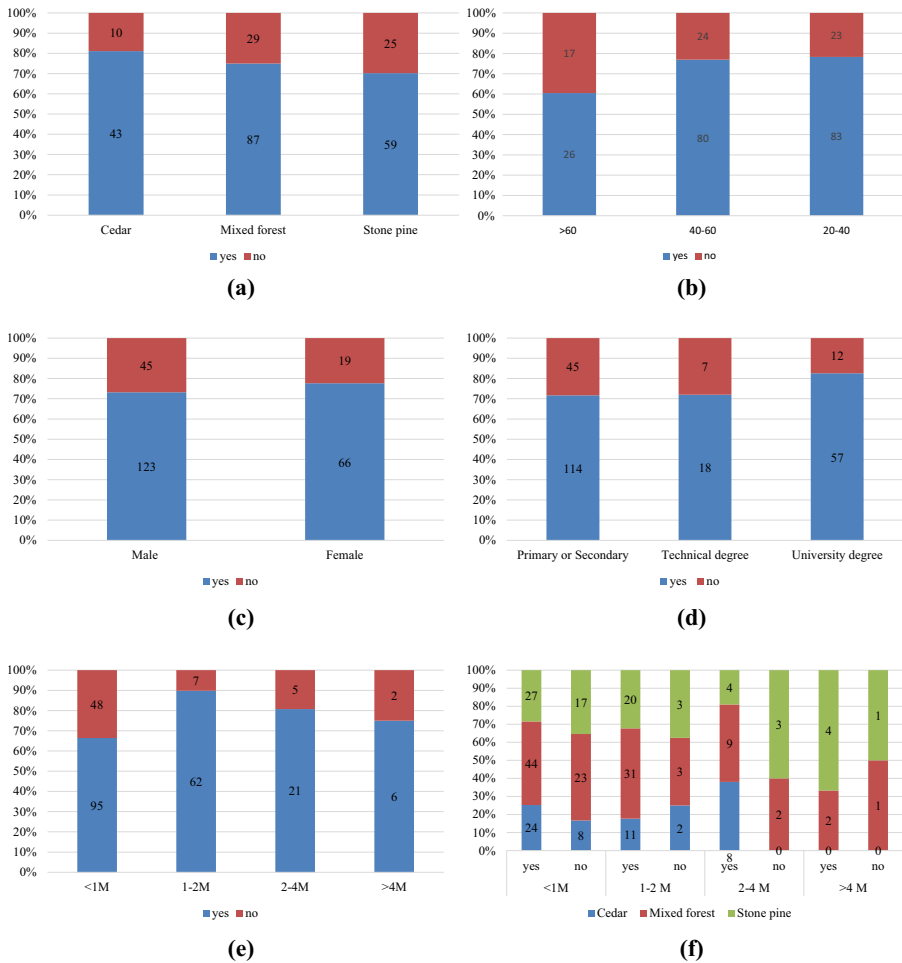
female respondents, knowing that male respondents were the majority of interviewees (Figure 7c). The education level did not significantly affect the WTP, yet respondents holding a university diploma expressed a higher WTP (Figure 7d), converging with the findings of other authors (Xiong *et al.*, 2018; Zheng and Tu, 2009). Despite their low income (less than 1 M LBP/month), 67% of the respondents having low income expressed WTP. The highest WTP percentage was observed among the middle-income category (income between 1 and 2 M LBP/month) as illustrated in Figure 7e.

Finally, when WTP was compared by both forest type and income, results revealed that most respondents with lower and middle income are willing to pay for all three types of forests, though mixed forests have the highest percentage (approximately 35%). It is noteworthy to highlight that very few respondents having higher income (more than 4 M LBP) were near the selected forest sites and none near cedar forests (Figure 7f). In addition to the previous results, a correlation analysis showed that surface area of the studied forest stands and the potential biodiversity indices were not correlated with the WTP (results not shown here).

There is a high WTP among the respondents and their economic situation is not affecting their WTP for the proposed project. Even respondents with lower incomes are willing to pay for the management and increase of the forest area. Yet the economic situation is the main cause for non-willingness to pay. These results are divergent from the general trend (Baumgärtner *et al.*, 2017; Zheng and Tu, 2009; Xiong *et al.*, 2018) but show a nonlinear relationship with income as confirmed by Barbier *et al.* (2017). The WTP could indicate that rural communities still rely on forests and consider the presence of these forests as a need for their livelihood (Sharaunga *et al.*, 2015).

This reveals out the importance of supporting these communities through reforestation and forest management as well as through the implementation of awareness campaigns in order to increase the goods and services provided by the forests, while insuring at the same time, the conservation and sustainability of these forests (Sattout *et al.*, 2007).

If we consider the reforestation of 1ha in each village by planting 600 seedlings per ha for the price of 10,000LBP per seedling, then this would require the participation of 200 persons per village to pay the minimum amount of 30,000LBP each, which is equivalent to a total of



**Figure 7.** Willingness to pay by forest type: (a) factor affecting the willingness to pay as selected by respondents; (b) willingness to pay by age; (c) willingness to pay by gender; (d) willingness to pay by education level; (e) willingness to pay by income; (f) willingness to pay by forest type; (g) income

6,000,000LBP. From another perspective, 650,000 LBP/ha are required to manage those old reforested sites and the expected TEV would be between five and 19 folds that amount based on the approaches used in the two studies of the biosphere reserves. As a result, the expected TEV would vary between 3.25 MLBP and 12.35 MLBP/ha in terms of return from goods and services in addition to the direct value of pine forests and which should be added to the TEV.

**4. Conclusion**

This study conducted a socioeconomic assessment for the first time in Lebanon on selected reforested sites that were part of old reforestation activities that are not dedicated for timber production. The socioeconomic assessment was based on surveys conducted with locals, mostly including people that benefit directly from these forests. Pine forests seemed to provide more direct services than the other ecosystems did, while the cedar forest presented important cultural services.

Lower income did not affect people’s WTP for the management communal forests as rural communities are more dependent on the services provided by the forest and consider the

presence of the latter as a need for their livelihood. Communities are willing to pay if reforestation activities on communal lands are of a recreational or environmental interest (soil and water conservation, carbon sequestration, aesthetic value, etc.) and are relatively reluctant if a direct economic good is exploited by the managers (i.e. pine production). Governance and transparency in management plans are key factors to improve the WTP. Yet the dramatic economical crisis is also a key barrier for WTP. Sustaining the livelihood of rural communities is a must, while managing forested sites should foresee more income generating services.

Finally, future work should investigate the degree of dependency of rural communities on these reforested sites and target city dwellers in order to reveal their willingness to fund reforestation policies with environmental objectives.

### Note

1. Lebanon faces a sharp devaluation of its currency towards the USD since October 2019. By end of 2020, 30,000 LBP are equivalent to 5 USD.

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### Further reading

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Caza	Villages	Forest type	Forest area (ha)	Latitude	Longitude	Altitude (m)	Forest ownership	Vegetation level
West Bekaa	Ain Zebdeh	Mixed	19.7	33°37'7.23"N	35°41'37.94"E	1,100–1,200	Communal land	Supra-Mediterranean
	Saghbine 1	Mixed	5.91	33°36'38.40"N	35°41'36.87"E	1,100–1,150	Communal land	Supra-Mediterranean
	Saghbine 2	Mixed	8.47	33°36'58.71"N	35°42'7.14"E	1,000–1,100	Communal land	Supra-Mediterranean
Rachaya	Lala and Baaboul	Mixed	124	33°35'30.38"N	35°45'54.49"E	1,300–1,400	Communal land	Supra-Mediterranean
	Rachaya Al Wadi	Mixed	45.2	33°29'21.82"N	35°51'13.45"E	1,200–1,300	Communal land	Supra-Mediterranean
	Anjar	Mixed	3.56	33°44'4.14"N	35°56'47.24"E	870–880	Communal land	Presteppic Eu-Mediterranean
Zahle	Qoussaya	Mixed	10.48	33°48'55.29"N	36°1'12.30"E	1,000–1,100	Communal land	Presteppic Supra-Mediterranean
	Barouk	Cedar	538	33°41'34.18"N	35°42'28.26"E	1,600–1,800	Communal land	Mountain Mediterranean
Chouf	Niha	Pine	66.5	33°33'51.67"N	35°37'57.15"E	1,100–1,300	Communal land	Supra-Mediterranean
	Kfarhim	Pine	3.22	33°41'6.57"N	35°31'5.96"E	300–400	Communal land	Thermo-Mediterranean
Aley	Jisr El Qadi	Pine	39.5	33°43'46.84"N	35°33'35.85"E	200–400	Religiously owned land	Thermo-Mediterranean
Baabda	Qornayel	Pine	38.6	33°51'10.18"N	35°44'14.22"E	1,300–1,400	Communal land	Supra-Mediterranean
	Falougha	Cedar	5.30	33°49'34.24"N	35°45'8.09"E	1,400–1,500	Communal land	Supra-Mediterranean

**Table A1.**  
Description of the  
selected sites in each  
village

Socio- economic survey in the villages around the selected reforested sites

Sheet #: \_\_\_\_\_ Date: \_\_\_\_\_  
Caza: \_\_\_\_\_ Village: \_\_\_\_\_

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**Figure A1.**  
The socioeconomic  
survey in the villages  
around the selected  
reforested sites

**Objectives:**

*Objective: Reforestation activities were undertaken in selected areas. The purpose of the survey is to:*

- *Assess the goods and services provided by these reforested sites*
- *Understand the socio-economic value of these sites*
- *Highlight the people's willingness to pay for the conservation these sites and increase their areas*

*The selected sites are found in different areas including in the Cazas of Rachaya, West Beqaa, Zahle, Aley, Shouf and Baabda.*

**Section 1: Goods and Services in the selected Reforested Site**

1. Can you list some species present in the forest?
  
2. Do you frequently visit the forest?  Yes  No
3. Do you know what types of activities are mostly undertaken in the forest?
  - Grazing
  - Tree pruning for wood/charcoal products or pine nuts products
  - Beekeeping
  - Hunting
  - Aromatic/medicinal plant collection
  - Ecotourism
  - Other services:
  
4. Do you practice any of these activities?  Yes  No
5. If yes, which one? 6. If yes, do you practice the activity:
  - As your main occupation
  - Secondary occupaton
  
7. Are recreation/tourism (eco-tourism) activities more frequent for:
  - Local people
  - Lebanese tourists from other regions
  - Foreign tourists
  - All of the above

**Section 2: Valuation Scenario**

8. Which of the following options do you prefer?

Activity	Options		
	Option 1	Option 2	Option 3
Management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Protection: forest area stay the same	Implement a management program	No management: degradation of the forest
Reforestation	No action	Increase the forest area	Decrease in the forest area
Goods and services	Stays the same	Improve	Decrease

9. In your opinion, what is the importance value of this reforested site?
  - Biodiversity
  - Wood production
  - NWFP (honey, medicinal and edible plants, hunting, grazing, fruits...)
  - Landscape/Aesthetic
  - Recreational/touristic
  - Soil protection from erosion
  - Climate and flood regulation
  - All the above
  - Other values

**Figure A1.**

10. What are the risks that the forest may face or is facing? Can you list some?

11. In comparison to the period before the reforestation occurred, do you consider that now the site has:

- |   |   |
|---|---|
| <input type="checkbox"/> Lost its economic value      | <input type="checkbox"/> Improved its economic value      |
| <input type="checkbox"/> Lost its environmental value | <input type="checkbox"/> Improved its environmental value |

12. Does the forested site generate employment to anyone?

- Yes       No

13. If yes do you know how many?

14. In your opinion, what would be the cost of losing the forest?

- Cost in lives and species (biodiversity loss)  
 Degradation of the environment (soil, water, air)  
 Degradation of the landscape  
 Reduction of services such as wood NWFP (recreation, spiritual/cultural well-being)  
 All of the above

**Section 3: Willingness to Pay (WTP)**

15. The government in collaboration with local and international organizations intends to assist the community in the management of the reforestation site to reduce the risks, reverse degradation, improve the landscape and the production of goods and services and expand the site through reforestation.

If a contribution to implement this project was demanded, will you be willing to pay?

- Yes       No

If yes, would you be willing to pay the amount of 30,000LBP per year?

- Yes       No

If yes, then would you be willing to pay more than 30,000LBP?

- Yes       No

If no, then would you be willing to pay less than 30,000LBP?

- Yes       No

If yes, then would you be willing to pay more than the amount of 60,000LBP?

- Yes       No

If yes, then would you be willing to pay less than the amount of 15,000LBP?

- Yes       No

Figure A1.

**Section 4: Understanding and Certainty**

16. What is the reason of zero WTP?

- Individual economic situation
- Responsibility of the state
- Indifference to existence of the forest
- Occasional user
- Lack of transparency of the implementing parties (government, municipality, etc.)
- Other reasons:

17. What is the reason for expressing a WTP for the implementation of the proposed project?

- Consumptive uses such as wood NWFP and medicinal and aromatic plants
- Non-consumptive uses such as recreation, spiritual/cultural well-being
- Conservation for future generations
- Right of forests to exist
- All of the above

**Section 5: Personal Information**

18. Age

- 20 – 30
- 40 – 60
- >60

19. Gender:  Male  Female

20. Education Level:

- Primary School
- Secondary School
- University Studies

21. Main occupation:

Other Occupations:

22. Permanent resident   
Summer resident

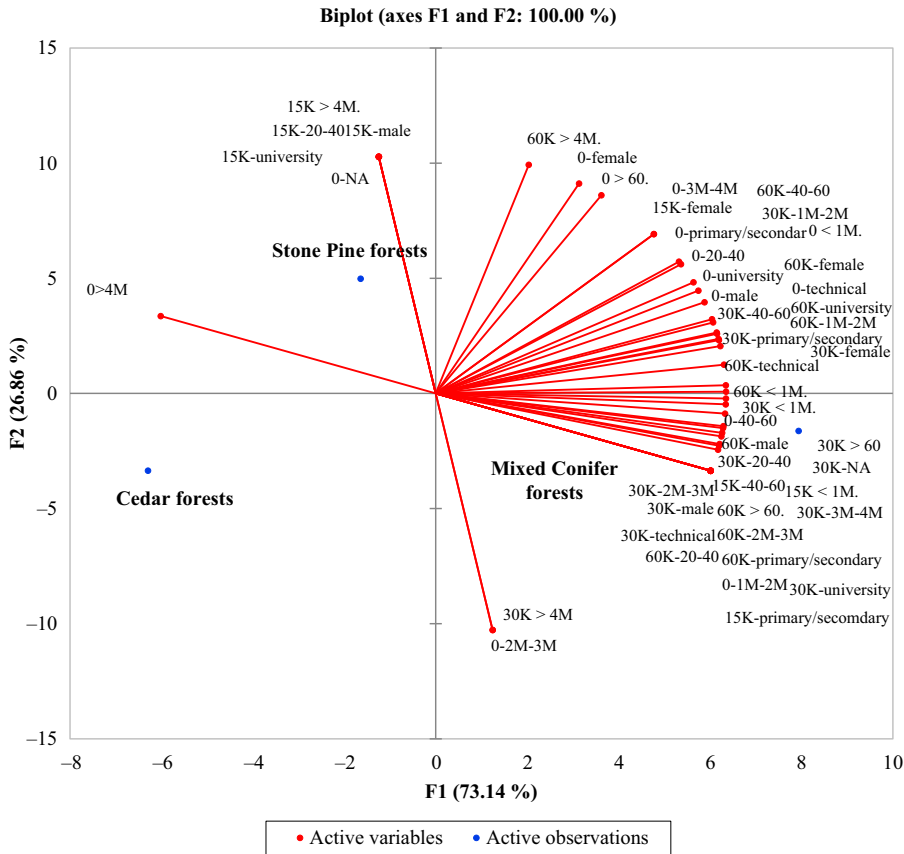
23. Income

- <1,000,000LBP
- 1,000,000 – 2,000,000LBP
- 2,000,000 – 3,000,000LBP
- 3,000,000 – 4,000,000LBP
- >4,000,000LBP

**Figure A1.**

Variable	Categories	Frequencies	%
Age	20–40 years	106	41.9
	40–60 years	104	41.1
	>60 years	43	17.0
Gender	Female	85	33.6
	Male	168	66.4
Education level	Primary or secondary school	159	62.8
	Technical school	25	9.9
	University studies	69	27.3
Income (in million Lebanese pounds)	1–2m	70	27.7
	2–3m	17	6.7
	3–4m	9	3.6
	<1m	143	56.5
	>4m	8	3.2
	NA	6	2.4

**Table A2.**  
Summary of  
descriptive data



**Figure A2.** Socioeconomic factors affecting the willingness to pay (0: no WTP, 30K: 30,000LBP, 15K: 15,000LBP, 60K: 60,000LBP) linked with the three forest types (blue dots) and four socioeconomic factors (age classes, gender, education level and income ranges)

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