



Socio-Economic Assessment of Old Reforested Sites in Lebanon

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Introduction

Economic valuation of ecosystems is the study of goods and services provided by these ecosystems to society. Since the 1960s, Lebanon has been subject to important reforestation activities which resulted in the establishment of several cedar, pine and other mixed forest stands.

Following all these years, no studies have included the assessment and valuation of old reforested sites by targeting the communities of the villages where reforestation occurred. In order to improve reforestation activities and enhance the management of benefits provided by these sites, it is crucial to understand the importance of the value given by the locals to these reforested sites.

The aim of this study is to assess the goods and services provided by old reforested sites and to value their socio-economic and environmental importance. For this purpose, thirteen reforested sites distributed in different villages were selected (Figure 1). The socio-economic assessment was based on stated preference methods to estimate their willingness to pay (WTP) using questionnaires distributed to locals that have close interactions with the forests. Environmental assessment included biodiversity assessment of the forests and the calculation of the Carbon Stock (CS) provided by the sites as part of the indirect use value of the forests.

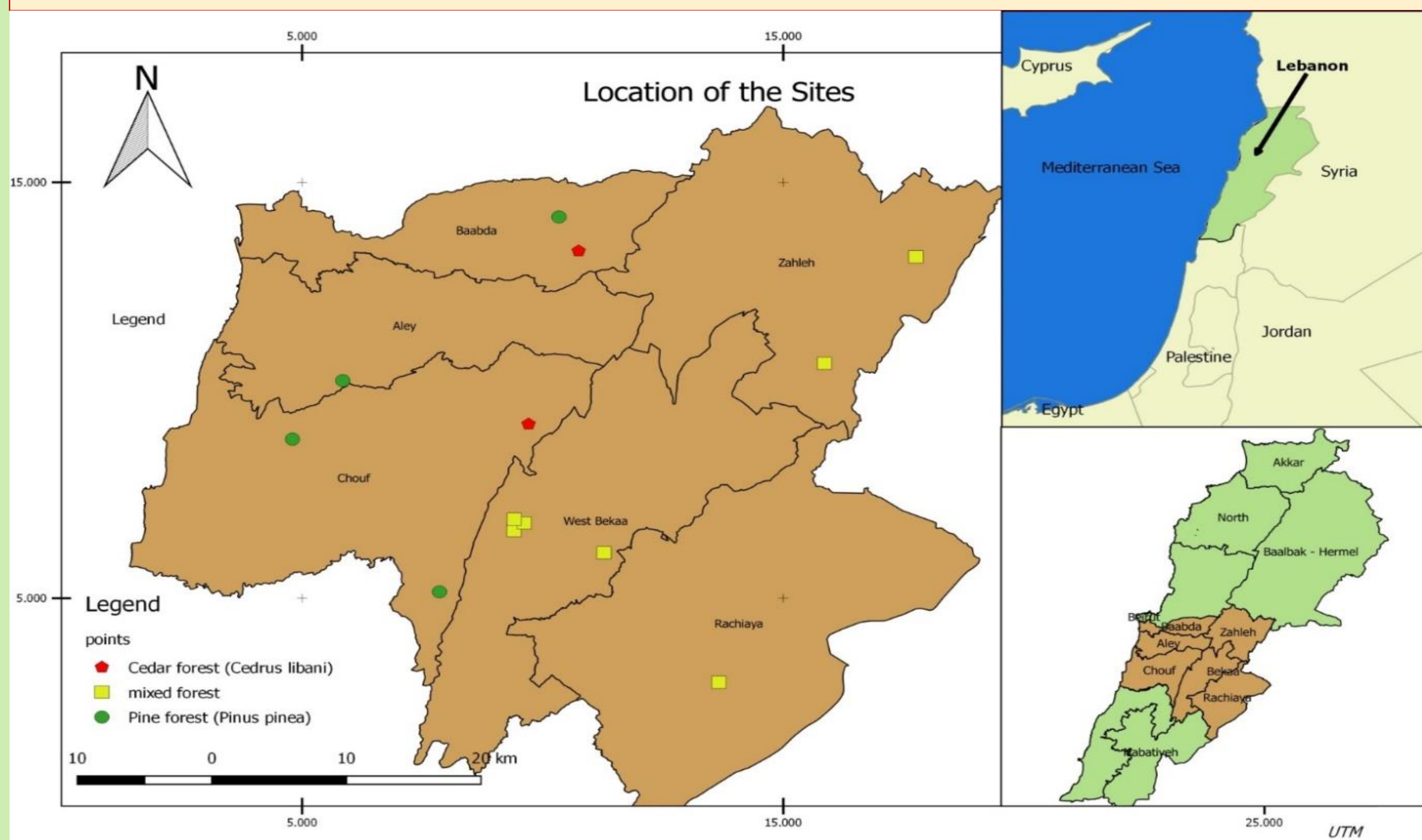


Figure 1. Locations of the Selected Reforested Sites

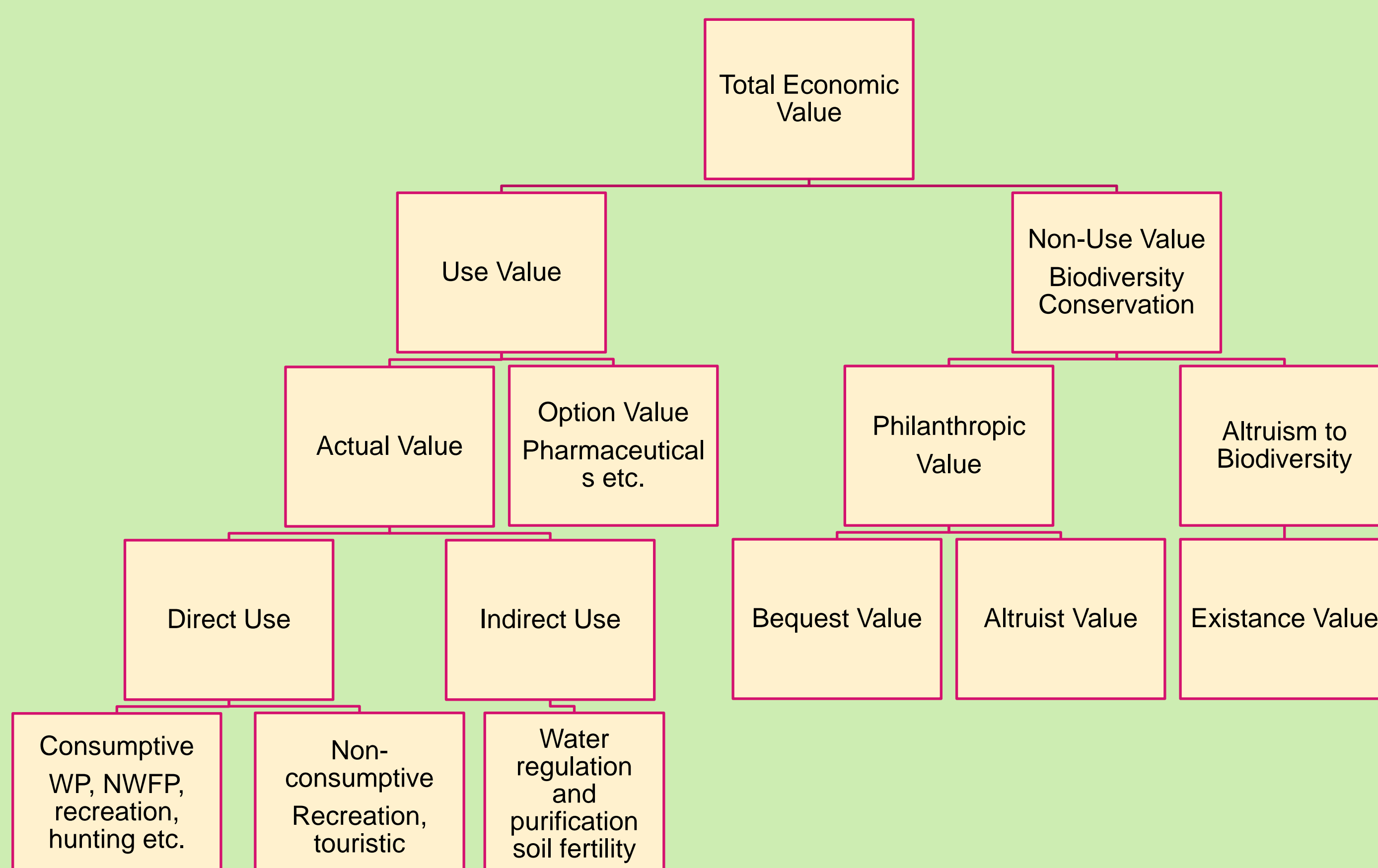


Figure 2. The Total Economic Value (TEV) of Ecosystems

Methods and Materials

The overall biodiversity within the forest stands was assessed using the Potential Biodiversity Index (IBP), while the carbon stock (CS) was estimated following empiric equations developed by FAO (Figures 3 and 4). The direct valuation of pine products was calculated in stone pine forests. The socio-economic assessment relied on Principle Component Analysis (PCA) of the questionnaires; these were distributed to individuals that are permanent residents of the surrounding villages, considering age categories, gender, education, employment and income. It included a double bonded dichotomous contingent valuation question, reflecting their willingness to pay for forest management or reforestation activities.

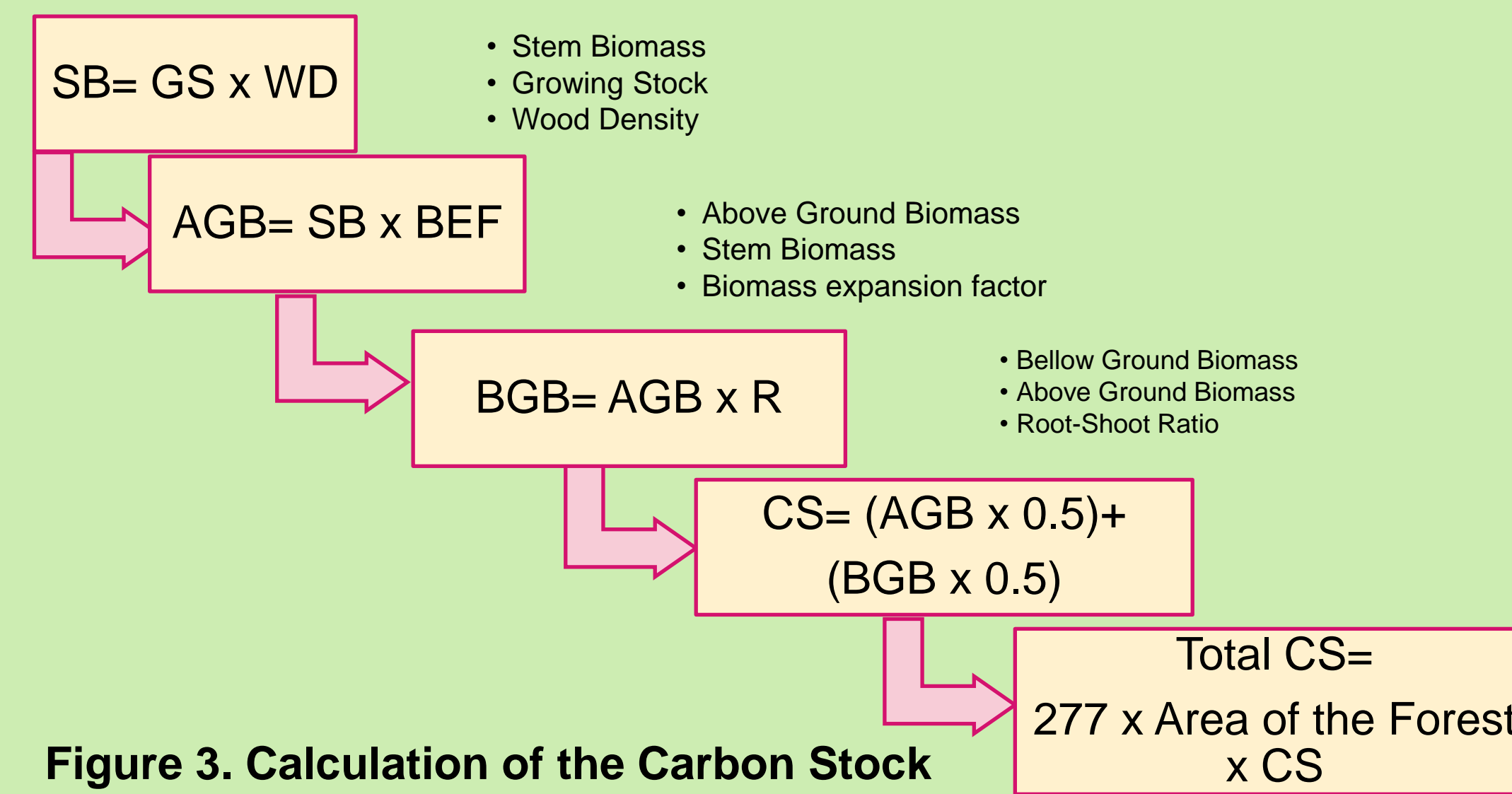


Figure 3. Calculation of the Carbon Stock

The Potential Biodiversity Index (IBP)

- Estimation of the potential taxonomic biodiversity, and assessment of the capacity to host species.
- A partial plot course of 1 ha was covered during the field survey.
- Scoring 0;2;5.

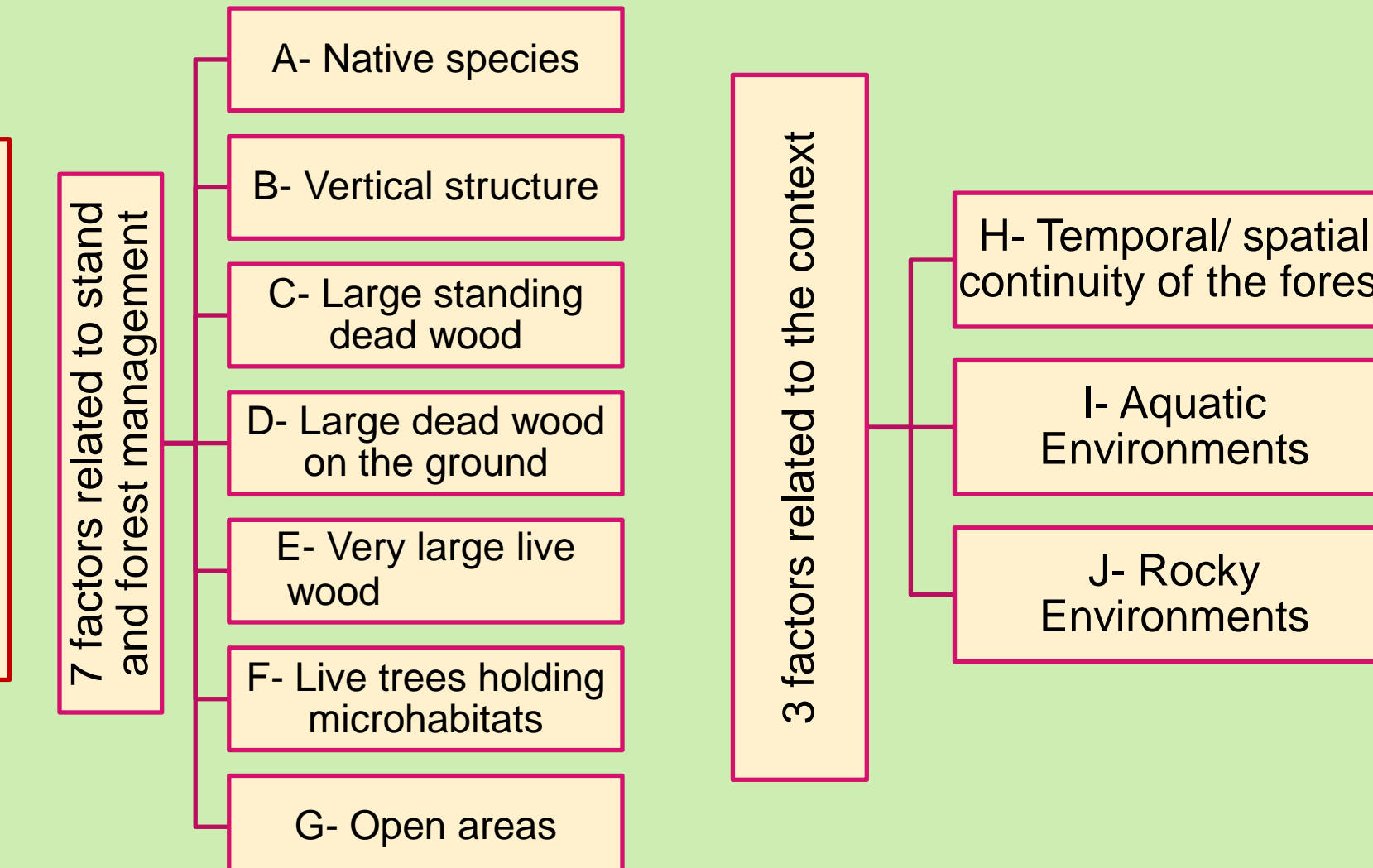


Figure 4. 10 key factors for assessing the IBP

Results and Discussion

Results from environmental assessment showed relatively low to average biodiversity (Figure 5). Carbon stock varied significantly among sites, due to the differences in site characteristics and forest species (Table 1).

The socio-economic assessment revealed that pine forests present more direct goods and services while cedar forests present more cultural and regulation services (Figure 6). Moreover, results of the contingent valuation question showed that in most cases people with lower incomes are more willing to pay for the increase of the forest area and that WTP was expressed for all types of forests (Figure 7). In general, respondents expressed a WTP for all types of forests; for cedar forests in Falougha and Barouk but also for the other mixed forests like in Qoussaya and Baaloul. The opinions of respondents on the WTP for pine forests varied: in Niha respondents did express a WTP while in the other pine forests of Qornayel, Kfarhim and Jisr El Qadi most of the respondents did not seem to express a WTP (figure 8).

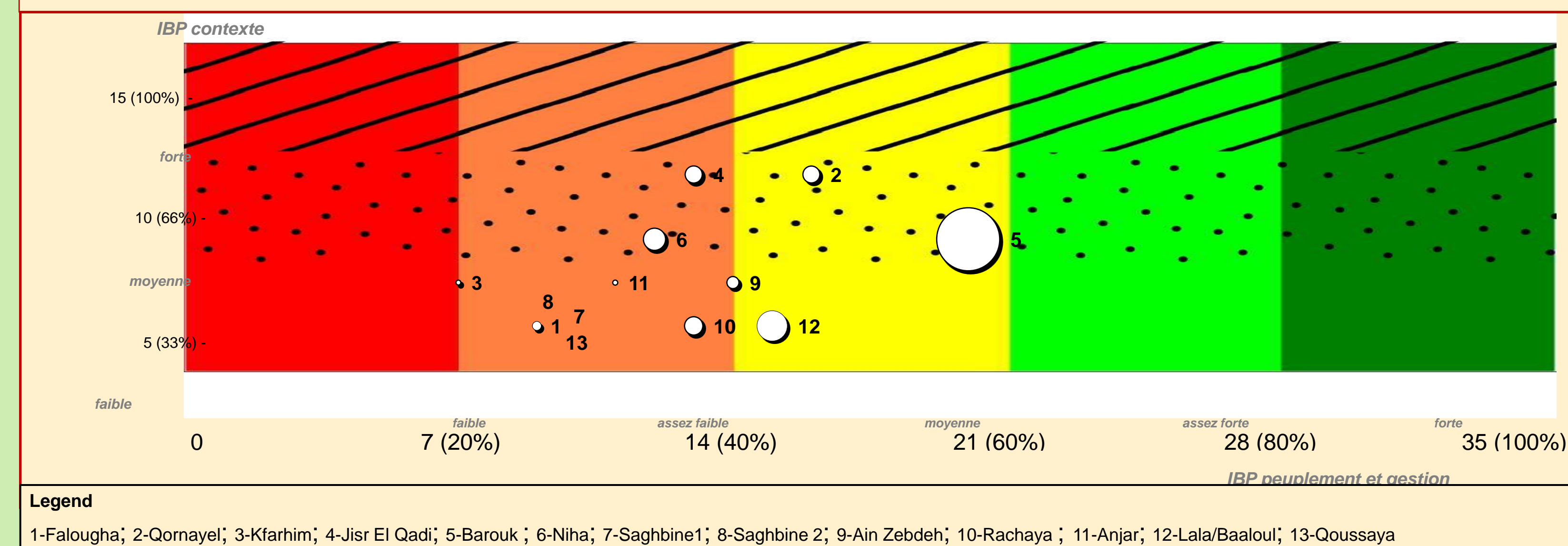


Figure 5. IBP context vs. IBP related to management for each site

Table 1. Biomass and Carbon Stock

Sites	Forest type	Area (ha)	Total CS (t) over 50 years	Productivity CS (t/ha)	Total CS (t/year)	Value of CS*	Value of CS USD/ha/year
Falougha	Cedar	5.3	267	50	5.34	53	10.1
Qornayel	Stone pine	38.8	4,612	119	92.24	922.4	23.8
Kfar Him	Stone pine	3.22	444	138	8.88	88.8	27.6
Jisr El Qadi	Stone pine	39.5	4,634	117	92.67	926.7	23.5
Barouk	Cedar	538	145,246	270	2,904.91	29,049	54.0
Niha	Stone pine	66.5	5,595	84	111.91	1,119	16.8
Saghibine 1	Mixed conifers	5.91	409	69	8.17	81.7	13.8
Saghibine 2	Mixed conifers	8.47	970	115	19.40	194	22.9
Ain Zebdeh	Mixed conifers	19.7	3,743	190	74.86	748	38.0
Rachaya	Mixed conifers	45.2	494	51	46.51	465	10.3
Anjar	Mixed forest	3.56	622	175	12.44	124.4	34.9
Lala-Baaloul	Mixed conifers	124	5,870	47	117.40	1,174	9.5
Qoussaya	Mixed conifers	10.48	461	44	9.22	92.2	8.8

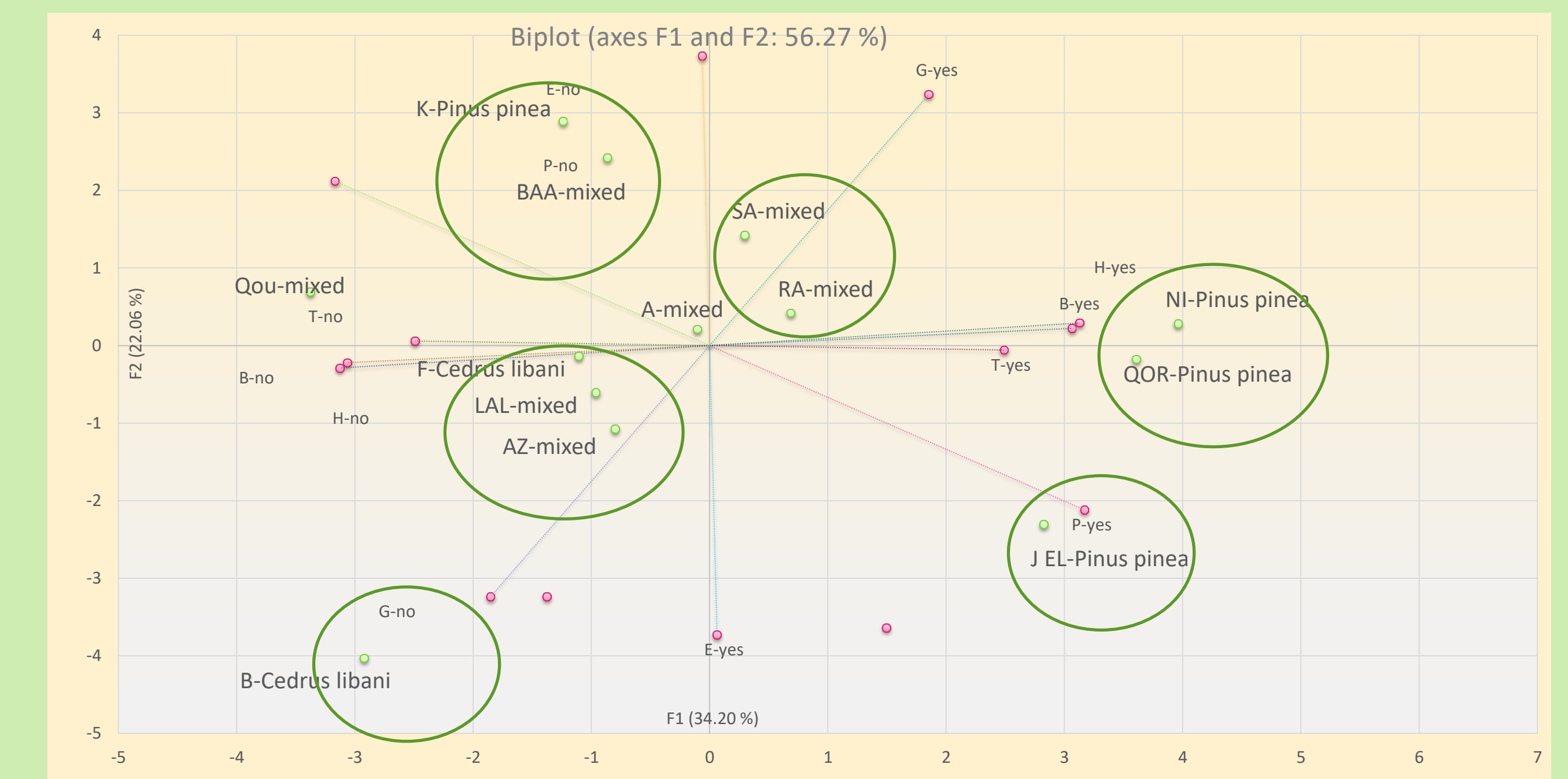


Figure 6. Relation between the goods and services and forest types

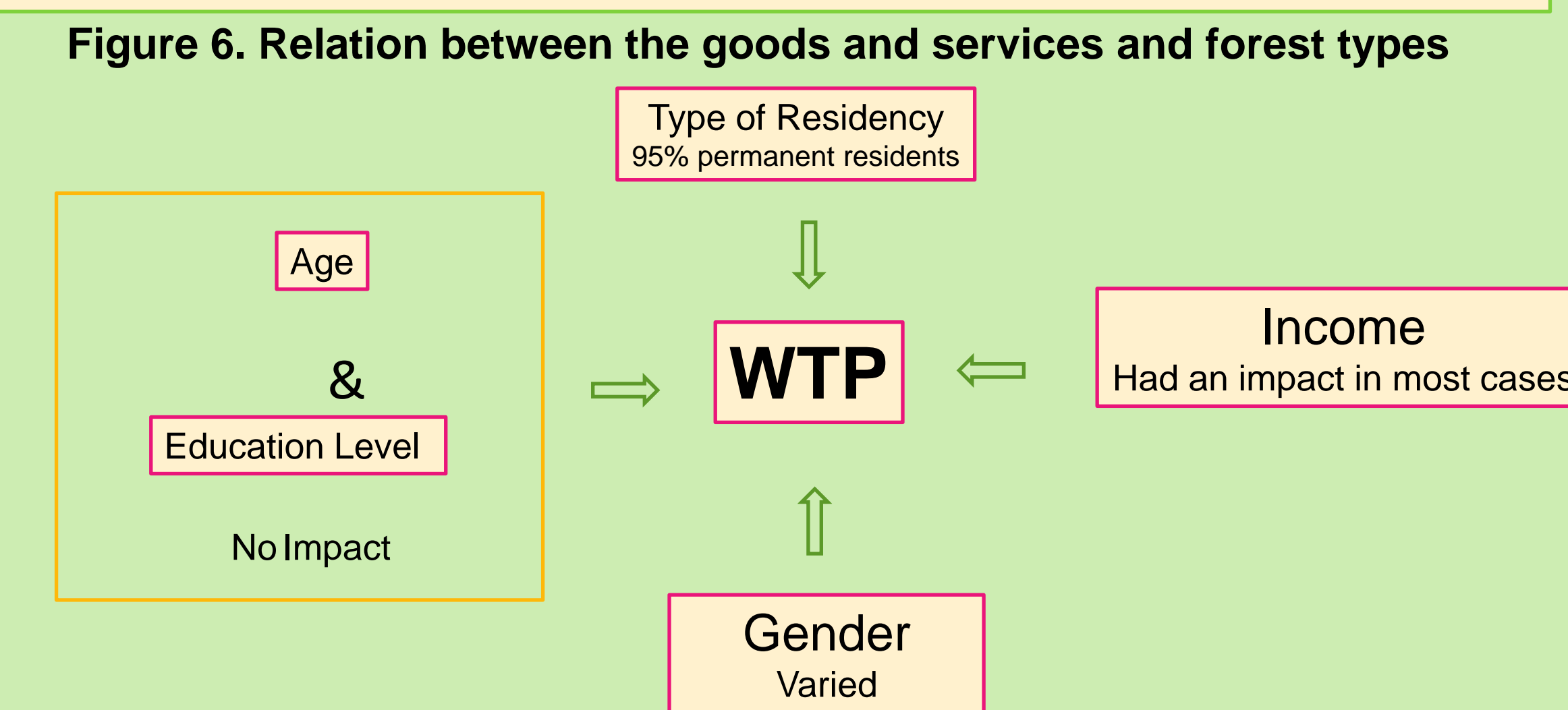


Figure 7. Socio-economic Factors Mostly Affecting the WTP

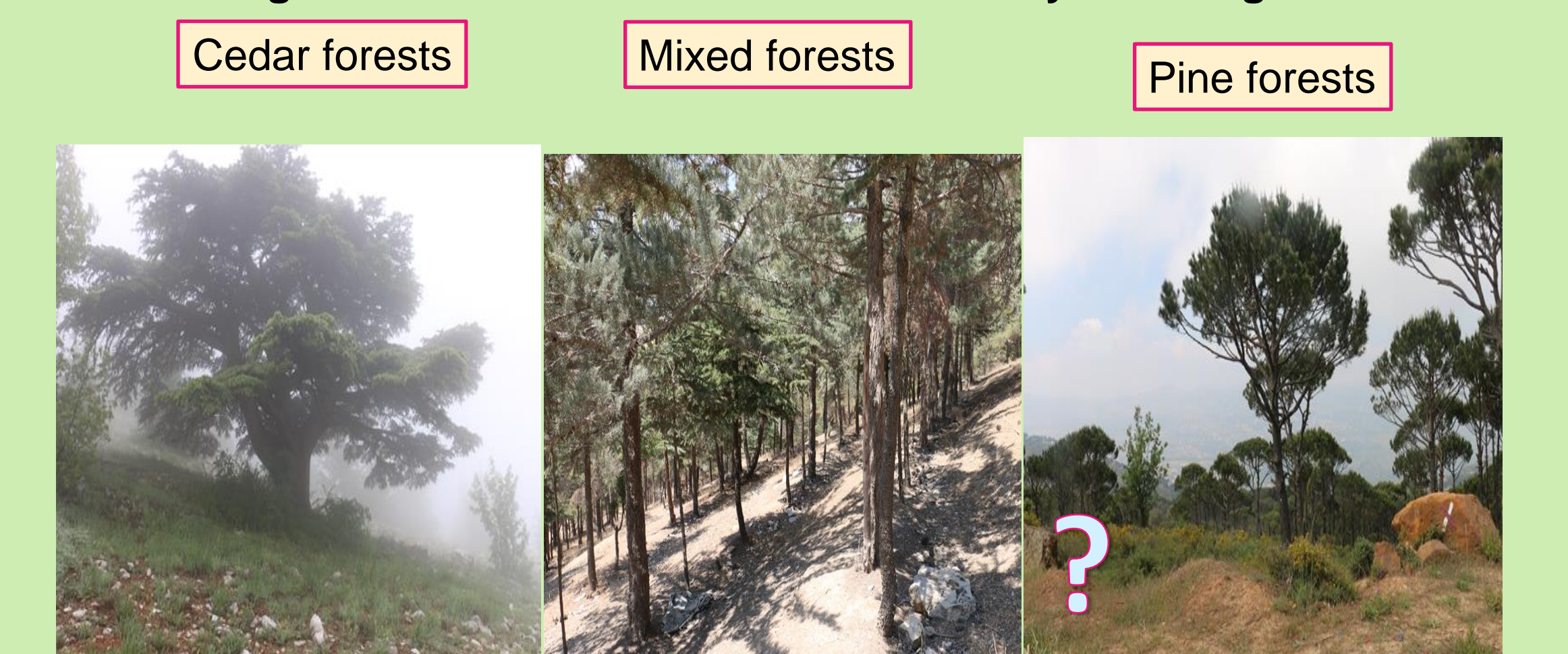


Figure 8. Type of forest and WTP

Conclusion

The TEV for old reforested sites varied between 20,000 USD/ha and 76,000 USD/ha, if we consider that the TEV is between 5 to 19 folds the WTP (as per previous studies conducted in the Shouf and Jabal Moussa Biosphere Reserves). In the case of pine forests the direct value of pine production which is estimated for 27,700 USD/ha is also added. This work shows for the first time the economic returns from reforestation activities, and their importance for neighboring communities. This work would trigger further research such as the potential and future value of timber production in reforested sites, or the social and environmental value of forests for city dwellers.