

Leaflet No- 23/2021

The Republic of the Union of Myanmar
Ministry of Natural Resources and Environmental Conservation
Forest Department



Willingness to Pay Money and Time for Community Forest Management:
A Contingent Valuation Study in the Central Dry Zone of Myanmar

May Zin Myint, Range Officer
Forest Department

December 2021

Contents

	Page
Abstract	i
စာတမ်းအကျဉ်း	ii
1. Introduction	1
1.1 Research and policy backgrounds	1
1.2 Community forestry and its link to ecosystem services	1
1.3 Rationale of the study	2
1.4 Economic valuation of forest management	2
1.5 Willingness to pay money and time	3
2. Objectives	3
3. Materials and methods	3
3.1. Contingent Valuation Method (CVM)	3
3.1.1. Application of CVM	4
3.1.2. Research questions	4
3.1.3. Hypotheses	4
3.1.4. Study area	5
3.2. Community forest characteristics and management in the study areas	6
3.2.1. Community 1: Yoe Sone Community Forest	6
3.2.2. Community 2: Myay Thin Twin Community Forest	6
3.2.3. Community 3: Kanbani Community Forest	7
3.3. CV scenarios and proposed community forest conservation programs	7
3.3.1. Setting of bidding prices	8
3.4. Questionnaire survey	9
3.4.1. Structure of the questionnaire	9
3.5. Survey implementation	10
3.6. Data analysis	11
4. Results and discussion	12
4.1. Respondents' characteristics	12
4.2. Respondents' experience in community forests	14
4.3. Knowledge of community forest and dependency on community forest	16
4.4. Respondents' preference on proposed community forest conservation programs	18

4.5. WTP results based open-ended and DBDC responses	18
4.5.1. WTPM and WTPT based on open-ended responses	18
4.5.2. WTPT in monetary value	22
4.6. WTP estimation based on double bounded dichotomous choice response	22
4.6.1. WTPM results based on DBDC response	25
4.6.2. Relationship between WTPM, WTPT, socio-demographics, knowledge and program preference	26
4.6.3. Correlation results	26
4.6.4. Effects of independent variables on WTPM and WTPT	27
4.6.5. Respondents' preference on types of contribution	30
4.7. Discussion	31
4.7.1. Willingness to pay money and time	31
4.7.2. Testing the hypotheses based on results	31
4.7.3. Understanding and awareness of community forest management among users	33
4.7.4. Discussion based on community forest characteristics	34
4.7.5. Limitations	34
5. Conclusions	35
5.1. Major findings	35
5.2. Policy implications	36
Acknowledgements	37
References	38

List of tables

Table 3.1. Three sets of bids used in the DBDC questions (MMK)	9
Table 4.1. Respondents' characteristics	13
Table 4.2. Respondents' experience in community forests	15
Table 4.3. Respondents' knowledge and dependency on community forest	17
Table 4.4. Respondents' preference on community forest conservation programs	20
Table 4.5. WTPM and WTPT based on open- ended responses	21
Table 4.6. Mean annual WTPT in monetary value (USD)	22
Table 4.7. Dichotomous choice contingent valuation model variables	24

Table 4.8. Estimated WTP based on DBDC responses (MMK)	25
Table 4.9. Mean annual WTPM (open-ended and DBDC) and WTPT	25
Table 4.10. Ratio of Yes response to the DBDC bids	26
Table 4.11. Correlation coefficients of socio-demographics, knowledge, program preference with open-ended WTPM and WTPT	27
Table 4.12. Regression analysis results between socio-demographics, knowledge, program preference and open-ended WTPM (Open-ended	28
Table 4.13. Regression analysis results between socio-demographics, knowledge, program preference and WTPT (Open-ended)	29
Table 4.14. Probit estimation of the effects of Socio-demographics, knowledge and program preference on WTPM (Dichotomous choice) (n=330)	30
Table 4.15. Preference on types of contribution in community forest conservation	31

List of figures

Figure 3.1. Location map of study areas	5
Figure 3.2. Location map of Yoe Sone Community Forest (Community 1)	6
Figure 3.3. Location map of Myay Thin Twin and Kanbani Community Forests(Community 2 and 3)	7
Figure 3.4. Contingent valuation scenario of community forest improvement	8
Figure 3.5. Sample WTPM and WTPT questions	10
Figure 3.6. Survey implementation photos	11

Abbreviations

CF	Community Forest
CFE	Community Forest Enterprise
CFI	Community Forestry Instructions
CFUG	Community Forest User Group
CVM	Contingent Valuation Method
DBDC	Double Bounded Dichotomous Choice
JICA	Japan International Cooperation Agency
MEA	Millennium Ecosystem Assessment
MMK	Myanmar Kyat (Currency: 1500MMK is equivalent to USD1)
NFMP	National Forestry Master Plan
NTFP	Non-timber Forest Product
SFM	Sustainable Forest Management
TEV	Total Economic Value
USD	US dollars
WTPM	Willingness to Pay Money
WTPT	Willingness to Pay Time

Willingness to Pay Money and Time for Community Forest Management: A Contingent Valuation Study in the Central Dry Zone of Myanmar

May Zin Myint, Range Officer
Forest Department

Abstract

Identifying and valuing forest ecosystem services will help analyzing cost and benefits of policy implementations and sustainable financing of the prioritized conservation programs in support of sustainable forest management. This willingness to pay study aims at estimating willingness to pay money (WTPM) and willingness to pay time (WTPT) for community forest management (participatory forest management) using contingent valuation method (CVM). A questionnaire survey was conducted using face-to-face interview with 330 respondents (CFUG members and non-members) who are managing three different community forests (agroforestry, naturally conserved and planted community forests). A scenario of forest cover increases by 30% and five hypothetical community forest conservation programs (tree planting, assisted natural regeneration, catchment protection, regular patrolling, and forest protection) was proposed to the respondents. Three sets of bidding price were set (I: initial bid at USD0.3, lower bid at USD0.2 and upper bid at USD1.0, II: USD1.0, 0.3, 2.0, III: USD2.0, 1.0, 3.0) and randomly presented to the respondents asking whether they are willing to contribute cash and/or time in community forest conservation for increased forest cover, improved water supply, biodiversity enhancement, climate regulation and reduced illegal activities. Open-ended and double bounded dichotomous choice (DBDC) questions were asked in the WTP questions. According to open-ended responses, the mean annual WTPM of all the respondents is USD1.58 (2370 MMK) and the mean annual WTPT (in monetary value) is USD86.67 (130000 MMK). The local people are willing to contribute, in terms of both money and time, in CF management regardless of CFUG membership or income level. CF characteristics may be considered as an important basis for the differences in WTPT and WTPM. The respondents highly supported the proposed CF management programs such as tree planting and catchment protection that are directly related to the basic needs, relevant to local situations, and their current CF management.

Keywords: willingness to pay, time contribution, cash contribution, contingent valuation method, forest ecosystem services, participatory forest management

ဈေးကွက်တန်ဖိုးသတ်မှတ်ချက်မရှိသော သစ်တောဆိုင်ရာဂေဟစနစ် ဝန်ဆောင်မှုများ၏
တန်ဖိုးကိုတွက်ချက်နိုင်ရန် Contingent Valuation နည်းလမ်းသုံး၍ ဒေသခံများ၏
အချိန်နှင့်ငွေပါဝင်ပံ့ပိုးလိုမှုကိုဆန်းစစ်ခြင်း

ဒေါ်မေဇင်မြင့်၊ ဦးစီးအရာရှိ

သစ်တောဦးစီးဌာန

စာတမ်းအကျဉ်း

သစ်တောဂေဟစနစ်ဝန်ဆောင်မှုများအားဖော်ထုတ်၍ တန်ဖိုးတွက်ချက်ခြင်းအားဖြင့် မူဝါဒများအကောင်အထည်ဖော်ဆောင်ရွက်ရာတွင် ကုန်ကျစရိတ်နှင့်အကျိုးကျေးဇူးများကို စိစစ်ပိုင်းခြားနိုင်ခြင်း၊ ရေရှည်တည်တံ့သောသစ်တောစီမံအုပ်ချုပ်မှုကိုအထောက်အကူပြုနိုင် မည့်ဦးစားပေးထိန်းသိမ်းရေးအစီအစဉ်များအတွက် ငွေကြေးပံ့ပိုးမှုကိုရေရှည်တည်တံ့အောင် သုံးစွဲနိုင်ခြင်းစသည့် အကျိုးကျေးဇူးများ ဖြစ်ထွန်းစေပါသည်။ ဤစာတမ်းတွင် စီးပွားရေး တန်ဖိုးတွက်ချက်ခြင်းဆိုင်ရာ Contingent Valuation နည်း လမ်းအသုံးပြု၍ မန္တလေးတိုင်း ဒေသကြီး၊ ညောင်ဦးနှင့် ဝမ်းတွင်းမြို့နယ်ရှိ ဒေသခံပြည်သူ အစုအဖွဲ့ပိုင်သစ်တော (၃) ခုမှ ဒေသခံ(၃၃၀)ဦး၏ ဒေသခံပြည်သူအစုအဖွဲ့ပိုင်သစ်တော စီမံအုပ်ချုပ်ခြင်းအတွက်ငွေနှင့် အချိန်(လုပ်အား)ပါဝင်ပံ့ပိုးလိုမှုကို မေးခွန်းများမေးမြန်းကာ ဆန်းစစ်တွက်ချက်ထားပါသည်။ သီးနှံသစ်တောရောနှောစိုက်ပျိုးခြင်း၊ သဘာဝတောထိန်း သိမ်းခြင်းနှင့် စိုက်ပျိုးခြင်းများ စသည့် ဆောင်ရွက်သည့်အစုအဖွဲ့များကို လေ့လာခဲ့ခြင်းဖြစ်ပါသည်။ယခုလက်ရှိ အခြေအနေ နှင့် နှိုင်းယှဉ်ပါက သစ်တောဖုံးလွှမ်းမှု ၃၀% တိုးတက်လာမည် ဟုမျှော်မှန်း ယူဆချက် သတ်မှတ်ကာ အဆိုပါတိုးတက်မှု ဖြစ်ထွန်းရေးအတွက် ဆောင်ရွက်မည့် သစ်တော ထိန်းသိမ်းရေးလုပ်ငန်းများတွင် ငွေကြေးနှင့်အချိန်ပါဝင်ပံ့ပိုးလိုမှုကို တွက်ချက်ခြင်း ဖြစ်ပါ သည်။ ဤသုတေသနတွင် အဆိုပြုထားသည့် သစ်တောထိန်းသိမ်းရေးလုပ်ငန်းများမှာ သစ်ပင်စိုက်ပျိုးခြင်း၊ ရေဝေရေလဲထိန်းသိမ်းခြင်း၊ သဘာဝတောတန်ဖိုးမြှင့်စိုက်ပျိုးခြင်း၊ ပုံမှန်ကင်းလှည့်စောင့်ကြပ်ခြင်းနှင့် သစ်တောကာကွယ်ခြင်းတို့ဖြစ်ပါသည်။ ဒေသခံများ၏ ငွေကြေးပံ့ပိုးလိုမှုကိုမေးမြန်းစိစစ်ရာတွင် အလွတ်သဘောမေးခွန်းများနှင့်ကြိုတင်သတ်မှတ် ထားသောငွေပမာဏကို မေးမြန်းကာ ပြေဆိုစေသောမေးခွန်းများပါဝင်ပါသည်။ မေးခွန်းတွင် ငွေပမာဏ (၃) စုံ သတ်မှတ်၍ ဒေသခံပြည်သူအစုအဖွဲ့ပိုင်သစ်တောအသုံးပြုသူအဖွဲ့ဝင်များ နှင့် အဖွဲ့ဝင်မဟုတ်သူ၊ စုစုပေါင်း လူ(၃၃၀) ကိုမေးမြန်းခဲ့ပါသည်။ ဆန်းစစ်ချက် ရလဒ် များအရ ဒေသခံများသည်တစ်နှစ်လျှင် သစ်တောထိန်းသိမ်းရေး အတွက် ပျမ်းမျှ ငွေကျပ် (၂၃၇၀)ခန့်၊အချိန်အားဖြင့် တစ်နှစ်လျှင် နာရီပေါင်း(၂၁၇)နာရီ (ငွေကြေးအားဖြင့် လုပ်အားခ

ဖြင့်ပြန်တွက်သော် ၁၃၀,၀၀၀ကျပ်ခန့်) ပံ့ပိုးလိုကြောင်း စိစစ်တွေ့ရှိရပါသည်။ ဒေသခံ များသည် အသုံးပြုသူအဖွဲ့ဝင်ဖြစ်ခြင်း၊ မဖြစ်ခြင်း၊ ဝင်ငွေအနည်း အများတို့နှင့် မသက်ဆိုင်ဘဲ ဒေသခံပြည်သူအစုအဖွဲ့ပိုင် သစ်တောစီမံအုပ်ချုပ်မှုတွင်အချိန်ရောငွေပါ ပါဝင်ပံ့ပိုးရန် ဆန္ဒရှိကြောင်းတွေ့ရှိရပါသည်။ အစုအဖွဲ့ပိုင်သစ်တော အမျိုးအစား (သဘာဝတောထိန်း၊ စိုက်ခင်း၊ သီးနှံသစ်တောရောနှောစိုက်ပျိုးခြင်း) သည်လည်း အချိန်နှင့် ငွေကြေးပံ့ပိုးလိုမှုအတွက် အခြေခံအကြောင်းအရာများဖြစ်ကြောင်း တွေ့ရှိရပါသည်။ ဒေသခံ များသည် မေးခွန်းလွှာတွင်ပါဝင်သော သစ်တောထိန်းသိမ်းခြင်းလုပ်ငန်းများအနက် သစ်ပင် စိုက်ပျိုးခြင်း၊ ရေဝေရေလဲထိန်းသိမ်းခြင်းကဲ့သို့ အခြေခံလိုအပ်ချက်များအပေါ် တိုက်ရိုက် အကျိုးသက်ရောက်မှုရှိသည့် လုပ်ငန်းများကို ပိုမိုနှစ်သက်ပြီးပါဝင်ဆောင်ရွက်ရန် စိတ်အားထက်သန်ကြောင်း တွေ့ရှိရပါသည်။စိစစ်ချက်ရလဒ်အရ အဖွဲ့ဝင်မဟုတ်သူများ၏ ငွေကြေးပံ့ပိုးလိုမှုရော လုပ်အား (အချိန်) ပေးလိုမှုပါ အဖွဲ့ဝင်များထက်ပိုများပါသည်။ အစုအဖွဲ့ (၃) ဖွဲ့စလုံးတွင် ငွေကြေးထက် အချိန်ပေးလုပ်အားပါဝင်လိုခြင်းကို ပို၍ဆန္ဒရှိကြောင်း တွေ့ရှိရပါသည်။ ဝင်ငွေ၊ ပညာရေးအခြေအနေနှင့် မိသားစုဝင်ဦးရေတို့သည် သစ်တောထိန်းသိမ်းမှုအပေါ်ပံ့ပိုးလိုမှုအပေါ် လွှမ်းမိုးမှုရှိကြောင်း တွေ့ရှိရပါသည်။ အချိန်ပေး လုပ်အားပေးခြင်းသည် အဆိုပါ ဒေသရှိဒေသခံများအတွက် သစ်တောထိန်းသိမ်းရာတွင် လက်တွေ့ကျပြီး တတ်နိုင်သောပံ့ပိုးမှုပုံစံဖြစ်ကြောင်း တွေ့ရှိ ရပါသည်။

Willingness to Pay Money and Time for Community Forest Management: A Contingent Valuation Study in the Central Dry Zone of Myanmar

May Zin Myint, Range Officer
Forest Department

Abstract

Identifying and valuing forest ecosystem services will help analyzing cost and benefits of policy implementations and sustainable financing of the prioritized conservation programs in support of sustainable forest management. This willingness to pay study aims at estimating willingness to pay money (WTPM) and willingness to pay time (WTPT) for community forest management (participatory forest management) using contingent valuation method (CVM). A questionnaire survey was conducted using face-to-face interview with 330 respondents (CFUG members and non-members) who are managing three different community forests (agroforestry, naturally conserved and planted community forests). A scenario of forest cover increases by 30% and five hypothetical community forest conservation programs (tree planting, assisted natural regeneration, catchment protection, regular patrolling, and forest protection) was proposed to the respondents. Three sets of bidding price were set (I: initial bid at USD0.3, lower bid at USD0.2 and upper bid at USD1.0, II: USD1.0, 0.3, 2.0, III: USD2.0, 1.0, 3.0) and randomly presented to the respondents asking whether they are willing to contribute cash and/or time in community forest conservation for increased forest cover, improved water supply, biodiversity enhancement, climate regulation and reduced illegal activities. Open-ended and double bounded dichotomous choice (DBDC) questions were asked in the WTP questions. According to open-ended responses, the mean annual WTPM of all the respondents is USD1.58 (2370 MMK) and the mean annual WTPT (in monetary value) is USD86.67 (130000 MMK). The local people are willing to contribute, in terms of both money and time, in CF management regardless of CFUG membership or income level. CF characteristics may be considered as an important basis for the differences in WTPT and WTPM. The respondents highly supported the proposed CF management programs such as tree planting and catchment protection that are directly related to the basic needs, relevant to local situations, and their current CF management.

Keywords: willingness to pay, time contribution, cash contribution, contingent valuation method, forest ecosystem services, participatory forest management

ဈေးကွက်တန်ဖိုးသတ်မှတ်ချက်မရှိသော သစ်တောဆိုင်ရာဂေဟစနစ် ဝန်ဆောင်မှုများ၏
တန်ဖိုးကိုတွက်ချက်နိုင်ရန် Contingent Valuation နည်းလမ်းသုံး၍ ဒေသခံများ၏
အချိန်နှင့်ငွေပါဝင်ပံ့ပိုးလိုမှုကိုဆန်းစစ်ခြင်း

ဒေါ်မေဇင်မြင့်၊ ဦးစီးအရာရှိ

သစ်တောဦးစီးဌာန

စာတမ်းအကျဉ်း

သစ်တောဂေဟစနစ် ဝန်ဆောင်မှုများအားဖော်ထုတ်၍ တန်ဖိုးတွက်ချက်ခြင်းအားဖြင့် မူဝါဒများ အကောင်အထည်ဖော် ဆောင်ရွက်ရာတွင် ကုန်ကျစရိတ်နှင့်အကျိုးကျေးဇူးများကို စိစစ် ပိုင်းခြားနိုင်ခြင်း၊ ရေရှည်တည်တံ့သောသစ်တောစီမံအုပ်ချုပ်မှုကိုအထောက်အကူပြုနိုင် မည့် ဦးစားပေးထိန်းသိမ်းရေးအစီအစဉ်များအတွက် ငွေကြေးပံ့ပိုးမှုကိုရေရှည်တည်တံ့အောင် သုံးစွဲနိုင်ခြင်းစသည့် အကျိုးကျေးဇူးများဖြစ်ထွန်းစေပါသည်။ ဤစာတမ်းတွင် စီးပွားရေးတန်ဖိုး တွက်ချက်ခြင်းဆိုင်ရာ Contingent Valuation နည်း လမ်းအသုံးပြု၍ မန္တလေးတိုင်း ဒေသကြီး၊ ညောင်ဦးနှင့် ဝမ်းတွင်းမြို့နယ်ရှိ ဒေသခံပြည်သူ အစုအဖွဲ့ပိုင်သစ်တော (၃)ခုမှ ဒေသခံ(၃၃၀)ဦး ၏ ဒေသခံပြည်သူအစုအဖွဲ့ပိုင်သစ်တော စီမံအုပ်ချုပ်ခြင်းအတွက်ငွေနှင့် အချိန်(လုပ်အား) ပါဝင် ပံ့ပိုးလိုမှုကို မေးခွန်းများမေးမြန်းကာ ဆန်းစစ်တွက်ချက်ထားပါသည်။ သီးနှံသစ်တော ရောနှောစိုက်ပျိုးခြင်း၊ သဘာဝတောထိန်းသိမ်းခြင်းနှင့် စိုက်ပျိုးခြင်းများစသည့် ဆောင်ရွက် သည့် အစုအဖွဲ့များကို လေ့လာခဲ့ခြင်းဖြစ်ပါသည်။ ယခုလက်ရှိ အခြေအနေ နှင့် နှိုင်းယှဉ်ပါက သစ်တောဖုံးလွှမ်းမှု ၃၀% တိုးတက်လာမည် ဟုမျှော်မှန်း ယူဆချက် သတ်မှတ်ကာ အဆိုပါ တိုးတက်မှု ဖြစ်ထွန်းရေးအတွက် ဆောင်ရွက်မည့် သစ်တော ထိန်းသိမ်းရေးလုပ်ငန်းများတွင် ငွေကြေးနှင့်အချိန်ပါဝင်ပံ့ပိုးလိုမှုကို တွက်ချက်ခြင်းဖြစ်ပါသည်။ ဤသုတေသနတွင် အဆိုပြု ထားသည့် သစ်တောထိန်းသိမ်းရေးလုပ်ငန်းများမှာ သစ်ပင်စိုက်ပျိုးခြင်း၊ ရေဝေရေလဲထိန်း သိမ်းခြင်း၊ သဘာဝတောတန်ဖိုးမြှင့်စိုက်ပျိုးခြင်း၊ ပုံမှန်ကင်း လှည့်စောင့်ကြပ်ခြင်းနှင့် သစ်တော ကာကွယ်ခြင်းတို့ဖြစ်ပါသည်။ ဒေသခံများ၏ ငွေကြေးပံ့ပိုးလိုမှုကိုမေးမြန်းစိစစ်ရာတွင် အလွတ် သဘောမေးခွန်းများနှင့် ကြိုတင်သတ်မှတ်ထားသောငွေပမာဏကိုမေးမြန်းကာ ဖြေဆိုစေသော မေးခွန်းများပါဝင်ပါသည်။ မေးခွန်းတွင် ငွေပမာဏ(၃)စုံ သတ်မှတ်၍ ဒေသခံပြည်သူ အစုအဖွဲ့ ပိုင်သစ်တောအသုံးပြုသူအဖွဲ့ဝင်များနှင့် အဖွဲ့ဝင်မဟုတ်သူ၊ စုစုပေါင်း လူ(၃၃၀) ကိုမေးမြန်း ခဲ့ပါသည်။ ဆန်းစစ်ချက်ရလဒ် များအရ ဒေသခံများသည်တစ်နှစ်လျှင် သစ်တော ထိန်းသိမ်း ရေးအတွက် ပျမ်းမျှ ငွေကျပ် (၂၃၇၀)ခန့်၊ အချိန် အားဖြင့် တစ်နှစ်လျှင် နာရီပေါင်း(၂၁၇)နာရီ (ငွေကြေးအားဖြင့် လုပ်အားခ ဖြင့်ပြန်တွက်သော် ၁၃၀,၀၀၀ကျပ်ခန့်) ပံ့ပိုးလိုကြောင်း စိစစ်

တွေ့ရှိရပါသည်။ ဒေသခံများသည် အသုံးပြုသူအဖွဲ့ဝင်ဖြစ်ခြင်း၊ မဖြစ်ခြင်း၊ ဝင်ငွေအနည်း အများတို့နှင့် မသက်ဆိုင်ဘဲဒေသခံပြည်သူအစုအဖွဲ့ပိုင် သစ်တောစီမံအုပ်ချုပ်မှုတွင် အချိန်ရော ငွေပါ ပါဝင်ပံ့ပိုးရန် ဆန္ဒရှိကြောင်း တွေ့ရှိရပါသည်။ အစုအဖွဲ့ပိုင်သစ်တော အမျိုးအစား (သဘာဝတောထိန်း၊ စိုက်ခင်း၊ သီးနှံသစ်တောရောနှောစိုက်ပျိုးခြင်း) သည်လည်း အချိန်နှင့် ငွေကြေးပံ့ပိုးလိုမှုအတွက်အခြေခံအကြောင်းအရာများဖြစ်ကြောင်းတွေ့ရှိရပါသည်။ ဒေသခံများ သည် မေးခွန်းလွှာ တွင်ပါဝင်သော သစ်တောထိန်းသိမ်းခြင်းလုပ်ငန်းများအနက် သစ်ပင် စိုက်ပျိုးခြင်း၊ ရေဝေ ရေလဲထိန်းသိမ်းခြင်းကဲ့သို့ အခြေခံလိုအပ်ချက်များအပေါ် တိုက်ရိုက် အကျိုးသက်ရောက်မှုရှိသည့် လုပ်ငန်းများကို ပိုမိုနှစ်သက်ပြီးပါဝင်ဆောင်ရွက်ရန် စိတ်အား ထက်သန်ကြောင်း တွေ့ရှိရပါသည်။ စိစစ်ချက်ရလဒ်အရ အဖွဲ့ဝင်မဟုတ်သူများ၏ ငွေကြေး ပံ့ပိုးလိုမှုရောလုပ်အား(အချိန်) ပေးလိုမှုပါ အဖွဲ့ဝင်များထက်ပိုများပါသည်။ အစုအဖွဲ့(၃) ဖွဲ့စည်း တွင် ငွေကြေးထက် အချိန်ပေးလုပ်အားပါဝင်လိုခြင်းကို ပို၍ဆန္ဒရှိကြောင်း တွေ့ရှိရပါသည်။ ဝင် ငွေ၊ ပညာရေးအခြေအနေနှင့် မိသားစုဝင်ဦးရေတို့သည် သစ်တောထိန်းသိမ်းမှု အပေါ်ပံ့ ပိုးလို မှုအပေါ် လွှမ်းမိုးမှုရှိကြောင်း တွေ့ရှိရပါသည်။ အချိန်ပေး လုပ်အားပေးခြင်းသည် အဆိုပါ ဒေသရှိဒေသခံများအတွက် သစ်တောထိန်းသိမ်းရာတွင် လက်တွေ့ကျပြီး တတ်နိုင်သောပံ့ပိုး မှုပုံစံဖြစ်ကြောင်း တွေ့ရှိရပါသည်။

Willingness to Pay Money and Time for Community Forest Management: A Contingent Valuation Study in the Central Dry Zone of Myanmar

1. Introduction

1.1. Research and policy backgrounds

According to the most recent State of the World's Forests report by the United Nations Food and Agriculture Organization (FAO), 5.2 million hectares of forests have been lost in each of the last 25 years, between 1990 and 2015. In response to deforestation and forest degradation, international effort towards sustainable forest management is growing worldwide with a concern about the loss of ecosystem services such as carbon storage, biodiversity conservation, water and food security. There is evidence that within the same region, forests managed by local or indigenous communities for the production of goods and services can be equally (if not more) effective in maintaining forest cover than those managed under solely protection objectives (Bray et al., 2008; Ellis and Porter-Bolland, 2008; Nepstad et al., 2006), or with respect to the wider forest landscape (Duchelle, 2009; Stocks et al., 2007).

Sustainable forest management (SFM) aims at sustainable management of the forests' entire ecosystem which also includes forest dependent communities. In recent decades, the role of community forestry (CF) as a mechanism to achieve SFM has gained much more attention. Community forestry (CF) initiatives took place in Myanmar after a series of forest policy reforms and decentralization arrangements during the 1990s. The theory of ecosystem services (ES) needs to be operationalized to contribute to practices leading to sustainable use of ecosystems, which includes solving trade-offs between private and public benefits and incorporating monetary and non-monetary values to help inform decisions (Rusch, 2017).

Community forest management comprises a range of efforts to involve people who live in and around forests in forest management decisions. Through systematic community forest management, environmental services of community forest ecosystems such as non-timber forest products, soil and water conservation, climate regulation and rehabilitation of biological habitats can be well conserved and contribute to poverty reduction and economic development.

1.2. Community forestry and its link to ecosystem services

Community forestry was initially defined as, "any situation which intimately involves local people in a forestry activity. Community forestry comprises three main elements. These are, the provision of "fuel and other goods essential to meeting basic needs at the rural household and community level", the provision of "food and the environmental stability necessary for continued food production" and the generation of "income and employment in the rural community" (FAO, 1978).

The assessment of ecosystem services in developing countries, where people are dependent on natural ecosystems such as forests and rangelands for their livelihoods is limited due to the lack of appropriate data, methods, tools, and management framework (Shrestha & Bawa, 2014). The concept of an ecosystem service highlights the role of natural ecosystems in providing goods and services for human well-being, economic development, and poverty alleviation (Nelson et al., 2009; Turner & Daily, 2008). Since the release of Millennium Ecosystem Assessment (2005), researchers and policy-makers have been leading

a global movement to use ecosystem services as a guiding framework for merging science and action for conservation purposes. The identification and valuation of ecosystem services supports decision making and policy aimed at biodiversity conservation and sustainable development (Burkhard et al., 2009; Fisher & Turner, 2008; Koschke et al., 2012; Seppelt et al., 2011).

The ecosystem services of forests identified by previous researchers are food, water, fuel, fibre, climate regulation, flood regulation, disease regulation, water purification, and spiritual and recreational considerations (MEA, 2003; Fisher et al., 2014). Due to the difficulties in accessing reliable socio-economic and biophysical data, it is not possible to value each, and every ecosystem service associated with the forest sector. In addition, any systematic assessment of Myanmar forest ecosystem services has not yet been in place. However, the ecosystem services of community forests can generally be identified in relation to common forest ecosystem services. Provisioning services (food, fodder and local fuelwood supply), regulating and supporting services (watershed protection, water quality improvement, erosion control and pollination) are closely related to community forest conservation. The study focused on both use and non-use values of community forest ecosystem services.

1.3. Rationale of the study

Although an accurate value cannot be put on forest ecosystem goods and services, economic valuation by some kinds of valuation techniques may be much helpful in forest management for better quality or quantity of goods and services. Many previous studies have estimated the monetary value of the use-value and non-use values of forest ecosystem services. The need for economic valuation studies in community forest sector was well recognized and WTP estimation, which is the initial step in total economic value (TEV) calculation and cost-benefit analysis, was focused in this study. This study adds time contribution component to the WTP estimation considering the economic constraints of the rural people in the study areas. The study's findings may partly contribute to further TEV calculations and cost-benefit comparison in the community forest management in the studied areas. This will, in turn, guide some entry points to sustainable financing of policy implementations.

1.4. Economic valuation of forest management

Despite their tangible and intangible benefits, forests ecosystem services have been largely ignored in forest and environmental policies, and conventional economic justifications have often underestimated the contributions of forests. This has often led to the conversion of forests to agricultural land uses, as well as to lower investment in forest conservation (Costanza et al., 1997; Daily et al., 2009).

With over 70% of total population living in the rural area of Myanmar, and the role of forests is very important for people's basic needs. However, the benefits of forests and forest management are not properly evaluated and, thus, underestimated in the cost-benefit analysis of policy implementation. Monetary and non-monetary values can complement each other and generate greater ecosystem services by communications between stakeholders and enabling comprehensive evaluation that frames all the aspects of an ecosystem's contribution within the broader ecosystem framework (deGroot et al., 2010; Daniel et al., 2012).

Myanmar, being the country with the third highest annual rate of forest reduction after Brazil and Indonesia according to Global Forest Resources Assessment (2015), needs to highlight the values of forest ecosystem through proper monetary and non-monetary valuation and cost-benefit analysis for prioritizing the forest conservation projects.

1.5. Willingness to pay money and time

In developing countries, people's income is very low and households cannot give up any part of their income for public goods such as amenity. As such, asking their contributions in monetary terms only may not fully capture their values. Apart from income factor, even people from the developed countries might be willing to contribute labor to feel a sense of ownership and closeness to nature (Lankia, Neuvonen, Pouta & Sievanen, 2014). Therefore, labor contribution is taken as a part in this study because most of the targeted respondents in the selected study areas are subsistence farmers and wage workers. Taking time contribution into consideration of the local people's willingness to pay may also avoid possible underestimation of the WTP of very poor communities and those who prefer participation in forest related activities.

2. Objectives

The overall objective of the study was to estimate willingness to pay money (WTPM) and willingness to pay time (WTPT) for community forest management for improved forest cover and related benefits of community forest ecosystem services. The specific objectives are;

- 1) To estimate WTPM of the local beneficiaries for community forest management,
- 2) To estimate WTPT of the local beneficiaries for community forest management,
- 3) To examine the role of peoples' time contribution in community forest management, and
- 4) To assess the factors influencing local peoples' WTPM and WTPT

3. Materials and Methods

3.1. Contingent Valuation Method (CVM)

The study employed Contingent Valuation Method (CVM), which is a stated preference method used for estimation of economic values for both use values and non-use values including ecosystem and environmental services. The contingent [valuation](#) method (CVM) is a simple, flexible nonmarket valuation method that is widely used in [cost-benefit analysis](#) and [environmental impact assessment](#) (L. Venkatachalam, 2004). The contingent valuation method uses survey questions to elicit peoples' values for private or public goods or services by determining what they would be willing to pay for specified changes in the quantity or quality of such goods or services or what they would be willing to accept in compensation for well-specified degradations in the provision of these goods or services (Mitchell and Carson, 1989). The method involves directly asking people's willingness to pay for specific environmental services, contingent on a specific hypothetical scenario and description of the environmental service (Mitchell and Carson, 1989). It is the most widely used method for estimating non-use values which are not directly observable (Carson, 2012).

3.1.1. Application of CVM

Forests provide great ecological and economic benefits to society and provide both public and private goods. For estimating people's willingness to pay for improved use-values and non-used values of forest ecosystem services from community forests, CVM is theoretically and practically relevant to the forest ecosystem services especially non-use values such as catchment protection, carbon sequestration, pollination and seed dispersal, and biodiversity restoration. In addition, the method involves scenarios of changes in quantity or quality of the goods or services, the application of the method is considered relevant to the willingness to pay for the hypothetical forest improvement which the respondents have not experienced before.

Since there is no systematic assessment of forest ecosystem services from community forests of Myanmar, this willingness to pay study aims at supporting the ultimate economic valuation of ecosystem services that are mainly related to the community forests. Provisioning services (local fuelwood supply and non-timber forest products), regulating services (water supply and climate regulation) and supporting services (pollination and seed dispersal) are included in the study.

3.1.2. Research questions

Although the goal of many WTP studies is cost-benefit analysis based on total economic value calculation on the values of ecosystem services, the study focuses on WTPM and WTPT estimation for community forest management to answer the following questions:

- 1) How much cash and/or time the CFUG members and non-members willing to pay as community forest conservation fees for improved community forest ecosystem services in the area?
- 2) What are the factors influencing the low or high WTPM and WTPT in the studied communities?
- 3) What is the most preferred mode of contribution among CFUG members and non-members? (i.e., contribution of both money and time, money contribution only, time contribution, or neither)

3.1.3. Hypotheses

Linked to the research questions, the hypotheses are developed as follows:

Hypothesis 1: WTPM of CFUG members is greater than that of non-members

Hypothesis 2: WTPT of CFUG members is greater than that of non-members

Hypothesis 3: WTPT is greater than WTPM in all communities regardless of CFUG membership

Hypothesis 4: The ratio of being willing to pay both money and time is higher in member respondents

CFUG membership status, community forest characteristics and the WTP amounts were mainly considered in the hypothesis development. In a poor rural community, the income is generally assumed low and this may influence the WTPM amount. This assumption takes the role of WTPT into the hypothesis.

3.1.4. Study area

The study was conducted in three villages in the Mandalay region of the central dry zone of Myanmar, namely Yoe Sone (Community 1), Myay Thin Twin (Community 2) and

Kanbani village (Community 3) which are currently managing three different types of community forests, agroforestry community forest, naturally conserved community forest and planted community forest respectively.

The dry zone of Myanmar covers 54,000 km² comprising three divisions, 13 districts, and 58 townships. The average rainfall is 722 mm (28.44 inches), which is much lower than the national average of 2,352 mm (92.6 in) while the temperatures range between 15 °C and 40°C. Community 1 is in Wundwin township and Community 2 and 3 in Nyaung U township which is 187 kilometers far from Wundwin. The study areas were selected based on the community forest characteristics and the local geographical conditions in relation to the need for forest conservation and management intervention. The location map of the study areas is shown in Figure 3.1.

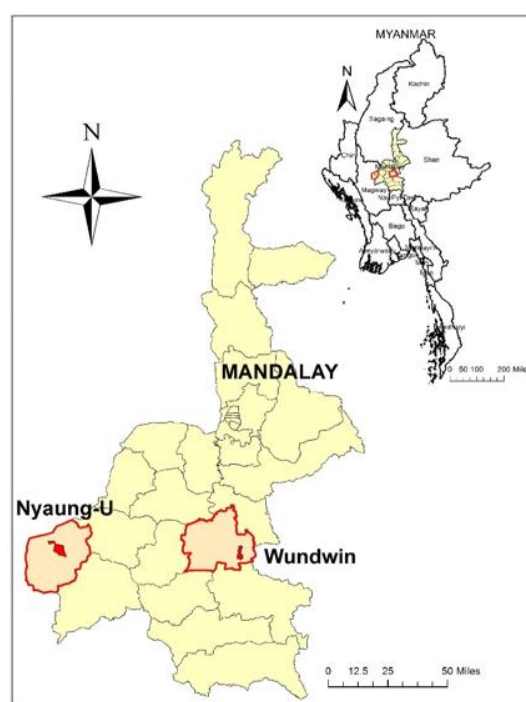


Figure 3.1. Location map of study areas

Source: *Myanmar Information Management Unit (2018)*

3.2. Community forest characteristics and management in the study areas

3.2.1. Community 1: Yoe Sone Community Forest

The community forest was established in 2004 in Yoe Sone village in Wundwin township of Mandalay region, Myanmar. The community forest covers an area of 222.577 hectares and it is in Taung Gyi Gone forest reserve. It is an agroforestry type community forest where the community forest user group members are allotted the forest plots where the local species *Sterculia versicolor* is planted and the surrounding natural forests are conserved according to community forest management plan developed by the users under Forest Department's rules and regulations. The community forest users are mainly depending on *Sterculia* cultivation which is the main source of income for them. Figure 3.2 shows the location map of Yoe Sone community forest.



Figure 3.2. Location map of Yoe Sone Community Forest in Wundwin township (Community 1)

Source: *Myanmar Information Management Unit (2018)*

3.2.2. Community 2: Myay Thin Twin Community Forest

Myay Thin Twin naturally conserved community forest is originally a village owned forest conserved by the community for provision of firewood, animal fodder and local food trees. The forest was established and conserved as a community forest since 2013 with the aid of Japan International Cooperation Agency (JICA), and local trees are planted to improve the natural forest. The forest is mainly providing fuelwood, animal fodder and some forest food such as edible fruits and mushrooms.

3.2.3. Community 3: Kanbani Community Forest

This community forest is a 60.7 hectares wide planted forest established in 2009 with the financial support of JICA and technical support of Myanmar Forest Department to provide local fuelwood supply and enhance the poor dry zone soil fertility and forest cover improvement in the area (Plantation CF). The planted tree species are local dominant dry zone species including *Acacia catechu*, *Albizia lebbek* and *Eucalyptus species*. The location map of Myay Thin Twin and Kanbani community forests is shown in Figure 3.3.

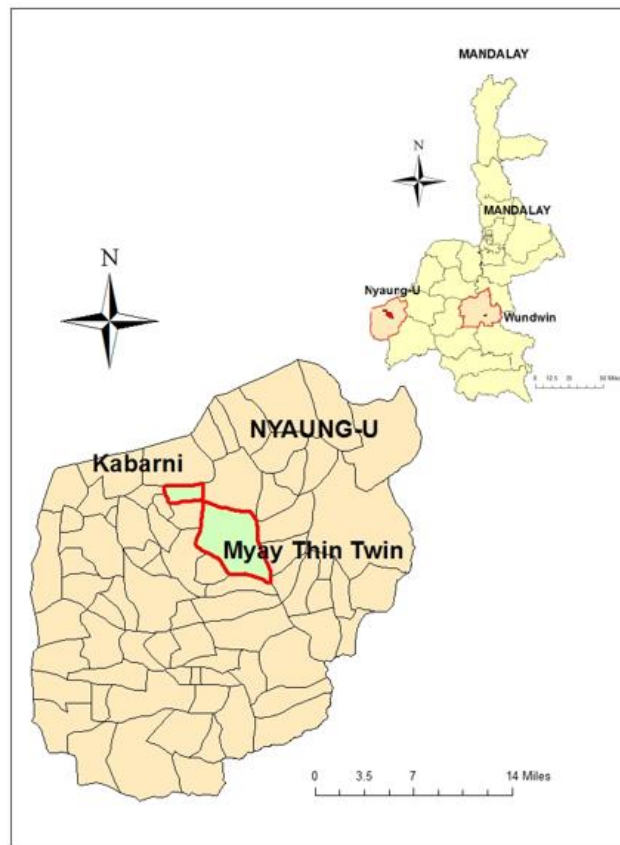


Figure 3.3. Location map of Myay Thin Twin and Kanbani Community Forests in Nyaung U township (Community 2 and 3)

Source: *Myanmar Information Management Unit (2018)*

3.3. CV scenarios and proposed community forest conservation programs

Since the contingent valuation surveys include a detailed description of a scenario that essentially constructs a hypothetical market for participants (Carson, 2000), a scenario of increased forest cover by 30% with improved ecosystem services was proposed to be used as a basis for asking conservation fee in the study. The scenario consisted of ecosystem improvement and related benefits such as increased local water supply and biodiversity enhancement as well as reduced illegal activities through community forest management. Figure 3.4 shows the proposed scenario of forest ecosystem improvement presented in the survey. The scenario was clearly explained to the respondents during the interview.

Current forest cover status



30% increase in forest cover



Figure 3.4. Contingent valuation scenario of community forest improvement

The following five community forest conservation programs were proposed under the scenario:

- (1) Tree planting
- (2) Assisted natural regeneration (ANR)
- (3) Catchment protection
- (4) Regular patrolling
- (5) Forest protection measures

In CVM questionnaires, a payment vehicle is usually specified as a means of securing an environmental or other outcome (Cummings, Brookshire and Shultze, 1986). Typical payment vehicles include levies on income taxes, water or land rates, increased park entrance fees and increased sales taxes (M. D. Morrison, 2000). Since the payment vehicle may influence the way respondents answer the elicitation questions in the survey, the study employed annual community forest conservation fee as the payment vehicle because the payment is familiar to the respondents and relevant to the context of the community forest conservation rather than tax or other forms of payment.

3.3.1. Setting of bidding prices

The present study employed two types of WTP question format, open-ended and double-bounded dichotomous choice (DBDC). Although single bounded dichotomous choice (SBDC) question is easier for the respondent, it is statistically inefficient and requires a larger sample to attain a certain level of precision. DBDC has proven to be a very widely adopted elicitation formation, mainly due to its simplicity of use in data collection (Antony and Rao, 2010) and statistical efficiency compared to the alternatives (Hanemann et al., 1991). In a DBDC question, when a respondent is offered a question with a bid amount, he or she may accept or reject that. Based on the 'yes' or 'no' response to the initial bid, the follow up bid is asked (higher bid if the respondent said 'yes' to the initial bid, and a lower bid if he answered 'no' to the initial bid).

The choice of initial and follow-up bid vectors is an important issue in the implementation of contingent valuation survey of DBDC format. Bid design is important from the point of view of the estimators because they determine the variance-covariance matrix when they are the only regressors (Cameron & Quinggin, 1994).

In this study, three sets of bids were set (I: initial bid at USD0.3, lower bid at USD0.2 and upper bid at USD1.0, II: USD1.0, 0.3, 2.0, III: USD2.0, 1.0, 3.0) (Table 3.1) and randomly presented to the respondents. To avoid the bid range bias, the basic income of the general local people in the survey areas was checked and discussed with local forest officers during questionnaire development.

Table 3.1. Three sets of bids used in the DBDC questions (MMK)

Sets of bids	Initial bid	Upper bid	Lower bid
Low	450 (0.30)	1500 (1.00)	300 (0.2)
Medium	1500 (1.00)	3000 (2.00)	450 (0.30)
High	3000 (2.00)	4500 (3.00)	1500 (1.00)

Note: USD1 is equivalent to MMK1500

(Numbers in parentheses indicate equivalent USD.)

3.4. Questionnaire survey

3.4.1. Structure of the questionnaire

The questionnaire composed of 34 questions was structured into five parts as follows. See the appendix I (a) for details of each question.

- 1) **The first part** asked the respondents characteristics including gender, income, education, occupation, house type, family size, and whether the respondent is a CFUG member or not.
- 2) **The second part** focused on the respondents' knowledge on environmental and forest ecosystem conservation asking whether and how much they know the community forest, notice of changes in the forest conditions in the area, whether they are willing to plant trees under land use rights, the benefits currently received from forests. This part also included questions about their dependency on forests such as source building materials and cooking fuels. To assess the respondent's awareness of environmental quality changes, questions about deforestation, forest degradation, drought and water scarcity experience were also included in this part. Questions about community forest such as the basic requirements for establishment of community forest, terms of land use rights, and the rules of community forest user groups were also included in this part.
- 3) **The third part** consisted of the questions related to respondents' experience in community forest conservation including participation in organized and individual activities, frequency of going to community forests and the purpose of being CFUG members.
- 4) **The fourth part** presented a description of the scenario and proposed community forest conservation programs and provided a five-point Likert scale for evaluating the five proposed programs from 1 to 5 (not important at all to very important).
- 5) **The final part** is the core component of the questionnaire consisting of WTP questions (DBDC and open-ended) for monetary and non-monetary contribution in community forest conservation (WTPM and WTPT), respondents' available free time and preferred mode of contribution (i.e., both money and time, money only, time only, or neither). Figure 3.5 shows a sample of WTP question using the highest set of bids used in the study.

Are you willing to pay MMK 3000(USD2.0) as conservation fee per year? Please make (√) in the box.	
Yes <input style="width: 50px;" type="checkbox"/> Go below	No <input style="width: 50px;" type="checkbox"/> Go below
The conservation fee has not been fixed yet. If the fee is MMK 4500 (USD3.0) , are you willing to pay?	The conservation fee has not been fixed yet. If the fee is MMK 1500 (USD1.0) , are you willing to pay?
Yes <input style="width: 50px;" type="checkbox"/> No <input style="width: 50px;" type="checkbox"/>	Yes <input style="width: 50px;" type="checkbox"/> No <input style="width: 50px;" type="checkbox"/>
How much are you willing to pay as conservation fee for the community forest? MMK Providing some of your time to work for forest conservation activities can be an alternative or additional way of contributing to sustainable management of the reforestation programs in the community forest. How many hours per week would you be willing to provide your time to support the forest management activities in this community forest? Hours per week	

Note: Translated from the original survey language (Burmese)

Figure 3.5. Sample WTPM and WTPT questions

3.5. Survey implementation

The survey was implemented in February and March 2019. A sample of 330 individuals, (110 in each community) was selected at random from village registry with the help of township general administration offices and village heads to avoid self-selection bias. Prior to the survey, a group discussion was also made with the chairmen and some community forest user group members (CFUG members) in each community to understand their interest in community forest and potential for participation in the survey.

A total of 330 respondents participated in the questionnaire survey, equating to a response rate of 100%. Due to poor internet service and telephone line as well as limited mobile phone application for email or telephone survey in the study areas, in-person interview was employed in the survey. Household visit was helpful in assessing the respondents' general socioeconomic condition and dependency on forests based on house type, use of cooking fuel and building materials. The survey lasted about 11 days in each community and the community forests were checked for better information of the forest

conditions. Depending on the time availability of some respondents, some individual interviews were grouped and interviewed at the same place such as village head's home. The pictures of survey implementation are shown in Figure 3.6.



Figure 3.6. Survey implementation photos

3.6. Data analysis

All statistical analyses were conducted using Stata 15 software package. WTP was estimated based on “yes” or “no” answers to the DBDC questions and open-ended questions. The DBDC questions were used to estimate the mean WTP of the respondents to observe the changes in the community forests of interest in each community for conducting further economic valuations and cost-benefit assessments, and for prioritizing future conservation programs in these areas. The dependent variable in the model is a dummy variable, which assumes either 0 or 1. The use of dichotomous choice questions with follow-up bids implies that the response for the second question is endogenous to that of the first. Therefore, the model cannot be estimated using the ordinary probit or logit model. Thus, bivariate probit model was employed in the analysis as the model estimates the two equations simultaneously. In this study WTP was estimated by WTPCIKR command developed by Jeanty (2007).

Studies have shown various social and economic factors that can affect WTP (Loomis et al. 2000; Cranford & Mourato 2011; Baral et al. 2013), and such variation emphasizes the needs to consider the significant factors in designing and implementing policies and management plans for each ecosystem. To understand the association between the

willingness to pay and socio-demographics, knowledge and preference of the proposed community forest conservation programs, correlation analysis was performed. Regression analysis was also performed to know the effects of these variables on WTPM and WTPT.

The survey design was reviewed and approved by the University of Tsukuba Research Ethics Committee.

4. Results and discussion

4.1. Respondents' characteristics

With an intent to assess population characteristics and representativeness of the sample of the study, the key socio-demographics of the respondents, gender, age, family size, income, education and occupation were asked in the survey. Table 4.1 shows the detail of the respondent characteristics for all respondents (n = 330), for each community (n = 110) and for the sub-groups of Community 1 (CFUG members and non-members, n = 55 each). The respondents' characteristics can be summarized as follows:

- 1) **Gender:** Over half of the respondents in the study are male (62.12% for all respondents, 73.64% in Community 1, 60% in Community 2, 52.73% in Community 3, 98.18% in members' respondents and 49.09% in non-member respondents of Community 1 respectively)
- 2) **Age:** The mean age of all the respondents was 46.46 years old. Community 3 shows a relatively higher mean age (49.55 years old). The respondents in that community are aged people who are available at home while the young people were working at the hotel zones near the archaeological site in Nyaung U city.
- 3) **Household size:** The mean household size of all the respondents is 4.5 persons (SD 4.26).
- 4) **Income:** The mean monthly income was USD96.19 (MMK144,285) for all respondents, USD96.94 (MMK145,410) for Community 1, USD105.45 (MMK158,175) for Community 2, USD86.2 (MMK129,300) for Community 3, USD128.91 (MMK193,365) for CFUG member respondents and USD64.96 (MMK97,440) for non-member respondents of Community 1. There is a big difference of mean monthly income (nearly half) between member respondents and non-member respondents of Community 1.
- 5) **Education:** 76.06% of all the respondents have completed primary education, 10.30% completed secondary, and 7.57% illiterate. There is only a small percentage of university degree holders (2.12%).
- 6) **Occupation:** Nearly all the respondents (95.76%) were farmers whose main livelihood is farming paddy, maize, peanut and sesame, and small domestic jaggery business. Only negligible percentage were government employee, retired persons and hired labor (1.82%, 0.61% and 1.82% respectively).

Table 4.1. Respondents' characteristics

	All (n=330)		Com 1 (n=110)		Com 2 (n=110)		Com 3 (n=110)		Com 1			
									Members (n=55)		Non-members (n=55)	
	Mean, %	SD	Mean, %	SD	Mean, %	SD	Mean, %	SD	Mean, %	SD	Mean, %	SD
Gender (male%)	62.12		73.64		60.00		52.73		98.18		49.09	
Age (years old)	46.46		43.09		46.74		49.55		42.78		43.4	
Household size (persons)	4.50	2.45	4.50	2.45	5.00	2.16	5.00	2.16	4.50	2.45	5.00	2.16
Monthly income (USD)	144,285 (96.19)		145,410 (96.94)		158,175 (105.45)		129,300 (86.2)		193,365 (128.91)		97,440 (64.96)	
Education (%)												
Illiterate	7.57		22.72		0.00		0.00		20.00		25.45	
Primary education	76.06		58.18		88.18		81.82		61.82		54.55	
Secondary education	10.30		12.73		8.18		10.00		9.09		16.36	
High school education	3.64		5.45		2.73		2.73		9.09		1.82	
University	0.30		0.00		0.00		0.91		0.00		0.00	
Graduated	2.12		0.91		0.91		4.55		0.00		1.82	
Occupation (%)												
Government employee	1.82		0.00		0.00		5.45		0.00		0.00	
Retired	0.61		0.00		0.91		0.91		0.00		0.00	
Farmer	95.76		94.55		99.09		93.64		100		89.09	
Hired labor	1.82		5.45		0.00		0.00		0.00		10.91	

4.2. Respondents' experience in community forests

The summary statistics on the participation and experience in community forest conservation of the respondents are shown in Table 4.2.

It was found that all the respondents have been to the community forests in their villages. The frequency of going to the forests varies with their major livelihood activities. The respondents of Community 1 (both members and no-members) go to the community forest more frequently throughout the year than those of Community 2 and 3 who are farmers living mainly on annual or seasonal cash crop farming. The CFUG member respondents in Community 1 go to the forests almost daily for collecting *Sterculia* resin from their community forest plots which makes their main income especially in the harvest season in June and late October.

As with the participation in community forest related activities, 77.27 % of all respondents answered they have not participated in organized activities and only 22.73% answered they participated once a month when there are some public campaign activities organized by the Forest Department of the Ministry of Natural Resources and Environmental Conservation of Myanmar. No one has participated in individual activities because the villagers often arrange collective activities with the lead of the village heads rather than individual activity. Respondents of Community 2 and 3 said that their family members particularly household heads participated in the community activities such as soil preparation, tilling and sowing in the early stages of the community forest establishment in 2013 and 2009.

Table 4.2. Respondents' experience in community forests

	All (n = 330)	Com 1 (n = 110)	Com 2 (n = 110)	Com 3 (n = 110)	Com 1 Members (n = 55)	Com 1 Non-members (n = 55)
Been to community forest (%)	100	100	100	100	100	100
Frequency of going to the community forest (%)						
Almost everyday	28.79	55.45	30.91	0.00	100	10.91
More than once a week	14.85	5.45	39.09	0.00	0.00	10.91
Once to a few times a month	13.03	9.09	30.00	0.00	0.00	18.18
Once to several times a year	43.03	29.09	0.00	100	0.00	58.18
Less than once a year	0.30	0.91	0.00	0.00	0.00	1.82
Participation in organized activities (%)						
None	77.27	50.00	81.82	100	0.00	100
Once a month	22.73	50.00	18.18	0.00	100	0.00
Participation in individual activities (%)						
None	100	100	100	100	100	100

4.3. Knowledge of community forest and dependency on community forest

Table 4.3 shows summary statistics of responses on the question of community forest related knowledge and awareness, the rules of community forest user groups, land use rights, and willingness to contract tree planting plots.

The respondents know a little and to some extent (37.27% and 62.12%) about the community forest but only a few respondents (0.61%) who are CFUG management committee members, know well about the purpose, procedures and the contribution of community forest to livelihood development and sustainable forest management. About 40% of the respondents of Community 1 CFUG members and non-members (43.64% and 45.45%) know about the community forest to some extent in relation to their current livelihood on forest while more than half (52.73% and 54.55%) of them know a little about basic information and requirements of CFUG members.

For all respondents, 22.12% depend on forests as their main source of income whereas the majority, 77.88%, earn their main income from farming cash crops. It was also found that all the respondents in the surveyed communities were using firewood as a cooking fuel as they do not have electricity. Small trees of local *Acacia* species are grown as hedge fences of their houses for domestic use of firewood, that is enough for each household.

Due to the typical dry soil and dominant scrub forests of the central dry zone, the people rely on the natural forests mainly for collecting fuelwood and animal fodders. This may explain the reason why 100% of the respondents buy the building materials such as timber and bamboo from the local sellers.

Regarding the willingness to plant trees in their own plots under government programs rather than community forests, only the Community 1 respondents (both members and members) agreed (100%). The respondents of Community 2 and 3 answered undecided (65.45%, 50.91%) and disagree (34.55%, 49.09%) respectively. This implies that Community 2 and 3 respondents take the current benefits and level of dependency on forest into their decision. As with the perception on implementation of forest rehabilitation programs in the dry zone area, all the respondents said important or essential.

Table 4.3. Respondents' knowledge and dependency on community forest

	All (n=330)	Com 1 (n=110)	Com 2 (n=110)	Com 3 (n=110)	Com1 Members (n=55)	Com 1 Non- members (n=55)
Knowledge of community forest (%)						
A little	37.27	53.64	0.00	58.18	52.73	54.55
Somewhat	62.12	44.55	100	41.82	43.64	45.45
Very well	0.61	1.82	0.00	0.00	3.64	0.00
Dependency on forest as the main source of income (%)						
Yes	22.12	66.36	0.00	0.00	100	32.73
No	77.88	33.64	100	100	0.00	67.27
Source of building materials (%)						
Buy from local shop	100	100	100	100	100	100
Collect from forest	0.00	0.00	0.00	0.00	0.00	0.00
Source of cooking fuel (%)						
Firewood	100	100	100	100	100	100
Willingness to contract plots for tree planting (%)						
Agree	33.33	100	0.00	0.00	100	100
Undecided	38.79	0.00	65.45	50.91	0.00	0.00
Disagree	27.88	0.00	34.55	49.09	0.00	0.00
Perception on forest rehabilitation programs (%)						
Important	15.15	26.36	10.00	9.09	25.45	27.27
Very Important	43.03	60.91	36.36	31.82	61.82	60.00
Essential	41.82	12.73	53.64	59.09	12.73	12.73

4.4. Respondents' preference on proposed community forest conservation programs

The respondents' preference on proposed community forest conservation programs is shown in Table 4.4. Five community forest conservation programs were proposed, and the respondents were asked to evaluate the importance of these programs on a five-point Likert scale from 1 to 5 (not important at all to very important).

Tree planting and catchment protection programs, among others, receive the highest preference of the respondents in all three communities and the two sub-groups of Community 1 (members and non-members) with the scores 4.67, 4.71, 4.75, 4.55, 4.49, 4.93 for tree planting program, and 3.92, 4.93, 3.84, 3.01, 4.96, 4.89 for catchment protection program. The preference score shows that the local people appreciate the importance of forest conservation and sustainable water supply through catchment in the area.

It was also found that the respondents' preferred programs in each community are relevant to the current socioeconomic conditions, community forest characteristics and management practices. The respondents of Community 2 highly supported regular patrolling program (100%) among others. It was reportedly known that their naturally conserved community forest is currently encountering the encroachment, illegal firewood collection and destruction of young trees by outsiders from the nearby village.

For Community 3, the preference for forest protection mechanisms was found relatively low (2.00) among the proposed programs. This may reflect the less importance of the need for intensive care of the 10-year-old planted community forest which was established along the highway road about 3 miles far from the village. The plantation has reached the exploitable size for industrial pulp wood production and no special care is required but the respondents supported regular patrolling program (2.75).

4.5. WTP results based open-ended and DBDC responses

4.5.1. WTTPM and WTPT based on open-ended responses

Table 4.5 presents mean annual WTTPM and mean weekly WTPT of the respondents based on their open-ended responses. The mean annual WTTPM of all the respondents is MMK 2363.48 (USD1.58), and that of Community 1, 2, 3 and sub-groups of Community 1 (members and non-members) are MMK2064.09 (USD1.38), MMK2447.27 (USD1.63), MMK2579.09 (USD1.72), MMK2110 (USD1.41) and MMK2018.18 (USD1.35) respectively. Community 2 and 3 respondents' WTTPM is higher than those of other Community 1. Community 1 CFUG members' WTTPM is higher than that of non-members. When income factor is controlled, the non-members' WTTPM is higher. The mean WTPTs per week of all the respondents, Community 1, 2, 3, Community1 members and non-members are 4.17 hours, 3.81 hours, 4.34 hours, 4.35 hours, 3.56 hours, and 4.05 hours respectively. The WTP of Community 2 and 3 is also higher in terms of time.

In Community 1, non-members' WTPT is found higher than that of members. Although the non-members have lower income and less free time, both their WTTPM and WTPT are higher than that of member respondents. The lower WTTPM and WTPT of members may be explained by how and to what extent the communities depend on the forests. All the member respondents (100%) depend on their income from agroforestry community forest (*Sterculia versicolor* resin tapping which is seasonal but market price is relatively high) under secure

land use rights whereas in non-member respondents, some are forest-dependent hired labor, and some are ordinary farmers with low seasonal income from food crops such as peanut, maize and sesame. Despite the same dependency on seasonal income between members and non-members, the type of commodity and market situations may have influence on the WTPM and WTPT.

The members may have answered the open-ended questions considering the potential of harvests of commodity and risk of market instability while the non-members may have stated their WTP amount as ordinary villagers without having to consider the vulnerability of market changes of their cheap food crops. Demand, distance to market locations, condition of road networks, and the frequency of local market days affect which products are sold (Nath et al. 2005), and that in turn can induce local people participate in forest management. The demand and market price changes may be factors influencing the lower WTPM and WTPT of members compared to non-members. It was also known from the interview of the member respondents that the price of *Sterculia* resin was recently going down due to the increasing number of people growing the species and market playing of some local brokers.

The non-members were found more willing to contribute their free time to community forest conservation. Moreover, as discussed in the previous section, 100% of the non-member respondents are willing to plant trees in their own plots under certain government program so that they can have secure land use right and improve their livelihood. Their current land tenure is not secure as they are living on a controversial land with a longtime complex land use right conflict among the responsible ministries and local government concerning the political transition of the country and difficulty in decision making.

Table 4.4. Respondents' preference on community forest conservation programs

Community forest management programs	All (n = 330)		Com 1 (n = 110)		Com 2 (n = 110)		Com 3 (n = 110)		Com 1 Members (n = 55)		Com 1 Non-members (n = 55)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Tree planting	4.67	0.47	4.71	0.46	4.75	0.44	4.55	0.50	4.49	0.50	4.93	0.26
Assisted natural regeneration	2.94	0.85	3.58	0.49	3.25	0.72	2.00	0.00	3.62	0.49	3.55	0.50
Catchment protection	3.92	0.93	4.93	0.26	3.84	0.37	3.01	0.74	4.96	0.19	4.89	0.31
Regular patrolling	3.53	1.12	2.85	0.56	5.00	0.00	2.75	0.49	2.93	0.63	2.78	0.46
Forest protection mechanisms	2.55	0.55	2.80	0.40	2.85	0.55	2.00	0.00	2.93	0.26	2.67	0.47

Table 4.5. WTPM and WTPT based on open- ended responses

Respondent type	Mean annual WTPM (MMK)	SD	Mean annual income (MMK)	WTPM/ income ratio	Mean weekly WTPT (Hours)	SD	Mean free time per week (Hours)	WTPT/free time ratio
All respondents (n=330)	2363.48 (1.58)	1021.69	1731420 (1154.28)	0.001	4.17	1.80	6.69	0.62
Community 1 (n=110)	2064.09 (1.38)	1099.39	1744920 (1163.28)	0.001	3.81	2.33	7.77	0.49
Community 2 (n=110)	2447.27(1.63)	965.62	1898100 (1265.4)	0.001	4.34	1.55	6.95	0.62
Community 3 (n=110)	2579.09(1.72)	930.14	1551600 (1034.4)	0.002	4.35	1.33	5.36	0.81
Community 1 Members (n=55)	2110 (1.41)	1443.58	2320380 (1546.92)	0.001	3.56	2.77	10.77	0.33
Community 1 Non-members (n=55)	2018.18(1.35)	592.89	1169280 (779.52)	0.002	4.05	1.79	4.77	0.85

Note: Numbers in parentheses indicate relevant USD

4.5.2. WTPT in monetary value

Contribution of time as labor in community forest conservation is as important as cash contribution. This is a useful utility measure especially in developing countries where beneficiaries of ecosystem services cannot contribute their income for public projects due to their low income and tight budgets. Contributing time as labor is another form of payment as the working hours can be translated into money values.

In this study, the open-ended responses of weekly WTPT was used in simple money value calculation. The annual WTPT in money is calculated based on the official minimum daily wage (MMK4800) set by the government in 2018 (Myanmar Payment of Wages Law, 2016). The WTPT resulted from open-ended response was translated into money amount using the hourly wage rate as follows:

$$\text{Annual WTPT (in monetary value)} = \text{WTPT per week} \times 52 \times \text{hourly wage}$$

Table 4.6 shows the mean money value of WTPT in US dollar for all respondents, Community 1, 2, 3 and sub-groups of Community 1 (members and non-members).

Table 4.6. Mean annual WTPT in monetary value (USD)

	Mean	SD
All respondents (n=330)	86.6	37.51
Community 1 (n = 110)	79.23	48.51
Community 2 (n = 110)	90.19	32.28
Community 3 (n = 110)	90.57	27.69
Com 1 Members (n = 55)	74.12	57.56
Com1 Non-members (n = 55)	84.33	37.21

4.6. WTP estimation based on double bounded dichotomous choice response

With a choice to whether “accept” or “reject” a randomly offered hypothetical bid, the probability (Pi) that a respondent will “accept” a bidding price for the double bounded model can be expressed in linear or logit form:

$$P_i = \frac{1}{1 + \exp\{-(\alpha - \beta \cdot BID) + \gamma \cdot X\}}$$

where α is a constant, β is the coefficient of the BID as community forest conservation fee, X is the vector of explanatory variables influencing the response, X is the vector of explanatory variables influencing the response, and γ is the vector of the corresponding slope parameter. The demographics such as gender, age, education, income, and family size and knowledge were considered as potential explanatory variables. The variables for the perceived importance of the community forest conservation programs proposed in the survey: tree planting, assisted natural regeneration, catchment protection, regular patrolling and forest protection.

Table 4.7 summarizes the dependent variables (Y1, Y2), key sociodemographic variables and the community forest conservation programs variables for the contingent valuation. These include gender, age, education, income, family size, knowledge of community forest of all the respondents.

Table 4.7. Dichotomous choice contingent valuation model variables

Variable	Description
Bid1	Initial bid used in DBDC question offered to respondents for annual community forest conservation fee
Bid2	The second bid offered when respondent accept or reject the initial bid
Y1, Y2	Dependent variables which takes the value “1” if the respondent accept to pay the offered bid amount, “0” if he/she refuses to pay to Bid 1 (Y1) and Bid 2 (Y2)
Socio-demographics	
Gender	Gender of respondents, “1” if male, “0” if female
Age	Age in terms number of years old
Education	Education level, “1” if respondent finished primary education, “0” if higher
Income	Respondent’s average monthly income in US dollars
Family size	Number of people in respondent’s family
Knowledge of community forest	Respondent’s knowledge level about community forest, “1” if respondent knows a little about community forest, “0” higher knowledge
Program preference	
Tree planting	Response of the respondent on tree planting program on 5-point Likert scale (1: not important at all, 2: not important, 3: neutral, 4: important, 5: very important)
Assisted natural regeneration	Response of the respondent to the importance of assisted natural regeneration program on 5-point Likert scale (1: not important at all, 2: not important, 3: neutral, 4: important, 5: very important)
Catchment protection	Response of the respondent to the importance of catchment protection program on 5-point Likert scale (1: not important at all, 2: not important, 3: neutral, 4: important, 5: very important)
Regular patrolling	Response of the respondent to the importance of regular patrolling program on 5-point Likert scale (1: not important at all, 2: not important, 3: neutral, 4: important, 5: very important)
Forest protection measures	Response of the respondent to the importance of forest protection program on 5-point Likert scale (1: not important at all, 2: not important, 3: neutral, 4: important, 5: very important)

4.6.1. WTPM results based on DBDC response

Table 4.8 presents WTPs per year estimated for the pooled data (all the respondents), Community 1, 2, 3 and sub-groups of Community 1 (members and non-members) by a bivariate probit regression model using bidding price variables only.

Table 4.8. Estimated WTP based on DBDC responses (MMK)

Respondent type	Mean WTP	Lower bound	Upper bound	ASL*	CI/MEAN
All respondents(n=330)	4,775.10 (USD3.18)	3995.79	6491.79	0.0000	0.52
Community 1 (n=110)	4345.86 (USD2.90)	3398.39	7244.60	0.0002	0.89
Community 2 (n=110)	3908.66 (USD2.61)	3270.56	6148.42	0.0008	0.74
Com 1 Members (n=55)	14,486.72 (USD9.67)	-100624.42	109222.84	0.2599	14.49

*Achieved significance level for testing H0: WTP≤0 vs H1: WTP>0

The mean WTP for all respondents is MMK4,775.10 (USD3.18). Mean WTPs for Community 1, 2 and Community 1 members are MMK4,345.86 (USD2.90), MMK3,908.66 (USD2.61) and MMK14,486.72 (USD9.67) respectively. The mean WTP of Community 3 and Community 1 CFUG members could not be estimated in the model.

In Table 4.9, the mean annual WTPM results from both open-ended and DBDC, and WTPT are summarized. The DBDC WTPM values are higher than those of open-ended response values.

Table 4.9. Mean annual WTPM (open-ended and DBDC) and WTPT

Respondent type	Mean Annual WTPM (USD) (Open ended)	Mean Annual WTPM (USD) (DBDC)	Mean annual WTPT (Money in USD)
All respondents (n = 330)	1.58	3.18	86.67
Community 1 (n = 110)	1.38	2.90	79.23
Community 2 (n = 110)	1.63	2.61	90.19
Community 3 (n = 110)	1.72	-	90.57
Community 1 (Member) (n = 55)	1.41	9.67	74.12
Community 1 (Non-member) (n=55)	1.35	-	84.33

Table 4.10 shows the ratio of “yes” response for each bid that was asked to the respondents. It was found that in the lower bids, the ratio of “yes” response is high.

Table 4.10. Ratio of Yes response to the DBDC bids

	Ratio of “yes” response to total response to the bids				
	USD0.20	USD0.30	USD1.00	USD2.00	USD3.00
Total people answering “yes”	111 (100%)	111 (100%)	106 (95.5%)	92 (85.19%)	92 (85.19%)
Total respondents to the bid	111 (100%)	111 (100%)	111 (100%)	108 (100%)	108 (100%)

4.6.2. Relationship between WTPM, WTPT, socio-demographics, knowledge and program preference

4.6.3. Correlation results

To find out the association between the open-ended WTPM, WTPT and the variables, a correlation analysis was performed. WTPM, WTPT, socio-demographics, knowledge and program preference were used in the analysis. The results of correlation coefficients with their associated p-values are presented in Table 4.11. The variables *gender*, *education*, *income*, *family size* and *knowledge level* are found significant.

The positive correlation coefficients of *education* and *family size* indicate that open-ended WTPM and WTPT are positively correlated with these variables, i.e., the more educated people are willing to contribute more to the community forest conservation. According to the correlation coefficients and direction of association, *tree planting* and *assisted natural regeneration* programs show negative significance. Respondents’ preference for *catchment protection*, *regular patrolling* and *forest protection mechanisms* program components shows positive association with WTPM and WTPT. This suggests that the higher their support for these programs, the greater their WTP in terms of money and time.

Table 4.11. Correlation coefficients of socio-demographics, knowledge, program preference with open-ended WTPM and WTPT

Variables	Coefficient	Significance
Socio-demographics		
Gender	-0.123	*
Age	-0.008	
Education	0.119	***
Income	0.336	***
Family size	0.203	***
Knowledge of community forest	-0.191	***
Program preference		
Tree planting	-0.119	**
Assisted natural regeneration	-0.205	***
Catchment protection	0.611	***

Regular patrolling	0.522	***
Forest protection measures	0.518	***

Significant at $p < 0.1^*$, $p < 0.05^{**}$, $p < 0.01^{***}$

4.6.4. Effects of independent variables on WTPM and WTPT

To examine the effects of socio-demographics, knowledge and program preference on WTP of all respondents, a regression analysis was conducted for open-ended WTPM and WTPT. Since the study areas are different in terms of their community forest characteristics and peoples' dependency on forests, regression analyses for WTPM and WTPT were separately performed for all respondents, Community 1, 2, 3, and sub-groups of Community 1 (members and non-members).

Table 4.12 presents the regression analysis results of the respondents in each community showing the predictor variables of WTPM. *Gender, income, education, and preference for forest protection program* were found significant. The results imply that WTPM is likely to increase with increased income.

Table 4.12. Regression analysis results between socio-demographics, knowledge, program preference and open-ended WTPM (Open-ended)

Variables	All (n=330)	Com1 (n=110)	Com2 (n=110)	Com3 (n=110)	Com1 members (n=55)	Com1 Non-members (n=55)
	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
Socio-demographics						
Gender	-257.08 *	92.39	-314.95	-368.72	-1866.94	38.10
Age	-6.84	3.71	120.83	-159.81	-73.95	87.11
Education	-57.95	-55.94	300.90	-226.26 *	-144.44	-0.01
Income	93.24	-46.33	338.00 *	205.97	-142.87	-31.02
Family size	14.28	79.73	-71.43	-6.19	71.27	17.41
Knowledge	-255.00	-322.59	-	-53.89	-649.44	-246.81
Program preference						
Tree planting	-33.12	397.67	-99.02	-256.55	571.21	-52.82
Assisted natural regeneration	45.11	89.41	213.29	-	-532.35	234.53
Catchment protection	-128.27	-152.57	28.46	-4.66	-296.27	-166.55
Regular patrolling	100.82	143.47	-	11.96	26.16	218.73
Forest protection measures	-109.68	256.19	-84.87	-	1501.04 *	8.41
Adj R-squared	0.0373	-0.0029	0.0329	0.0383	0.1230	-0.0464

Significant at $p < 0.05^*$

Note: The coefficients of *knowledge* and *regular patrolling* in Community 2, *assisted natural regeneration* and *forest protection* in Community 3 are omitted due to collinearity and thus their coefficients are not presented in the table.

In Table 4.13, the coefficients of the predictor variables for WTPT and their associated significance levels are presented. *Income* and *family size* variables are significant at 95% confidence level. The negative significance of family size in all respondents, Community 1 and 3 suggests that WTPT is likely to increase with a decrease in family size. Positive significance of income suggests that WTPT may increase with increased amount of income.

Table 4.13. Regression analysis results between socio-demographics, knowledge, program preference and WTPT (Open-ended)

Variables	All (n = 330)	Com1 (n = 110)	Com2 (n = 110)	Com3 (n = 110)	Com1 members (n = 55)	Com1 Non- members (n = 55)
	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
Socio-demographics						
Gender	-0.07	0.03	-0.12	-0.12	1.98	0.32
Age	0.13	0.17	-0.03	0.06	0.15	0.12
Education	-0.12	0.01	-0.23	-0.20	0.09	-0.03
Income	0.02	-0.14	0.29	0.59 *	-0.10	-0.43
Family size	-0.18 *	-0.36 *	0.13	-0.23 *	-0.46	0.01
Knowledge	-0.23	-0.61	-	0.26	-0.67	0.13
Program preference						
Tree planting	0.05	0.55	-0.08	0.02	0.16	3.15 *
Assisted natural regeneration	0.27	0.95 *	0.39	-	1.10	0.53
Catchment protection	-0.23	-0.22	0.22	0.25	-1.23	-0.21
Regular patrolling	0.06	0.16	-	-0.11	0.75	-0.84
Forest protection measures	-0.13	-0.23	0.37	-	-0.48	-0.45
Adj R-squared	0.0064	0.0488	0.0124	0.0682	-0.0067	0.1597

Significant at $p < 0.05$ *

Note: The coefficients of *knowledge* and *regular patrolling* in Community 2, *assisted natural regeneration* and *forest protection* in Community 3 are omitted due to collinearity and thus their coefficients are not presented in the table.

To understand the influence of these independent variables on the “yes” response, probit regression was also conducted as a secondary analysis. The positive (yes) response was used as dependent variable, and Bid 1, open-ended WTPM, socio-demographics, knowledge and program preference were added as independent variables. Table 4.14 presents the coefficients of the variables and significance levels.

Table 4.14. Probit estimation of the effects of Socio-demographics, knowledge and program preference on WTPM (Dichotomous choice) (n=330)

Variables	Coefficient	Significance
Bidding price (Bid 1)	-0.003	***
Open-ended WTPM	0.004	***
Gender	-0.194	
Age	-0.735	**
Education	0.160	
Income	1.807	***
Family size	0.144	
Knowledge of CF	1.810	***
Tree planting	0.305	
Assisted natural regeneration	0.334	
Catchment protection	-0.615	
Regular patrolling	-0.970	***
Forest protection measures	-1.924	***
Log pseudolikelihood	-15.306	
Wald chi2	41.85	
Prob>chi2	0.0001	
Pseudo R-squared	0.8042	

Significant at $p < 0.1^*$, $p < 0.05^{**}$, $p < 0.01^{***}$

As shown in Table 4.14, the predictor variables *income* and *knowledge* and shows positive significance on answering “yes” to the DBDC questions, suggesting that the higher the respondent’s income, the greater the probability of answering yes to the WTP questions, and the more he knows about the community forest, the more he may be willing to contribute money. Likewise, the response to open-ended WTPM questions may have positive influence on DBDC response, i.e., a respondent who stated a large WTP amount in open-ended question is likely to accept higher bid amounts in DBDC questions. However, the *bidding price* variable has negative influence on the response to DBDC question. This suggests that as the bid amount decreases, the probability of “yes” responses may increase. *Age* variable was found negatively significant suggesting that the younger the respondent, the greater the probability that he will answer “yes” to the DBDC questions. The programs regular patrolling and forest protection were negatively significant on WTPM.

4.6.5. Respondents’ preference on types of contribution

After examining the respondents stated their WTP in terms of both money and time in open-ended and DBDC questions, their preferred mode of contribution was also examined in the survey. Table 4.15 presents the four possible type respondents may contribute to community forest conservation (both money and time, money only, time only) and their preference. Majority of the respondents answered that they prefer contributing both money and time based on the amount they can afford and their available time.

Table 4.15. Preference on types of contribution in community forest conservation

Type of contribution	All (n = 330)	Com 1 (n = 110)	Com 2 (n = 110)	Com 3 (n = 110)	Com 1 Members (n = 55)	Com 1 Non- members (n = 55)
Both money and time	72.73	54.55	89.09	74.55	67.27	41.82
Money	13.64	16.36	6.36	18.18	16.36	16.36
Time	13.64	29.09	4.55	7.27	16.36	41.82
Neither	0.00	0.00	0.00	0.00	0.00	0.00
Total	100	100	100	100	100	100

4.7. Discussion

4.7.1. Willingness to pay money and time

The WTPM is found higher in non-member group than CFUG members in both open-ended and DBDC results. Both members and non-members of Community 1 are depending on seasonal income from farm crops (food crops in non-member group and *Sterculia* resin tapping in member group). According to the income level, the members' WTPM should be higher as the income factor was also found positively influencing the WTPM. Basically, the income of the people in the study areas are relatively lower compared to other parts of the country due to their low agricultural productivity. The respondents may consider the amount of money they can annually contribute to community forest based on their crop harvests. The Community 1 members may have considered market changes and harvest amount of their agroforestry cash crop.

As with WTPT, the non-members' WTPT was also found higher. In all three communities, the respondents' WTPT was higher than WTPM in both open-ended and DBDC responses. This implies that labor contribution may be considered more affordable for both low-income and higher-income people in each community. Introducing conservation programs that mainly use local people's labor contribution may be successful in some forest management operations. This suggests that non-monetary contribution is important in the community forest management in the area even though the people's income is very low.

Income and knowledge variables were found positively influencing WTPM. In addition, the bidding price has negative influence on WTPM and WTPT. According to the ratio of positive (yes) response to total respondents of each bidding price used in the study, it was found that the number of "yes" response was higher in lower bid amounts (Table 4.10).

4.7.2. Testing the hypotheses based on results

Hypothesis 1: CFUG members' WTPM for community forest conservation is greater than that of non-members

The results did not support the hypothesis. Based on the open-ended responses, the mean annual WTPM of all respondents (n=330) was USD1.58. The mean WTPMs of CFUG members (Community 1 members, Community 2 and Community 3) were USD1.38, USD1.63, USD1.72 and USD1.41, and that of Community 1 non-members was USD1.35 which seems lower than the overall average and average of each community.

When the income factor was controlled (i.e., the ratio of mean WTPM to mean annual income), the ratio of non-members was found higher than that of the other groups except Community 3 (i.e., all respondents, Community 1 members and Community 2). The WTPM/income ratio of Community 3 equals that of non-members. It was also found that both the non-members and Community 3 had relatively lower incomes compared to the other groups (USD779.52 and USD1034.4) but these respondents were willing to contribute a greater amount of money from their income. Most non-members respondents (89.09%) are ordinary farmers with low seasonal income from food crops such as peanut, maize and sesame, and some are hired labor.

Despite very low dependency on community forests for direct use values such as timber, resins and basic building materials, firewood and building materials, the non-members have appreciated the indirect use values (i.e., ecological functions of forests) such as catchment protection, nutrient recycling, climate regulation. They highly supported the programs related to indirect use values such as tree planting (4.93), catchment protection (4.89) and assisted natural regeneration programs (3.55) among other proposed community forest conservation programs.

Hypothesis 2: CFUG members' WTPT for community forest conservation is greater than that of non-members

The hypothesis was not supported by the results. The open-ended WTPT results shows that the mean weekly WTPT of all the respondents was 4.17 hours, and that of Community 1, 2, 3, Community 1 CFUG members and non-members were 3.81 hours, 4.34 hours, 4.35 hours, 3.56 hours and 4.05 hours respectively. The open-ended WTPTs of members (Community 2 and 3) were higher than that of non-members. However, the Community 1 members' WTPT was lower than that of non-members.

When the mean free time factor was controlled, the WTPT/free time ratio of non-members was found the highest, suggesting that the non-members are willing to contribute their time more than CFUG members, and thus hypothesis was not, again, supported.

The high ratio implies that the non-members are willing to contribute a large proportion of their free time in community forest management every week. Basically, most of the surveyed respondents were spending nearly the whole day in their farming activities thus their mean free time per week is very few. However, many respondents stated that they are happy to participate in collective voluntary forest conservation works for half a day or the whole day because it is their customary way of contribution to social activities in the community such as wedding or other religious occasions. The respondents may prefer labor contribution to community forest conservation activities rather than cash contribution due to their tight financial situations. Both members and non-members stated higher WTPTs than

their weekly mean free time, but the non-members' WTPT is highest among other groups. Looking also at the results of preferred mode of contribution of non-members, their preference for time contribution is the highest among all groups.

Most of the Community 1 non-members are farmers and hired labors. During the seasons without farming activities, they work as hired labor in the member's community forests. Basically, their income is not different whether from farming or hired labor work. This may make them think about more time contribution without considering too much about income, whereas in member's group, they might consider that time contribution may cause decreased productivity in their cash crop. That is why the members may be willing to pay less time than the non-members.

Hypothesis 3: Time contribution is greater than money contribution in all communities (Community 1, 2 and 3) regardless of CFUG membership

The hypothesis was supported by the study results. A large gap was found when comparing the mean annual WTPT (in monetary value) and mean annual WTPM (open-ended and DBDC) in all three communities. In all respondent groups except Community 1 CFUG members, the respondents are willing to contribute more than 45% of their weekly free time in community forest conservation. This is a considerably high ratio in the poor farming communities who have to work all day for very low monthly income.

Hypothesis 4: The ratio of being willing to pay both money and time is higher in member respondents

The hypothesis was supported by the results. The hypothesis was tested based on respondent's preferred mode of contribution to the community forest (i.e., the ratio of respondents who chose contributing both time and money). To avoid the bias of the number of respondents among members and non-members, Community 2 and 3 members were not considered in this hypothesis.

Only Community 1 CFUG members and non-members were taken in this hypothesis because the two groups have the same number of respondents (55 in each) making the comparison much appropriate. Based on the results of the preferences on contributing both money and time in Community 1 respondents, the ratio of CFUG members was 67.27% which is greater than the ratio of non-members (41.82%). The results imply that the local people are willing to participate in the community forest conservation regardless of membership or income level. Although their income and available time is low, they show their motivation and willingness to pay money and time based on their affordable amount.

4.7.3. Understanding and awareness of community forest management among users

The studied communities, both members and non-members have the knowledge of the importance of the values of forest ecosystem services especially non-use values mainly watershed protection, climate regulation and nutrient recycling. As they are living in the area very vulnerable to drought, their crop harvests are mainly dependent on the rainfall and water availability. Although their current participation in individual and organized community forest conservation activities was weak, they highly supported the conservation programs such as tree planting and catchment protection that are directly related to the local situations and their respective community forest management.

In the preference for contribution, contribution of both time and money was also found higher in all three communities. The results indicate that time contribution was greater than money contribution in all communities. For the studied low-income communities, time contribution may be considered a better option by the respondents due to their considerably low monthly income (less than USD100). The WTPT component of the study's finding highlights the local people's appreciation of the community forest ecosystem services and their willingness to contribute to the community forest management in a possible format they can (i.e., labor contribution). The WTP of the people would be underestimated if only monetary contribution was studied.

4.7.4. Discussion based on community forest characteristics

The type of community forests may also be considered as an important basis for the differences in WTPT and WTPM. In agroforestry community forest (Community 1), the WTPM and WTPT seem to be influenced by the type of agroforestry crops. The type of cash crop and its market value may have influence on the responses. Comparing between two agroforestry community forest user groups with different cash crops may tell another result. According to this study's results, the members are less willing to contribute money and time than non-members.

The Community 3 respondents are ordinary farmers who are totally dependent on farming and conserving their community forests for non-use values of the community forest because their planted forest is far from the village and is not yet exploited for income. But their open-ended WTPM and WTPT responses are relatively high among other member groups. The potential for exploitation of the forest may be a financial incentive for the community. Although their current dependency on the community forest for use values is low, they considered the aspects of non-use values such as local climate regulation, biodiversity conservation and soil erosion control.

In Community 2, the respondents are also ordinary farmers, but they receive some use-values (food and fodder, firewood) from the naturally conserved community forest. Their WTPM and WTPT were also high. The benefits received from the forest, whether use or non-use value may influence the CFUG member respondents' WTP regardless of community forest types. This implies that community forest is important to local people in different ways.

4.7.5. Limitations

The study mainly focused on the WTPM and WTPT of the local community forest user group members and non-members on the hypothetical improvement community forest ecosystem services and did not perform total benefit estimation nor cost-benefit comparison. Insufficient data on community forests characteristics and socioeconomic data of all the dry zone community forests hindered the researcher to conduct the TEV calculation and cost-benefit analysis of the proposed community forest conservation programs under the proposed scenario. Thus, the present results do not cover the community forests in the whole dry zone in the country though the study was conducted in the three well recognized model community forests of the dry zone. Yet, these results will be helpful in calculation of TEV of the community forest ecosystem services for future cost-benefit analyses in the studied community forests in the central dry zone of Myanmar. WTP estimation based on the CFUG

members' forest plot areas (i.e., individual forest ownership) would be another possible research particularly in the agroforestry community forests.

5. Conclusions

5.1. Major findings

The ultimate objective of the study was to estimate WTP in terms of money and time and to examine the factors influencing people's WTPT and WTPM to provide TEV calculation for the use and non-use values of community forest ecosystem services in the central dry zone of Myanmar. The study applied the Contingent Valuation Method setting a scenario of 30% forest cover increase and associated ecosystem services such as biodiversity restoration, improved local water supply and reduced illegal activities in community forests. In addition to cash contribution in community forest, time contribution as labor was added in the study to estimate the contribution of low-income people who cannot afford money contribution due to tight financial situations, and the role of local peoples' time contribution in the community forest management.

The estimation of WTPM and WTPT was based on open-ended and DBDC responses, and the predictors of WTP and WTPT were estimated using other analyses such as correlation analysis, regression analysis, probit and bivariate probit regression models. The key socio-demographics, knowledge about community forest conservation, and respondent's choice of the proposed community forest conservation programs were added to the analyses.

According to the results, the mean annual WTPM of non-CFUG members were higher than that of CFUG members in both open-ended and DBDC responses. The non-members' WTPT was also found higher than the other groups. In addition, the results of preferred mode of contribution showed that the non-members preference for time contribution is the highest among all groups.

The study also examined the role of WTPT in the study area compared to monetary contribution. Time contribution is greater than cash contribution in all communities (Community 1, 2 and 3) regardless of CFUG membership. There was a significantly different gap between the WTPM and WTPT (in money value) in all three communities. Results of respondents' preference on mode of contribution mode also provided an evidence to explain the higher value of WTPT in all three communities. Majority of the respondents in the study chose to contribute both money and time but the affordable amount and available time. The respondents' interest in forest ecosystem services was high. We can conclude that time contribution may be a more relevant and affordable contribution for the studied communities who are living on the monthly income less than USD100.

People's preferred type of contribution may vary based on their financial situations, time availability, appreciation of the values and benefits that they receive from the community forests. The study found out that a greater number CFUG members chose contributing both time and money compared to the same sample of non-members. It was found out that the community forests can fully provide the firewood and fodder for the local people in the study area. This supports the findings from the financial calculation of Oo (2012) that fuelwood has the largest financial value among other benefits of community forests. This study's findings also support a previous study of Soe (2012) that CFUG members have higher socioeconomic conditions than non-members in the central dry zone of Myanmar. However, contrary to another finding of that study, willingness to participate and

initiate agroforestry community forests was found higher in the non-member group. Secure land use rights, financial and technical support, and relevant certification procedures will help the local people who are willing to participate in community forest conservation and sustain their livelihoods.

5.2. Policy implications

The development of community forest management requires a strong collaborative effort between the government and participation of beneficiaries (both community forest users and non-users) and more importantly, an appropriate financial mechanism that will help facilitate implementation and equitable benefit sharing. In the forestry sector of Myanmar, inclusion of cost-benefit assessments in policy implementation is currently very weak. Consequently, some funding and efforts of implementation of conservation programs are not as successful as in the projects implemented by cost-benefit assessments. With constraints of funding in forest conservation programs, total economic value calculation and cost-benefit analysis should be included to efficiently manage the forest resources and support local development.

The study was the initial step in economic valuation of community forest management in the three community forests with different characteristics (agroforestry, naturally conserved, and planted community forests) in the central dry zone of Myanmar. It is critically important to assess the link between forest ecosystem services values and the conservation program implementations. Assessing and identifying the forest ecosystem values may help the policy makers and the implementing institutions in funding prioritizing. As many forest ecosystem services have no market price, especially regulating, supporting and cultural services, economic valuation using a variety of techniques will be beneficial for the sustainability of the projects.

This study on people's willingness to pay will provide an insight into the importance of economic valuation in community forest management and the basic requirements for conducting cost-benefit analysis related to use and nonuse values of forest ecosystem services. As monetary and non-monetary contribution in forest conservation are equally important in community forest management, the findings of this WTP study highlighted the importance of forest conservation scenario and choice of practically implementable programs, and settings of bid prices that are relevant to a contingent WTP study. Encouraging valuation studies in community forest management in Myanmar and other countries will guide the implementers to take the cost-benefit assessment into consideration in future sustainable forest management planning.

Acknowledgements

First and foremost, I would like to express my sincere gratitude to my supervisor Prof. Naoko Kaida for her continuous support with dedicated and patient supervision throughout my master's study and research at the University of Tsukuba in Japan from October 2017 to September 2019.

I would like to convey my special thanks to the Japanese Government through JICE JDS project for the financial support for this research.

I also would like to express my sincere gratitude to the Forest Department for all the arrangements and support of my master's study and research survey in Myanmar.

Finally, I would like to convey my special thanks to village heads, CFUG chairmen and members of Yoe Sone, Myay Thin Twin and Kanbani villages for their kind participation and support in my survey.

References

- Baynes, J., Herbohn, J., Smith, C., Fisher, R., & Bray, D. (2015). Key factors which influence the success of community forestry in developing countries. *Global Environmental Change*, 35, 226–238. <https://doi.org/10.1016/j.gloenvcha.2015.09.011>
- Bhandari, P., KC, M., Shrestha, S., Aryal, A., & Shrestha, U. B. (2016). Assessments of ecosystem service indicators and stakeholder's willingness to pay for selected ecosystem services in the Chure region of Nepal. *Applied Geography*. <https://doi.org/10.1016/j.apgeog.2016.02.003>
- Carson, R. T. (2000). Contingent valuation: A user's guide. *Environmental Science and Technology*. <https://doi.org/10.1021/es990728j>
- Carson, R., Flores, N., Martin, K., & Wright, J. (1996). Contingent Valuation and Revealed Preference Methodologies: Comparing the Estimates for Quasi-Public Goods. *Land Economics*, 72(1), 80-99. doi:10.2307/3147159
- Carson, R. T., & Mitchell, R. C. (1993). The Value of clean water: The public's willingness to pay for boatable, fishable, and swimmable quality water. *Water Resources Research*, 29 (7), 2445–2454. <https://doi.org/10.1029/93WR00495>
- Chazdon, R. L. (2008). Beyond deforestation: Restoring forests and ecosystem services on degraded lands. *Science*. <https://doi.org/10.1126/science.1155365>
- Hanemann, W. M. (1994). Valuing the Environment Through Contingent Valuation. *Journal of Economic Perspectives*. <https://doi.org/10.1257/jep.8.4.19>
- Hlaing, E. & Inoue, M. (2013). Factors affecting participation of user group members: Comparative studies on two types of community forestry in the Dry Zone, Myanmar. *Journal of Forest Research*, 18:60-72. DOI 10.1007/s10310-011-0328-8
- Jeanty, P. W. (2007). Constructing krinsky and robb confidence intervals for mean and median willingness to pay (wtp) using stata. *Sixth North American Stata Users' Group Meeting, Boston, August*. <https://doi.org/10.1080/08109028.2011.616027>
- Kaida, N. & Dang, N.A. (2016). Tourists' perception of marine ecosystem conservation in the Nha Trang Bay Marine Protected Area, Vietnam. *Tropics* 24 (4): 187-194
- Lindhjem, H. (2007). 20 years of stated preference valuation of non-timber benefits from Fennoscandian forests: A meta-analysis. *Journal of Forest Economics*. <https://doi.org/10.1016/j.jfe.2006.09.003>
- Monica I. O., Alex., S., M., & Barry D S. (2008). Economic valuation of environmental services sustained by water flows in the Yaqui River Delta. *Ecological Economics*. 65:155-66.
- Oo, T., Park, Y., Woo, S., Phonguodume, C., & Lee, Y., (2012). Contributions of community forestry to the rural livelihoods and watershed conservation: A case study in Ywangan township, Shan state, Myanmar. *Journal of Environmental Science and Management*, 15:77-89
- Pham. T. D., Yoshino, K., Kaida, N., Nguyen, X, H., & Bui, D, T. (2018). Willingness to pay for mangrove restoration in the context of climate change in the Cat Ba biosphere reserve, Vietnam. *Ocean and coastal management*, 163, 269-277. <https://doi.org/10.1016/j.ocecoaman.2018.07.005>
- Shahbaz, M. (2012). Does trade openness affect long run growth? Cointegration, causality

- and forecast error variance decomposition tests for Pakistan. *Economic Modelling*, 29(6), 2325–2339. <https://doi.org/10.1016/j.econmod.2012.07.015>
- Soe, A., & Sato, N., (2012). Local People's Attitudes towards the Community Forestry - The Case Studies in the Central Dry Zone of Myanmar. *Journal of the Faculty of Agriculture, Kyushu University*, 57(1), 273-280
- Tao, Z., Yan, H., & Zhan, J. (2012). Economic Valuation of Forest Ecosystem Services in Heshui Watershed using Contingent Valuation Method. *Procedia Environmental Sciences*. <https://doi.org/10.1016/j.proenv.2012.01.233>