

THE ROLE OF ANALYSIS AND  
DELIBERATION IN CHANGING  
COMMUNITY PREFERENCES FOR  
STRATEGIES AND INDICATORS OF  
SUSTAINABLE FOREST MANAGEMENT

By

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Submitted to the Faculty of the  
Graduate College of the  
Oklahoma State University  
in partial fulfillment of  
the requirements for  
the Degree of  
DOCTOR OF PHILOSOPHY

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## ACKNOWLEDGMENTS

I would like to express my gratitude to all those who have helped, supported, and encouraged me along this journey. I have worked with a great number of people whose contributions to this research deserve special mention. It is my pleasure to express my gratitude to them all in my humble acknowledgments.

I want to thank my dissertation advisor Dr. David K. Lewis, who has been a dedicated mentor and supporter. His immense knowledge and patience have been crucial contributions to my intellectual maturity. I truly appreciate all the time he committed to read, line-by-line, this document and provide his critical comments to enrich it. I really appreciate his understanding and sensitivity to issues of sustainable forest management in local communities.

My gratitude goes also to Dr. Will Focht, my Ph.D. Chair; his involvement in this dissertation has been very valuable. I thank him for all the hours he spent sharing his knowledge of sustainability and Q-methodology; those conversations have inspired me, challenged me, and helped me to grow as a researcher. I also thank him for providing funding for the first years of my Ph.D.

Many thanks to Dr. Beth Caniglia for her contributions and comments on social research and for helping me to organize the methodology. I also thank Dr. Art Stoecker for his significant questions and support in this project. I have benefited from their guidance and expertise. I gratefully thank Dr. Diane Montgomery for instilling in me a growing passion for Q-methodology in my future research; her unconditional contribution in this research has been very valuable.

My Ph.D. was funded from different sources: The Associate Dean of Academics at the College of Agricultural Science and Natural Resources in Oklahoma State University (Dr. Ed Miller) provided the funding for the last two years of work and also funded the dissertation in collaboration with the Vice president for Outreach and Development at UPAEP (Agustin Landa). Two and a half years of the work was funded by the Environmental Institute at Oklahoma State University. Many thanks to these institutions for their support. I also want to thank Mr. James Esbenshaded for the 2007 scholarship in Rural Sustainability.

I am much indebted to Dr. Ed Miller for making this project feasible and for helping me to continue my Ph.D. His positive attitude has helped me to understand that a Ph.D. is just the beginning of a new life. I really appreciate his support, encouragement, and friendship.

Collective and individual acknowledgments are owed to my colleges in UPAEP. Thanks to Austin Landa, for his motivation to help students and communities. “Muchas gracias” to Rodolfo Lopez for sharing mutual concerns, for listening, and for allowing me to be on the team. My appreciation goes to Rodolfo Carvajal, Lupita Fabregas, Odette Peregrino, Ailed Muñoz, and Jeremy McLean for helping me with all the logistics in Puebla. I also extend the acknowledgement to Rogelio Zenteno and David Jimenez for borrowing information about the research site. Special thanks to my colleague in the

Colegio de Posgraduados in Texcoco, Dr. José René Valdez, for explaining Mexican Forestry Legislation to me. I also thank Carlos Albicker the director of SEMARNAT, Puebla for his willingness to visit the forest and for allowing his staff to provide information to me.

I want to acknowledge Talya Henderson and Matt Albright on the Environmental Science Graduate Program for all their help dealing with administrative work. I am grateful for their friendship; their encouragement during the difficult times will always be remembered. Many thanks to Dr. David Henneberry and Dr. Adel Tongco for being so patient and flexible with the work schedule; thanks also for cheering me up.

“Mil gracias” to the community of La Preciosita for their hospitality and willingness to cooperate with this project. I especially thank Benita Caballero for all the information provided and for her hospitality. Thanks to my friends Hilario and Lupita Guzman, without them the interviews would not have been possible. Thanks to Mercedes Velazques and her sister Flor del Campo for their assistance.

Thanks to Peter Mayer, Alexander Buck, and Dr. Michael Klein at the IUFRO headquarters for allowing me to access needed information, danke schön. Thanks to my Vienna Community Church friends Carolyn, Randy, Lizia, Stephanie, Karo, Helen and Dan for the wonderful time I spent in Vienna with them during my internship in IUFRO.

Many thanks to Jason Abercrombie, Tricia Kippola, Lichi Lin, and Jan Meig for helping me with the statistics for the survey. I also thank my colleagues and friends in Colombia Liz Villarraga and Naydhu Bohorquez for giving me their comments on the survey, and for their constant support. Thanks to Laura Dumin for helping me with editing and Al Tongco for helping me with GIS.

Friends are an important part of this journey and I want to thank Dr. Yesica Mayett for her friendship and support during my stay in Puebla; this thanks is also extended to my colleague Carolina Lara. Sumit, Saima, Yuyun, Fitry, Hannah, Christina Stallings, Diana, Jacky, Chelito, Josh, Lore, Ku and Tofi have been my great moral supporters; thank you guys. Thanks to my dear friend, the American soldier, Yamil Castillo who was always caring even when he was in Iraq having a difficult time.

I am so much indebted to my great friend Nancy Miller for her understanding and caring; Nancy without your help this could not have been possible. You will be always remembered.

Where would I be without my family? I deeply thank my sister Carol Collins, who has been there day-by-day listening, cheering, and caring unconditionally; sister I do not have words to thank you. I thank you for helping me with all the projects during my Ph.D. and for being so unselfish and giving me great advices. Your time and friendship are invaluable. Thanks to my brothers Jairo, Alvaro, Leonardo, and Henry for their encouragement and prayers, thank you for listening to me and for being close to me when I needed you most. We have all grown together; I love you.

The last paragraph is to my mother, Clara. I do not have words to express my gratitude to her. She has been my motivation and inspiration; I thank her for all the sacrifice she endured, for guiding me to be the person I am now, and for all her love. To her I want to dedicate this dissertation; she is a real example of those women who, with many sacrifices, are able to confront the world to offer a better future to their children. With all my love, the following lines are to her.

## ABBREVIATIONS

A&D: Analysis and Deliberation

CIFOR: Center for International Forestry Research

C&I: Criteria and Indicators

CBFM: Community Base Forest Management

CIFOR-NA: Criteria and Indicators developed by CIFOR for North America

FAO: Food and Agricultural Organization of the United Nations

IRB: Institutional Review Board

LUCID: Local Unit Criteria and Indicators Development

SEMARNAT: Secretaria del Medio Ambiente y los Recursos Naturales (Mexico)

SFM: Sustainable Forest Management

UPAEP: Universidad Popular Autonoma del Estado de Puebla

## TABLE OF CONTENTS

CHAPTER I.....	1
INTRODUCTION .....	1
1.1 Background and Setting.....	4
1.1.1 Research Site – La Preciosita.....	5
1.2 Statement of the Problem.....	8
1.3 Purpose of the Study .....	10
1.4 Hypothesis.....	10
1.5 Definition of Terms.....	11
1.6 Limitations of the Study.....	11
1.7 Basic Assumptions of the Study .....	12
1.8 Significance of the Study.....	13
CHAPTER II.....	17
LITERATURE REVIEW .....	17
2.1. Sustainable Forest Management at the Local Level .....	18
2.1.1 The Evolution of Sustainable Forest Management.....	18
2.1.2 The Role of SFM in Poverty Alleviation.....	21
2.1.3 Criteria and Indicator of SFM.....	23
2.1.4 Community-Based Forest Management .....	25
2.1.5 The Applicability of Analysis and Deliberation in CBFM.....	28
Source: Dr. Will Focht PPA notes, Oklahoma State University-ES.....	31
2.2 Values and SFM Strategies .....	31
2.3 Preference for C&I of SFM .....	34
2.4. Summary .....	36
CHAPTER III .....	39
METHODOLOGY .....	39
3.1 Research Site.....	39
3.2 Institutional Review Board Clearance .....	40
3.3 Research Design.....	40

3.3.1 Research Questions .....	41
3.4 Q-Methodology .....	41
3.4.1 Instrumentation .....	43
3.4.2 Data Collection Q-Methodology.....	45
3.4.3 Q-sorts Data Analysis .....	47
3.5 Survey .....	49
3.5.1 Instrumentation .....	50
3.5.2 Data Collection Survey .....	51
3.5.3 Data Analysis Survey.....	52
CHAPTER IV .....	54
FINDINGS FROM Q-METHODOLOGY .....	54
4.1 Subjects and Instrumentation.....	54
4.2 Factors.....	57
4.2.1 Factor A: Forest Conservation.....	59
4.2.2 Factor B: Community Development.....	62
4.2.3 Factor C: Family Recreation.....	66
4.2.4 Factor D: Sustenance .....	69
4.2.5 Summary of Factors.....	72
4.2.6 Second Rotation Factor A and B .....	75
CHAPTER V .....	80
FINDINGS FROM THE SURVEY.....	80
5.1 Subjects and Instrumentation.....	81
5.2 Findings from Baseline Survey.....	86
5.3 Findings from Analysis Survey .....	94
5.4 Findings from Deliberation Survey .....	105
CHAPTER VI.....	114
DISCUSSION .....	114
6.1 Consensus Strategy for Sustainable Forest Management .....	114
6.2 The Role of Analysis and Deliberation.....	116
6.3 Findings and Implications.....	127
6.4 Postscript on the Acceptance of Forest Management Plan for Tourism.....	131

CHAPTER VII.....	135
SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS.....	135
7.1 Summary .....	135
7.1.1 Findings.....	136
7.2 Conclusions.....	143
7.3 Recommendations and Reflections upon the Process.....	145
REFERENCES .....	147
APPENDICES .....	158
Appendix 1: IRB .....	158
Appendix 2: Interview for Q-Methodology English.....	159
Appendix 3: Interview for Q-Methodology Spanish .....	161
Appendix 4: Spanish Survey.....	163
Appendix 5: Alternatives of Management.....	166
Appendix 6: New Forest Management Plan (Amendment to the “Programa de Manejo Forestal para el Aprovechamiento de Recursos Forestales en la Sociedad Productora Rural La Preciosita” .....	170
Appendix 7: Final Interview -English.....	178
Appendix 8: Final Interview Spanish .....	180
Appendix 9: Copy of the Agreement UPAEP – Forest Owners .....	182



## LIST OF TABLES

Table 1: Economic Activities of La Preciosita Village .....	6
Table 2 Demographics for interviews and Q-sorts .....	55
Table 3 Four-Factor Matrix .....	58
Table 4: Factor Correlation Matrix .....	58
Table 5: Distinguishing Statements for Factor A - Conservationist .....	60
Table 6: z-scores for Q-Statements: Factor A - Conservationist .....	61
Table 7: Distinguishing Statements for Factor B – Community Development .....	64
Table 8: z-Scores and Rankings for Statements: Factor B – Community Development..	65
Table 9: Distinguishing Statements for Factor C – Family Recreation .....	67
Table 10: z-Scores and Ranking for Statements: Factor C – Community Development .	68
Table 11: Distinguishing Statements for Factor D - Sustenance .....	69
Table 12: z-Scores and Ranking for Statements: Factor D – Sustenance.....	71
Table 13: Demographics for People who Significantly Defined Each Factor.....	72
Table 14: z-Scores for Factor A’ .....	77
Table 15: z-Scores for Factor B’ (+ and -).....	79
Table 16: Demographics for the Survey .....	81
Table 17: Selected Indicators for Sustainable Forest Management.....	83
Table 18: Indicators for Sustainable Forest Management, Sources, and Grouping.....	88
Table 19: Cronbach’s Alpha Values for Baseline Survey .....	91
Table 20: Indicators Ranked 5 (Very Important for more than 50% of the Population).	92
Table 21: Indicator Ranked 4 for more than 50% of the Population .....	93
Table 22: Cronbach’s Alpha Values for Analysis Survey .....	95
Table 23: Indicators Significantly Different after Analysis Survey .....	96
Table 24: Indicators that Increase on Ranking after the Analysis Survey .....	98

Table 25: Indicators that Decreased on Ranking after Analysis Survey .....	103
Table 26: P-values for Principles .....	104
Table 27: P-values for Three Pillars of Sustainability .....	105
Table 28: Cronbach's Alpha Values for Deliberation .....	106
Table 29: Indicators Significantly Different after Deliberation.....	107
Table 30: Indicators that Increase on Ranking after Deliberation .....	109
Table 31: Indicators that Decrease in Ranking after Deliberation.....	111
Table 32: P-values for Principles .....	113
Table 33: P-values for Three Pillars of Sustainability .....	113
Table 34: Indicators Ranked Very Important (5) for More than 60% of the Population in Each of the Surveys .....	126
Table 35: Indicators that Increased Importance after both Analysis Survey and Deliberation.....	127

## LIST OF FIGURES

Figure 1: Representation of Analysis and Deliberation.....	31
Figure 2: Q-Board.....	45
Figure 3: Factor A Sort.....	62
Figure 4: Factor B Sort.....	66
Figure 5: Factor C Sorts.....	69
Figure 6: Factor D Sorts.....	72
Figure 7: Factors A and B.....	76
Figure 8: Second Rotation Factors A and B (40 degrees).....	76

## **CHAPTER I**

### **INTRODUCTION**

Forests around the world support several socio-economic functions; millions of people directly depend on forest resources for their livelihoods. Forests are used for timber, fuel-wood, spiritual sites, medicines, honey, mushrooms, roofs, fruits, environmental services, and many other benefits for more than 1.6 billion people in the world (FAO & DFID, 2001). As populations keep growing, more resources are demanded; therefore, the sustainability of the forest is a major concern in the international environmental arena (FAO, 2007).

In this context, the term sustainable forest management (SFM) became popular to describe stewardship and use of the forest/forest services to fulfill economic, ecological, and social functions for current and future generations without jeopardizing its ecological functions and availability (FAO, 2005a). However, its real practice remains exiguous; the lack of resources and adequate knowledge to implement forest management plans are some of the challenges to achieve SFM. Furthermore, stakeholders' participation in forest planning has been disregarded for several decades because of the complexity of including social values (Agnoletti & Anderson, 2000; Ananda, 2007). Additionally, integrating criteria and indicators (C&I) to monitor SFM

has become an intricate task due to differences in forest types, geography, and socioeconomic conditions of forest users.

Although forest sustainability is a global concern, achievements towards SFM can be better practiced at the local level. Community-based forest management (CBFM) represents a good venue to implement SFM. Small communities share the same geographic location, resources, and cultural values, all of which facilitates communication (Menzies, 2007). In small communities, the common concepts for achieving SFM are equity, legitimacy, inclusion, economic benefit, empowerment, respect for culture, and ecological issues. This suggests that small forestry communities provide meaningful C&I of SFM (Stephen R. J. Sheppard & Meitner, 2005; Sherry, Halseth, Fondahl, Karjala, & Leon, 2005; Woodley et al., 1999; Wright et al., 2002) because people's needs, values, and priorities can be integrated into them. Additionally at the community level the development of forest management plans can be more participative to meet community's needs.

There is an urgent need to develop participatory approaches for forest management planning that involve values, preferences, and real commitments to action (Howlett, Bond, Woodhouse, & Rigby, 2000; Knopp & Caldbeck, 1990; Lawes & Everard, 1999; Maness & Farrell, 2004; G. A. Mendoza & Dalton, 2005; Guillermo A. Mendoza & Prabhu, 2000; Guillermo A. Mendoza & Prabhu, 2006; Montreal Process, 2001; Mrosek, Balsillie, & Schleifenbaum, 2006; Wright et al., 2002). Analysis and deliberation (A&D), is a decision-making framework (Stern & Fineberg, 1996) recommended by the National Research Council, that has promised to be an approach

for involving people's and forest's values in the development of forest management plans that are socially acceptable, ecologically sustainable, and economically efficient.

This research investigates changes in preferences for indicators of SFM, while a sustainable forest management plan is developed in a participatory process of analysis and deliberation. A&D serves as a mechanism to incorporate values and preferences during planning; A&D also assures that the final outcome, as reflected by the adoption of a forest management plan, meets people's preferences, includes their values, and ensures that the indicators for SFM are fully understood and embraced.

A forestry community of 200 families in the State of Puebla, Mexico provided the venue for this research. Qualitative and quantitative data were collected to investigate people's values and preferences associated with forest management. The analysis of Q-methodology (Stephenson, 1953) provided the basis for understanding the subjective perspectives associated with forest management (*problem identification*). Indicators of sustainable forest management were summarized in a survey to capture the difference in preferences before and after analysis and deliberation. Three forest management alternatives were presented in a search meeting to expose the forest owners to information (*policy analysis*). A deliberation meeting was conducted to select the alternative for implementation (*policy deliberation*).

A sustainable forest management plan for tourism was desired by the forest owners. The selected plan addressed indicators of ecological and socioeconomic sustainability. The forest owners agreed to use the forest as an ecological reserve for tourism; they also agreed on timber extraction only to improve the health of the forest; the use of non-timber products was restricted to domestic use only. The forest owners

also agreed to manage the forest on their own, although they will consult with forestry professionals to provide technical guidance.

The compelling quest of Adam and Kneeshaw (2008) of “how values will be translated into effective management strategies” (p.2035) can be answered with this process. The research also goes further toward showing a systematic procedure to incorporate values into strategies and to make the strategies socially acceptable and implementable. Q-methodology proved to be effective in the identification and definition of the problem. It gave insights on perceptions of forest management, which allowed the incorporation of values into a strategy of management to avoid further conflicts; it helped to structure analysis and to avoid conflict. A&D proved to be a strong platform to develop sustainable policies associated with forest management, and A&D helped to clarify management objectives; it further to refines indicators of SFM. Consequently, the forest management plan is legitimate, transparent, and trustworthy.

### **1.1 Background and Setting**

In November 2007, the OSU College of Agricultural Sciences and Natural Resources agreed to participate with Universidad Popular Autonoma de Puebla – UPAEP in its effort to assist a small rural community in a sustainable development project. The community authorities approached UPAEP requesting help to develop a management plan for a forest land of 420 ha. There was a general discontent with an existing plan that was designed without forest owners’ consultation for intensive timber harvesting. The forest owners wanted to use their forest as means to improve their quality of life; however, some disagreements on how to use the forest were appearing.

Hence, a plan was needed that reflected people's values and needs, included indicators of SFM, and complied with Mexican Forest Law. However, the plan itself was not enough; there was a concern for how the forest owners would agree to implement the plan. Consequently, it was necessary to find a decision-making framework that recognized a plurality of values and incorporated good science, a process in which forest owners could express their desires without feeling intimidated, and a process in which the final outcome assured the health of the forest and the well-being of the community.

This was an appropriate scenario to investigate the role of analysis and deliberation in the development and implementation of sustainable forest management strategies; it was also a good case study to explore a systematic procedure to incorporate people's values into management strategies.

### **1.1.1 Research Site – La Preciosita<sup>1</sup>**

The village of La Preciosita Sangre de Cristo is one of the 17 communities of the municipality Santa Rita Tlahuapan in the northeast State of Puebla, Mexico. It borders the states of Tlaxcala and Mexico. The village is part of the Sierra Nevada mountain system and belongs to the Atoyac Basin. It takes its name after a Sanctuary constructed in 1792, which is located at the edge of the village. La Preciosita has a population of 890 inhabitants, and according to 2006 statistics, 287 people migrated to the United States; the community has a large population of women and children. La Preciosita is an ejido, a form of land tenure in which the land is shared by people. On average, each *ejidatario* (farmer) has 2-3 hectares of land to cultivate. The economy of La Preciosita is based on

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<sup>1</sup> The research site background was extracted from a non published document "Ordenacion Territorial del Municipio de Tlahuapan." This document is part of a project established between the ONG Enlace and the government of Puebla, the project is in process.



subsistence farming; corn, beans, and wheat are the principal crops. Vegetables are also produced seasonally, including pumpkins, tomatoes, and chili. Fruit trees grow wild in the *ejido*; pears, nogal, tejocote, peaches, and apples are abundant. Some families have cattle which produce milk to be sold within the village; 90% of the families grow chickens on their patios. To help make their living, women weave tablecloths and napkins that are sold in a famous large market (San Martin Texmelucan) an hour from La Preciosita. Some men also go to the big cities to work on construction, and many of them migrate to United States and Canada to work temporarily. The following table shows the distribution of economic activities:

**Table 1: Economic Activities of La Preciosita Village**

<b>Activity</b>	<b>No. Families</b>	<b>Observation</b>
Dependent farming	28 families	Their farming depends on remittances from family member overseas. 2 or more members are migrating. Domestic consumption of the products with small production to sell in the market.
Subsistence farming	42 families	Family farming, low dependence of remittances. 1 member of the family is migrating. Domestic consumption only.
Proletarian farming	48 families	Strong dependence on government subsidies and work force. Young families are characteristic in this group because land distribution is getting smaller.
Merchant	2 families	Diverse income from different small businesses.
Entrepreneurs	0	
<b>Total</b>	<b>130</b>	

*Source: Plan de Ordenamiento Territorial Municipio de Tlahuapan*

The role of men in La Preciosita is concentrated around farming, conservation of the reserve, and political administration. The role of women revolves around school, health, nutrition, and being promoters of development projects. Although the voice of women is silent because by tradition men make the decisions, the women's active participation in developing projects has been a milestone in the last years. The

community of La Preciosita has an elementary school and long distance middle school (telesecundaria) in which students are in a classroom with the supervision of one teacher but the classes are transmitted on TV. The closest high school is 3 kilometers away in the community of Colzingo. Public services are extremely deficient; electricity is intermittent, water is channelized from the small creek, and waste management does not exist; and only the sewage service is in good condition. The community of La Preciosita is classified as the least developed area of the region.

Despite the unsatisfactory economic situation, this community is characterized for its cultural richness, which relies on the spiritual relation to forest resources along with the conservation of traditions inherited from the Aztec Empire. In 1972, one hundred members (99 men and 1 woman) of the community purchased a forestland of 416 hectares. According to comments from forest owners, the land was purchased for a very modest price from a priest; because of this, forest owners believe that it was a blessed gift from God. As a consequence, they feel strong commitment to protect the forest and to keep it in good condition. In the early '80s the forest land was legally registered as a Unit of Management and Harvesting of Wildlife (UMA, Unidad de Manejo y Aprovechamiento de Flora y Fauna Silvestre) under the name "Reserva Ecológica Campesina La Preciosita Sangre de Cristo" which is owned by "Sociedad de Producción Rural de Responsabilidad Limitada La Preciosita." This legal title was needed to establish a deer-hunting project inside the reserve. However, five years after the legal name was established, the project failed. Since then the reserve (as it is usually called) has not been subject of management of any kind, although the extraction of timber and non-timber products has been practiced.

Land tenure of the forest has been modified since the date of its acquisition. In early stages of purchasing the land 100 community members invested in the forest land. As a result the name of these members appears in the legal title as principal owners. However, due to immigration (most of the middle age men immigrated to USA) there was not enough man power to work on the land, a new legal figure was implemented to allow other people to participate as owners. As a result principal owners involved their male children as shareholders, who at that time where teenagers. This process required the payment of an extra fee for each child. The new owners became secondary owners and have their names on the legal title. Therefore, the final legal document for the property contains 157 owners. However, there is not a legal document that clarifies the distribution of the benefits. This situation becomes a limitation in the practice of decision making; although by tradition, activities associated with forest land have been decided by principals and secondary owners or their immediate family members in their absence.

The reserve of La Preciosita is home to more than 40 species of fauna (mammals, birds, and reptiles), 5 species of pines, 7 species of broad-leaf trees, and more than 20 species of herbaceous plants.

## **1.2 Statement of the Problem**

The concept of sustainable forest management (SFM) as a strategy to ameliorate deforestation has been evolving over the last 25 years. The World Commission on Environment and Development in 1987 was a milestone to incorporate sustainable practices world-wide (Wright et al., 2002). The Intergovernmental Panel on Forest (IPF) and the Intergovernmental Forum on Forest (IFF) have proposed that all countries create

their own national criteria and indicators (C&I) as a framework for promoting SFM (Lawes & Everard, 1999).

Currently, several C&I are available; the first set was developed for temperate and boreal forests under the coordination of the Montreal Process. Then, international organizations such as International Tropical Timber Organization (ITTO), United Nations Food and Agricultural Organization (FAO), and Center for International Forestry Research (CIFOR), in coordination with some countries in Africa, Asia, and North and South America have proposed their own C&I. However, there is still a problem with their actual implementation due to differences in forest types and sizes (S. R. J. Sheppard, 2005; Sherry et al., 2005; Wright et al., 2002) as well as differences in economic and social conditions within the same region and country (Cheng & Durst, 2000; Wright et al., 2002). Furthermore, issues of temporal and spatial scale are more salient when reporting and analyzing data (Montreal Process, 2001). Therefore, further research is needed to understand how C&I can be developed and implemented for local forest units.

There is a global concern for developing strategies to incorporate values into forest planning (Adam & Kneeshaw, 2008; Berninger, Kneeshaw, & Messier, 2009; Sherry et al., 2005; Steelman & Maguire, 1999) to assure the success of forest management. Furthermore, it has been widely expressed that to guarantee SFM, more stakeholder participation is needed (Carr & Halvorsen, 2001; Dourojeanni & Seve, 2006; Parkins & Mitchell, 2005; Pujadas & Castillo, 2007; Steelman & Maguire, 1999; Stoll-Kleemann & O'Riordan, 2002). Therefore, there is a need to find a decision-making process for forest planning that acknowledges the plurality of values and incorporates the indicators of SFM.

### **1.3 Purpose of the Study**

The purpose of this study is to examine the role of analysis and deliberation on preferences toward the use of a forest according to a set of indicators for sustainable forest management. One of the biggest challenges of indicators of SFM is their implementation at the local forest units. A local forest unit is the scale in which management policies are implemented (Wright et al., 2002) and community participation is required. This study focused on people's preferences and perceptions toward their forest. It aimed to understand how people view their forest and what they want from it. This information was important to prepare a comprehensive forest management plan that contained relevant indicators of SFM for the local population. People's preferences were reflected by choice in the selection of management alternatives.

### **1.4 Hypothesis**

General question: Does analysis and deliberation change people's preferences with regard to indicators for sustainable forest management?

Specific questions:

1. What are people's viewpoints toward forest use?
2. What are people's preferences in regard to the forest?
3. What are the changes in preferences for indicators of sustainable forest management resulting from analysis (knowledge) and deliberation?

## 1.5 Definition of Terms

**Indicators:** “An indicator is a quantitative or qualitative parameter which can be assessed in relation to a criterion. It describes in an objectively verifiable and unambiguous way features of the ecosystem or the related social system, or it describes elements of prevailing policy and management conditions and human driven processes indicative of the state of the eco-and social system” (Woodley et al., 1999, p. 23).

*Indicator* is also understood as “A measure (measurement) of an aspect of the criterion. A quantitative or qualitative variable which can be measured or described and which, when observed periodically, demonstrates trends” (Montreal Process, 1995).

**Sustainable Forest Management:** CIFOR has defined sustainable forest management as: “a set of objectives and outcomes consistent with maintaining or improving the forest’s ecological integrity and contributing to people’s well-being both now and in the future” (Woodley et al., 1999, p. 23).

Some other definitions are available: ITTO (2006) defines SFM as “the process of managing permanent forest land to achieve one or more clearly specified objectives of management with regard to the production of a continuous flow of desired forest products and services without undue reduction in its inherent values and future productivity and without undue undesirable effects on the physical and social environment” (p.12).

## 1.6 Limitations of the Study

The following are some limitations to accomplishing the purpose of the study.

1. This study cannot be replicated due the unique social and biological conditions.

2. General assemblies were not always 100% attended. Part of the population of the community spends most of their time out of the country.
3. During the general assemblies, the women tended to be silent because of gender issues.
4. Legal title of the reserve is not fully clear; therefore the population selected for the study is a mix of principal owners, secondary owners, and immediate family members of principal owners.
5. New officers for the reserve committee were elected during the research project.
6. Mexico does not have clear legislation and guidelines to manage a forest for tourism.

### **1.7 Basic Assumptions of the Study**

The following assumptions were considered in this study.

1. People actively participated in discussions because they showed an interest in conserving the forest. A forest committee is selected by consensus, and is in charge of all the activities related to the forest.
2. The selected indicators satisfy people's needs for at least the next 20 years. However, studies have shown that indicators tend to be refined due to new policies, new scientific information, and exchange of experiences (Lawes & Everard, 1999).

## 1.8 Significance of the Study

According to (FAO & DFID, 2001) about 1.6 billion ( $10^9$ ) people in the world depend heavily on forest resources for their living. Forests provide several benefits to humanity; they help to protect and enrich soil and sustain water resources, they serve as a barrier for some natural disasters (i.e. hurricanes, landslides, etc.), they are the principal sink for CO<sub>2</sub>, and they produce most of the oxygen on earth. As ecosystems, they stabilize the habitat for many species of fauna and flora that are sources of medicines; they are also a source for numerous important timber products (Gardner-Outlaw & Engelman, 1999; Siry, Cabbage, & Ahmed, 2005). However, despite their importance, the world's natural forests are declining (FAO & DFID, 2001). Some of the causes of deforestation are related to the conversion of forests for agricultural land, cattle grazing, urbanization, unplanned industrial logging, etc.

To conserve the world's remaining forests, many international and national actions have been taken. The most popular and perhaps controversial is the 'Sustainable Forest Management' approach. The United Nations Forum on Forest was created in 2000 to "promote the management, conservation, and sustainable development of all type[s] of forest and to strengthen long-term political commitment to this end" (The United Nations Forum on Forest Secretariat, 2000) ¶ 1. This decision was made based on the premise that forest resources contribute directly to livelihoods, particularly in developing countries (FAO & DFID, 2001). Additionally, global wood consumption has tripled during the last century (Gardner-Outlaw & Engelman, 1999). It will be impossible to



become totally independent of forest resources; therefore, sustainable management has to be a priority in all instances.

Although, SFM is still in its infancy (Dourojeanni & Seve, 2006; Siry et al., 2005), some progress has been done. To promote SFM, strategies such as C&I, forest certification, market regulation, private property rights, and community forest participation have been tried. The definition of C&I as key instruments for monitoring and evaluating SFM is a good strategy. At the international level, commitments in adoption of C&I are possible (Lawes & Everard, 1999; Montreal Process, 2001). Research institutes have started processes with countries to provide technical support in the formulation of C&I such as the Center for International Forestry Research (CIFOR), The United States Forest Service, and the International Tropical Timber Organization (ITTO) (Lawes & Everard, 1999; Siry et al., 2005).

Criteria and Indicators, as a framework for SFM, face the challenge of actual implementation (Siry et al., 2005) due to the inability of C&I to reflect the specific needs of small forest communities. Usually, forestry activities take place in small units (Lawes & Everard, 1999; Maness & Farrell, 2004; Guillermo A. Mendoza & Prabhu, 2005; Wright et al., 2002); therefore, developing C&I for these small forest units is a priority (Mrosek et al., 2006; S. R. J. Sheppard, 2005; Stephen R. J. Sheppard & Meitner, 2005; Sherry et al., 2005; Wright et al., 2002).

The C&I at the local level seem to be more realistic, especially when they have to be implemented and analyzed (Woodley et al., 1999). Additionally, they help to enhance local policies related to forest use. An advantage of developing C&I at the local level is

the ease in which the researchers and policy-makers can access other stakeholders (Guillermo A. Mendoza & Prabhu, 2005, 2006; S. R. J. Sheppard, 2005; Stephen R. J. Sheppard & Meitner, 2005; Sherry et al., 2005). If stakeholders develop their own C&I according to their needs, the probability of C&I being accepted and implemented will increase (Guillermo A. Mendoza & Prabhu, 2005; Sherry et al., 2005).

Some of the strategies to promote SFM, including the development of C&I, have gained participation among forestry communities in which local democratic control over natural resources has been exercised. These strategies have helped reduce deforestation (Didia, 1997) and poverty (A. M. Larson, 2003), contributed to social equity, and increased awareness of sustainable management practices (Benjade & Ojha, 2005; Gupte & Bartlett, 2007; Parkins & Mitchell, 2005; S. R. J. Sheppard, 2005).

Although participatory democracy is a necessary condition for effective collaboration and decision-making in public land planning, it is not sufficient. Value conflicts can make consensus impossible (Arvai, Gregory, & McDaniels, 2001; Moote, McClaran, & Chickering, 1997; Rowe & Frewer, 2004). Natural resource management, particularly with forests, involves a large variety of values related to nature and the human condition. Therefore, it is important to include values when planning and to adopt a political decision-making framework that acknowledges the plurality of those values.

Deliberative democracy theory is sensitive to a plurality of values. It offers a process in which individuals engage their values to obtain mutual understanding and resolve conflicts (Arvai et al., 2001; Gupte & Bartlett, 2007; Smith, 2003). Deliberative democracy theory has been applied successfully to environmental and forest management

decisions-making (Arvai et al., 2001; Beierle & Cayford, 2002; Benjade & Ojha, 2005; Carr & Halvorsen, 2001; Gupte & Bartlett, 2007; Parkins & Mitchell, 2005). It not only recognizes differences in values, but also informs and educates citizens and encourages them to formulate solutions to local problems.

Analysis and deliberation as a practice of deliberative democracy is thus well suited to the accommodation of the plurality of values involved in sustainable forest management. Because analysis and deliberation emphasizes stakeholder participation in both the analysis of policies and policy formulation, it builds political legitimacy based on its efforts to obtain the voluntary and informed consent of citizens.

## **CHAPTER II**

### **LITERATURE REVIEW**

This chapter summarizes the theoretical and research literature that supports this study. The purpose of the study is to investigate the role of analysis and deliberation in people's changes in preferences for indicators of sustainable forest management (SFM) at the local level. To accomplish this purpose the research examined values and perceptions of forest owners and their relation to social, economic, and ecological factors associated with an already established set of indicators for North America. Analysis and deliberation were used as mechanisms for community participation in the development and adoption of a sustainable forest management plan that met peoples' preferences and values and included indicators for sustainable forest management.

This review of literature describes community-based forest management (CBFM) as a means to use analysis and deliberation, to achieve sustainable forest management. The chapter is divided in four sections. Section one provides an examination of the evolution of SFM and its role in poverty alleviation; it also contains a review of criteria and indicators of SFM at the local level and their applicability in CBFM. Sections two and three present a review of the available research associated with the inclusion of people's values into SFM strategies and preferences for C&I at the local level. Section four of this review of previously published work provides a summary of the findings.

## **2.1. Sustainable Forest Management at the Local Level**

Despite numerous definitions of sustainable forest management that are available, general agreement rests on the idea that forests provide many benefits and services that are associated with ecosystem functions, economic development, and social stability. Consequently, the integration of the sustainability of these functions into forest management guarantees the sustainability of the forest. Much research has been done to demonstrate that SFM is best accomplished at the local level (Adam & Kneeshaw, 2008; Klooster, 2002; Mrosek et al., 2006; S. R. J. Sheppard, 2005; Sherry et al., 2005). Local communities have firsthand experience with forest benefits. Criteria and indicators (C&I) as means to evaluate progress on SFM serve as a platform for decision-making and evaluation. Although several projects have been conducted to develop C&I of SFM at the local level in a participatory process (Cheng & Durst, 2000; Lawes & Everard, 1999; Guillermo A. Mendoza & Prabhu, 2000; S. R. J. Sheppard, 2005; Stephen R. J. Sheppard & Meitner, 2005), there is still a need to find a systematic framework that includes people's values and C&I in management strategies and decision-making.

### **2.1.1 The Evolution of Sustainable Forest Management**

During the late 19<sup>th</sup> century the term “sustained-yield forest management” became popular in the United States (Sample, 2004) as a mean of managing national forests by and for the people (Henderson & Krahl, 1996). As a consequence, the Sustained-Yield Forest Management Act was passed by Congress in 1944 (Dana & Fairfax, 1980). Its

purposes were to promote forest industries, employment, forest wealth, and to maintain ecological functions (United States Secretary of Agriculture, 1944, p. 1).”

According to Henderson and Krahl (1996), the Act “did not address community development, social well-being or the political process in relation to forest management (p. 5).” Later in 1960, the Multiple-Use Sustained Yield Act was implemented. This Act acknowledged other forest services and products different from timber and also instructed the Forest Services to account for the needs and interests of stakeholders (Leach, 2006). In 1976, the National Forest Management Act put some limits on timber harvesting to protect non-timber resources (Sample, 2004) and to include public involvement in national forest planning (Henderson & Krahl, 1996). However, it has been criticized because its earlier applicability seemed to be more consultative than participative (Dana & Fairfax, 1980; Henderson & Krahl, 1996; Scardina, Mortimer, & Dudley, 2007).

Due to the discontent of stakeholders and the increasing amount of litigation and appeal, in mid-1980 the Forest Service decided to explore more interactive collaborative approaches to public involvement (Leach, 2006). Through the time of this publication, some progress has been made to better involve the public in forest planning (Carr & Halvorsen, 2001; Hunt & Haider, 2001; Leach, 2006; Scardina et al., 2007; Steelman & Maguire, 1999).

In Latin America the first forest policy that mentioned the use of forests for the benefit of people was in Argentina in 1948 (Llaurado & Speidel, 1981) followed by Mexico’s Forest Law of 1960 that declared that forest resources were of public interest and thus they should be used to derive maximum social benefit. However, the emphasis was on the industrial production of timber (Silva, 1997b).

In Latin America policies that included community participation, intergenerational needs, and ecosystem sustainability became important only after the World Commission on Environment and Development defined sustainable development and encourage the transfer of funds from the developed to the developing world (Silva, 1997b). The earliest forest policies were market-oriented, pursuing economic development for an increasing population (Llaurado & Speidel, 1981; Silva, 1997b).

The Brundtland report (World Commission on Environment and Development, 1987, p. 43) became a benchmark for the term “forest sustainability” in Latin America; although, sustainable forest practices only gained significance years later. The Earth Summit marked the beginning of a “New Era” for the practice of forestry. At the Earth Summit a set of Forest Principles were adopted. This was the first global consensus on the management, conservation, and sustainable development of all types of forests (United Nations, 1992). These Forest Principles acknowledged the importance of forests for the economic development of countries and also for the maintenance of all types of life. As a consequence of the Forest Principles, forest management has moved from being focused only on timber yield to a more holistic approach now well known as Sustainable Forest Management (SFM).

Luckert and Williamson (2005) identified four differences between SFM and sustained yield. SFM explicitly considers a large set of values associated with forest goods and services, including economic, cultural, and social values. SFM also accounts for trade-offs among forest goods, services, and uses. The health of the forest, ecological integrity, and biodiversity are more emphasized in SFM. The importance of dealing with the uncertainty due to the complexity of the forest is also acknowledged in SFM. In this

sense SFM is a more holistic concept that goes beyond timber extraction and economic development; it encompasses the three pillars of sustainability: economic, environmental, and socio-cultural aspects related to forest practices (FAO, 2005b). Sustainable Forest Management is an array of actions with which people rationally use the forest to perpetuate its availability to provide an array of services.

### **2.1.2 The Role of SFM in Poverty Alleviation**

Sustainable Forest Management became an international strategy to fight deforestation and overcome poverty. Forest loss is directly associated with poverty, and people who live in or near the forest are forced to shift forest land into agricultural land in search of a better life (Schimdt, Berry, & Gordon, 1999). However, the dependence on natural resources is not the major cause of poverty (Ali et al. 2006); conversely poverty is not the major cause of resource degradation (Agudelo, Rivera, Tapasco, & Estrada, 2003; Ravnborg, 2003; Scott M. Swinton, Escobar, & Reardon, 2003; S. M. Swinton & Quiroz, 2003).

The primary causes of both poverty and resource degradation included centralized economic and political structures; concentration of resource's ownership and benefits (S. Dasgupta, Deichmann, Meisner, & Wheeler, 2005; A. Larson, Pacheco, Fabiano, & Vallejo, 2006; Rodríguez-Piñeros & Lewis, 2005; S. M. Swinton & Quiroz, 2003); counterproductive legislations that encourage conversion of forest land to agriculture (Freitas, Kahn, & Rivas, 2004; Southgate & Hitzhusen, 1987); the lack of opportunities and programs that directly address social influence to forest; and poor coordination between institutions (Schimdt et al., 1999) are the most representative.



Bebbington (1999) indicated that in order to help overcome rural poverty it is important to understand how rural households access the five capital assets: natural, produced, human, social, and cultural. Local communities have internal and external pressures that make them fragile organizations. Most rural poor communities have suffered from migration, acculturation, colonization, land conflicts, and conflicts within organizations (Bebbington et al., 1993; Hurst, 2003). Development facilitators have a tendency to impose their own concept of sustainable development (top-down approach), ignoring the fact that local organizations have their own political, cultural, and social concerns, which in most cases differs from the concerns of the state and other groups.

Strategies to reduce poverty are associated with the enhancement of the forest products market and forest governance (FAO 2001). Recently more attention has been given to forest governance, particularly community participation and forest decentralization. It has been demonstrated that by empowering the local population, people feel ownership of the resources and thus are more committed to implementing, monitoring, and enforcing the law (Nygren, 2005). Some studies have demonstrated that well-organized poor communities know how to use resources without creating any damage, and at the same time obtain monetary benefits from the adequate use of those resources (Antinori & Rausser, 2007; Bebbington, 1999; Bebbington & Perreault, 1999; Benjade & Ojha, 2005; Loiza-Villegas, 2004; Mitchell, 2006).

In this sense SFM and its contribution to poverty alleviation implies more commitment to understanding local socio-cultural and economic aspects (Rice, Sugal, Ratay, & da Fonseca, 2001) as well as ecological sustainability of the forest. In addition, more local participation is required (Carr & Halvorsen, 2001; Haggith, Muetzelfeldt, &

Taylor, 2003; Hunt & Haider, 2001; G. A. Mendoza & Dalton, 2005; Mitchell, 2006; Nygren, 2005; Purnomo et al., 2003). Several studies have shown that traditional knowledge is essential for environmental management; therefore, the involvement of the communities in decision-making should be encouraged as well (Beierle & Cayford, 2002; Benjade & Ojha, 2005; Berkes & Folke, 1998; Blanchet, 2001; Lyons, Smuts, & Stephens, 2001; Pujadas & Castillo, 2007).

To monitor and assess healthy forest conditions that guarantee social and economic stability, and to create a common understanding of sustainable forest management, criteria and indicators are needed. According to FAO 2005b, C&I help to

increase understanding of sustainable forest management by generating better information; improv[ing] the development and implementation of forest policies, programs and practices; strengthen[ing] stakeholder involvement in decision-making; and enhanc[ing] collaboration on forest issues at the local, national, regional and international levels (p. 15).

It is because of these factors that have C&I in place is so important.

### **2.1.3 Criteria and Indicator of SFM**

The Montreal Process provides the following definitions for criteria and indicators.

A criterion is a category of conditions or processes by which sustainable forest management may be assessed. A Criterion is characterized by a set of related indicators which are monitored periodically to assess change.” An indicator is “[A] measure (measurement) of an aspect of

the criterion. A quantitative or qualitative variable which can be measured or described and which, when observed periodically, demonstrates trends (Montreal Process, 2001, p. 1).

Criteria and associated indicators are grouped by social, economic, and ecological factors to obtain better information on the ecosystems, to assess more sustainable management decisions, and to help the society to understand its relative position to sustainability (Woodley et al., 1999, p. 15).

In 1993, the government of Canada convened a group of experts on boreal and temperate forests to find ways to measure progress toward sustainable forest management. As a result of this meeting, seven criteria and 67 indicators for SFM were defined. These international initiatives have been replicated in different countries and regions to find ways to implement C&I at the local, national, and regional level (Cheng & Durst, 2000; Lawes & Everard, 1999; Maness & Farrell, 2004; G. A. Mendoza & Dalton, 2005; Mrosek, Balsillie, & Schleifenbaum, 2006; Organization, 1998; Sheppard & Meitner, 2005; Sherry, Halseth, Fondahl, Karjala, & Leon, 2005; Woodley et al., 1999; Wright et al., 2002).

The Center for International Forestry Research (CIFOR) tested C&I of SFM around the world (Woodley et al., 1999). For North America, the project was named CIFOR-NA, which was lead by the USDA-FS. It evaluated 207 indicators at the forest management unit (FMU) level; this perhaps was the first attempt to test C&I in small units. Testing C&I is complicated because of the lack of a comprehensive methodology that acknowledges norms in a regional or national context (Mrosek et al., 2006).

Furthermore, integrating C&I into different disciplines remains a difficult task due to complexities among forest users as well as forest products and services.

Consequently, there is a need to test and develop C&I at the local level to simplify understanding and better asset SFM. Several researchers have already started to investigate ways to develop and test C&I at the local level as tools for forest policy and management; computer-based simulation is one of the strategies used (Maness & Farrell, 2004; Guillermo A. Mendoza & Prabhu, 2000; Mrosek et al., 2006). Qualitative research has also played a role in testing C&I at the local level (Sherry et al., 2005); stakeholder meetings and questionnaires have been used (Berninger et al., 2009; Pokharel & Larsen, 2007), as well as comparison among different sets of C&I (Adam & Kneeshaw, 2008; Mrosek et al., 2006).

These efforts to understand the role of C&I as a means to achieve forest management have lead to the conclusion that C&I are easier to develop and test in small communities; local people tend to introduce indicators that are more meaningful to them (Adam & Kneeshaw, 2008; Fraser, Dougill, Mabee, Reed, & McAlpine, 2006; Pokharel & Larsen, 2007) because they have firsthand experience with the resource(s) and have their own definition of sustainability (Sherry et al., 2005). Furthermore, the involvement of local communities in the development of C&I helps to make management decisions more participative; thus, sustainable forest management promises to be a reality.

#### **2.1.4 Community-Based Forest Management**

The new tendency of forest management is named “Community-based forest management” (CBFM) (Menzies, 2007), which implies that forests are managed in small communities where participation is the most salient component.

The World Commission on Environment and Development (1983) urged an increased public involvement in decision-making to facilitate equity in the allocation of the resources (Hunt & Haider, 2001). This statement arose due to the failure of several development projects in Latin America during the late 1970s that practiced the top-bottom approach (Bebbington, 1997; Bebbington & Perreault, 1999; Beierle & Cayford, 2002; Didia, 1997; Southgate & Hitzhusen, 1987). Therefore, in the forest sector a call for a more participative approach to manage forests emerged.

Lane and McDonald (2005) indicated that at the local level, community participation gains importance because people are “better able to understand and intervene in environmental problems because they are ‘closer’ to both the problem and the solution” (p. 710). In this sense, Antinori and Rausser (2007) studied the implication of having collective choices that lead to collaborative outcomes. Their study in a Mexican forestry community, which is characterized by a common property system, revealed that participation between foresters and community members via the General Assembly leads to positive outcomes in forest management planning. Stoll-Kleemann & O’Riordan (2002) identified three reasons for why this participatory approach is important in achieving sustainable livelihoods; it increases levels of democracy, legitimacy, and knowledge. However, there are several levels of participation and several barriers to participation which contribute to failures to achieve the expected outcome.

In some countries gender equity might hinder the process of participation (Menzies, 2007; Mitchell, 2006; Pierce-Colfer, 2005; Stoll-Kleemann & O’Riordan, 2002), issues of land tenure are still a problem (Carruthers, 2001), and the concept of

democracy for some countries is still in its infancy (Alteiri & Rojas, 1999; Midlarsky, 1998). Conflicts between expert knowledge and local practices are a common problem in many situations (Blanchet, 2001; Cojti-Cuxil, 1998; Lane & McDonald, 2005; Stoll-Kleemann & O'Riordan, 2002).

In a community with a relatively small population, different values may be presented; all individuals are different and so they see the world from different perspectives (Arvai et al., 2001). Different actors pursue different benefits including livelihood subsistence, forest health, labor and employment, social justice, gender equity (Pierce-Colfer, 2005), markets for forest products, spiritual places, and water reservoirs (Belfer, 2001; Berkes & Folke, 1998; Bossel, 1998; Doubleday, Mackenzie, & Simon, 2004; FAO & DFID, 2001; Flora, Flora, & Fey, 2004).

CBFM's basic premises are the common sharing of the benefits and services from the forest, seeking balance between local and national interests, and increasing local responsibility for the health of the forest (Harrison & Suh, 2004). There is not a common framework on how to approach a perfect community-based forest management; however, some valid recommendations based on successful projects are provided by different researchers. Briefly, common concepts in community-based forest management are gender equity, legitimacy, inclusion, economic, culture, empowerment, and ecological issues.

Community-based forest management as a means to achieve SFM in which participation is a constant appears to be a promising trend. It provides a good place to express values and to agree on actions; it facilitates communication among different stakeholders ensuring legitimacy. Due to the closeness of the resources, CBFM helps to

also easily identify biological problems of the ecosystem. In many cases, CBFM serves as a model example for other communities who, for some reason, have problems with organization (Fraser et al., 2006; Sherry et al., 2005).

### **2.1.5 The Applicability of Analysis and Deliberation in CBFM**

The National Academy of Sciences urged groups to use “more participatory approaches to risk management that integrate analysis and deliberation to incorporate a wide range of stakeholders values in decisions about risk management” (Arvai et al., 2001, p. 1065). This resulted in a framework that considered analysis and deliberation (A&D) as two interdependent components for policymaking proposed by the National Research Council.

Deliberation is the formal process of citizen communication for collectively considering issues; it offers a place for people to present, exchange, and reflect on ideas that matter to them (Stern & Fineberg, 1996). Deliberation is a participatory learning process that involves both affected and concerned parties, therefore, it makes the process of policy making more democratic, legitimate, and informative (Stern & Fineberg, 1996). It also increases the acceptance of substantive decisions and trustworthiness because it gives the community the potential to consider more choices and clarify the nature and extent of agreements or disagreements among the parties.

In relation to forest management through participation, local knowledge about ecological, social, and economic contexts can be assessed (Carr & Halvorsen, 2001). Participation also helps to create social equity and enhance the sustainability of the environment (Benjade & Ojha, 2005; Hunt & Haider, 2001; Knopp & Caldbeck, 1990).

However, participation *per se* is not sufficient to promote sustainable forest management. In some cases, participation means that the public is involved but might be a passive recipient of information (Rowe & Frewer, 2004)

Stoll-Kleemann & O’Riordan (2002, p. 165) questioned “what would happen if local people decided, through participatory mechanisms, that they wanted to use their resources in an unsustainable way?” This question has serious implications in the practice of participatory approaches; it implies that people did not have sufficient and meaningful knowledge or that the facilitators did not know the traditional practices of the community they were helping; or that the sense of community is weak (Rosenberg, 2007).

To ameliorate the factors that hinder participation, and to gain legitimate policy process and outcomes, expert information is needed. Therefore, analysis, as defined by Stern & Fineberg (1996), is the other essential part of good policymaking. Understanding local interests, values, and needs can break the barriers to communication between local people and experts; this understanding would also contribute to an increase in legitimacy and trust.

Analysis is a procedure that provides reliable information about a problem; it also contributes to the strength of the knowledgebase for deliberation. Analysis gives affected and interested parties the best scientific information; it characterizes risk, shows uncertainties, and analyzes possible outcomes. However, it is important to mention that analysis is not only about sciences, it is also a way to learn from others (Webler, 1998); the inclusion of all parties in the analysis process suggests that values are involved (Stern & Fineberg, 1996). Therefore, as suggested by Webler (1998), analysis is about both facts and values.

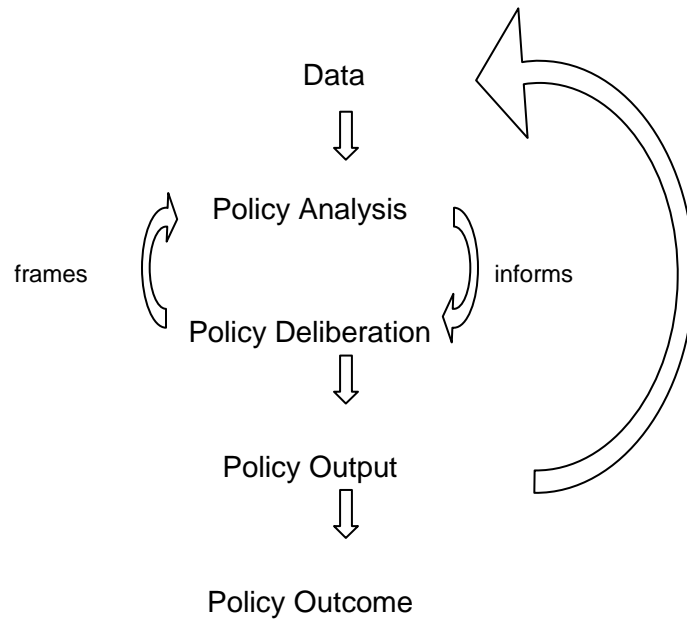


The A&D framework not only includes participation (as a good component of democracy) but also includes public information; thus, the role of citizens in policymaking and implementation is both voluntary and informed. The A&D framework is a process that increases understanding, implements good science, involves interested parties, and informs these parties about facts and values. One of the strengths of A&D is that it is a recursive process that can be applied from the first step (problem formulation) through the last step (decision) of policymaking. During this process, analysis and deliberation become interdependent components (see Figure 1) for policymaking; deliberation frames analysis and analysis informs deliberation (Stern & Fineberg, 1996). A&D also helps to identify relevant issues that are sometimes otherwise disregarded by science.

The A&D framework guarantees accountability, as both the interested and concerned parties are involved. It also promotes responsiveness; when people's values are engaged people tend to respond positively, and this becomes a completely informed process. The A&D framework also legitimizes policies because it is a voluntary and informed process. According to Smith (2003), environmental management involves a large variety of values related to nature and the human condition. Forest ecosystems, as part of the environment, involve several social, timber, and non-timber values. Therefore, any decision-making process associated with forest resources might need to include a political process that acknowledges the plurality of these values.

A&D, as recommended by the National Academy of Sciences (Stern & Fineberg, 1996), represents a the theoretical framework in which criteria and indicators are used as a means to achieve sustainable forest management implemented at the local level.

**Figure 1: Representation of Analysis and Deliberation**



Source: Dr. Will Focht PPA notes, Oklahoma State University-ES

## **2.2 Values and SFM Strategies**

Sustainable forest management implies that forest sustainability, community wellbeing, and participation are inseparable. There is a global concern for developing strategies to incorporate people's values into forest planning to assure the success of the decision-making associated with forest management (Adam & Kneeshaw, 2008; Berninger et al., 2009; McFarlane, 2000; Sherry et al., 2005; Steelman & Maguire, 1999; Swedeen, 2006; Xu & Bengston, 1997). It has been widely expressed that to guarantee SFM, more stakeholder participation is needed (Carr & Halvorsen, 2001; Dourojeanni & Seve, 2006; Parkins & Mitchell, 2005; Pujadas & Castillo, 2007; Steelman & Maguire, 1999; Stoll-Kleemann & O'Riordan, 2002). However, stakeholders' participation in forest planning has been difficult for several decades because of the complexity of

including social values (Agnoletti & Anderson, 2000; Ananda, 2007; Ananda & Herath, 2003). Then participation becomes a challenge because different stakeholders pursue different goals according to their own values (Ananda & Herath, 2003; Arvai et al., 2001; Berninger et al., 2009; Pokorny & Schanz, 2003).

Winter (2005) expressed clearly that “multiple stakeholders compete for their different views to be heard” (p.1). In this sense, Barry and Proops (1999) stated that it is very hard to judge environmental policies to be socially acceptable and implemented if people’s discourse is unknown. Therefore, it is important to identify *how* people think about environmental issues. Briefly, there is a need to understand how a person communicates key words of his or her point of views associated with SFM to make decision process more participative because it reflects for people’s values.

Q-methodology is a technique that has successfully been used to identify people’s viewpoints and their application for decision-making in local communities (Barry & Proops, 1999; Ockwell, 2008; Pelletier, Kraak, McCullum, Uusitalo, & Rich, 1999; Tindall, 2003). It emerged in 1935 for the study of subjectivity; William Stephenson was the first scientist who introduced it to the scientific community (McKeown & Thomas, 1988; Robbins, 2005). Since then, it has been used in several disciplines from psychology, sociology, health, education, political science, environment, and forest management among others. Subjectivity is assumed to be communicable and operant; thus in the first case individuals have a coherent explanation of their beliefs and motivations. In the second case, subjectivity can be “performed anytime someone articulates his or her point of view or agrees or disagrees with others” (Robbins, 2005, p.

210). Subjectivity is also operant because opinions on a specific topic are interrelated and can be expressed as a whole.

Q-methodology allows stakeholders to “subjectively define their opinions on an issue” (Ockwell, 2006, p. 176). It is designed to analyze the psycho-social internal psychology of people, which is composed of beliefs, motivations, attitudes, and opinions that people develop. Those are elements that people interrelate to create their own points of view and made their own decisions (deHegedus & Vassallo, 2005).

Q-methodology has been widely used in different disciplines including forestry related research. Previous researchers have used Q-methodology as a systematic technique to capture people’s viewpoints associated with SFM, to identify preferences for management, to discover internal and external constituencies, and to identify areas of agreement and disagreement in relation to forest management (P. Dasgupta & Vira, 2005; Steelman & Maguire, 1999; Swedeen, 2006). In addition Steelman and Maguire (2006); and Swedeen (2006) used Q-methodology to understand social discourse toward forest management and to find cooperation among groups that had long histories of conflict over forest management. Q-methodology has also been used to understand public perspectives on forest’s contribution to climate change mitigation (Nijnik, 2005).

These researchers aimed to understand people’s values and reduce conflict among stakeholders, there is still a need to understand how to incorporate these values into management strategies (Adam & Kneeshaw, 2008) and to avoid conflict. Q-methodology provides a systematic statistical procedure to understand stakeholders’ perspectives toward the use of resources in a small community; its use to develop sustainable management strategies will considerably contribute to avoiding future conflicts.

Q-methodology has also been used to develop and evaluate indicators of sustainable development that were relevant to stakeholders in the city of Limerick, Ireland (Doody, Kearney, Barry, Moles, & O'Regan, 2009). The study of Doody et al. resulted in a list of indicators that were both technically accurate and incorporated the views of the public.

For the purpose of this research, Q-methodology is useful in understanding people's viewpoints toward forest management, and to selecting indicators of SFM that are relevant for the forest owners of La Preciosita and that can be integrated into a forest management strategy, in a more participative process.

### **2.3 Preference for C&I of SFM**

Research to test and develop C&I of SFM is relatively new; the earliest local level test was conducted by the Center for International Forestry Research in 1994 (Mrosek, 2002) where different evaluations in different parts of the world, Germany, Indonesia, Cote d' Ivoire, Brazil, Austria, India, and Cameroon took place (Woodley et al., 1999). The results of these tests led to a set of C&I that was further tested in North America in 1998. The testing consisted of four phases to evaluate 207 indicators at the forest management unit (FMU) level. Sixty-five indicators were rejected because "they were conceptually weak, impossible to use operationally, or irrelevant to the North America context" (Woodley et al., 1999, p. 9). This was the first attempt to test C&I in small units. The outcome is known as CIFOR-NA and it contains 17 criteria and 57 indicators.

CIFOR-NA has been used as base to develop and evaluate C&I at the local level in different settings. Computer based simulation such as the Multi-Criteria Decision

Making (MCDM) has been used to enhance the set of C&I proposed by CIFOR (Guillermo A. Mendoza & Prabhu, 2000; Mrosek, 2002; Mrosek et al., 2006).

Although Mendoza and Prabhu (2000) used a rank system to determine the relative importance of CIFOR-NA C&I and Mrosek (2002) did an excellent job measuring the applicability of CIFOR-NA C&I at the local level, these works were expert oriented. These frameworks provide a good theoretical and methodological contribution to develop C&I at the local level and they serve as a platform for participatory decision making. However, their applicability remains a challenge because of the lack of stakeholders' participation. There is an increasing need to include stakeholders' values and perceptions in assessing SFM (Adam & Kneeshaw, 2008; Mrosek et al., 2006; Pokharel & Larsen, 2007).

Sherry et al. (2005) used a grounded theory content analysis to develop C&I at the local level and compared them with the most general C&I frameworks, Canadian Council of Forest Ministers (CCFM), Local Unit Criteria and Indicators (LUCID), and the CIFOR generic C&I template. Pokharel and Larsen (2007) explored local perceptions of SFM by asking community leaders what C&I should be included in the evaluation of the national Ganeshman Singh Forest Conservation Award in Nepal (GSFC). Fourteen criteria and 52 indicators were suggested during six meetings with community forest user groups (CFUGs). Natcher & Hickey (2002) used interviews and direct observation to develop C&I of SFM in the Little Red River Cree Nation in Alberta, Canada. This study identified 6 criteria and 62 indicators of SFM. Sheppard and Meitner (Stephen R. J. Sheppard & Meitner, 2005) weighted criteria for a set of C&I developed by the Arrow IFPA project, to develop a new approach to public participation in BC. Their study

compared expert and other stakeholder's weightings to determine priorities and difference in sustainability criteria among forest users.

The Natcher and Hickey (2002), Sherry et al. (2007), and Pokharel and Larsen (2007) sets of C&I are excellent examples of involving stakeholders in developing C&I at the local level. Natcher and Hickey (2002) is perhaps the first study that directly asked local communities about the value they give to their forests.

Established indicators of SFM have not been directly ranked by stakeholders; therefore, the understanding and implementation of indicators at the local level remains a challenge. Additionally, there is a gap in the literature that shows changes in indicators' importance after education on planning and after deliberation. Furthermore, while CIFOR-NA was conceived to be applicable in Canada, USA, and Mexico to date, there is no research that assesses its effectiveness and understanding in the temperate forest of Mexico.

Therefore, there is a need to expose and explain indicators of SFM to forest owners to explore the extent in which indicators included local people's values and needs. There is also a need to examine how people's preferences toward indicators change after exposition to knowledge and deliberation.

## **2.4. Summary**

The concept of sustainable forest management is well understood and used in the implementation of good forest practices along with the selection of C&I that have some meaning to forest owners and users; however, its progress remains barely sufficient. Sustainable forest management (SFM) is a concept that promotes the use of forest

ecosystems without jeopardizing their availability for future generations. The concept of sustainable forest management includes issues of natural, economic, and social systems. However, increases in deforestation lead to ecological and social problems; therefore, there is a high demand for policies that help reduce deforestation and at the same time improve the well-being of the people who are directly associated with the forest (Gardner-Outlaw & Engelman, 1999).

There is an urgent call for effective stakeholder participation in all the issues related to the sustainability of the forest (P. Dasgupta & Vira, 2005; FAO & DFID, 2001; Howlett et al., 2000; Menzies, 2007; Richards, Davies, & Yaron, 2003), and to develop criteria and indicators (C&I) at the local level to monitor forest sustainability.

The current literature does not show changes in preferences associated to indicators of SFM. There is a need to understand how the exposure to knowledge (analysis) and deliberation change forest's owner's preferences associated to indicators of SFM.

The development and testing of sustainability indicators requires the involvement of several actors, as well as a good understanding of the forest and people's values. Q-methodology facilitates the understanding of people's viewpoints towards SFM and the inclusion of these values in management strategies.

Analysis and deliberation is an efficient mechanism to test changes in preferences regarding indicators of SFM because it provides a scenario in which the public is educated and then exposed to deliberation. Purnomo et al. (2003) indicated that SFM should be carried out in a multi-stakeholder environment. One of the advantages of small forest units is the ease of bringing together stakeholders who can develop their own



indicators according to their needs and priorities (S. R. J. Sheppard, 2005; Sherry et al., 2005; Woodhouse, Howlett, & Rigby, 2000; Wright et al., 2002).

Studies have shown that deliberative democracy can be exercised in small poor and semi-literate communities (Benjade & Ojha, 2005; Gupte & Bartlett, 2007), conditions that are present in most small forest communities worldwide (Gardner-Outlaw & Engelman, 1999; Godoy et al., 1997). There are good possibilities for and reasons to use the analysis and deliberation framework in observing changes in preferences for indicators of SFM in small communities.

## **CHAPTER III**

### **METHODOLOGY**

This chapter describes the methodologies used to answer each of the research questions. Q-methodology and a longitudinal survey were used to understand people's viewpoints regarding forest management and preferences for indicators of sustainable forest management. The formal research design uses mixed-methods (Creswell, 2002; Creswell & Tashakkori, 2007; Tashakkori & Creswell, 2007); six different qualitative and quantitative data sources were used. This chapter is divided in five sections; section one describes the research site, section two discusses the Internal Review Board used for the research, section three explains the research design, and sections four and five present the instrumentation, the procedure to collect data, and the data analysis for both Q-methodology and the survey respectively.

#### **3.1 Research Site**

The research site of this study was a rural forestry community in the State of Puebla, Mexico. The name of the village is "La Preciosita Sangre de Cristo"; it is a community of approximately 850 people, comprising 200 families. There was a large population of children, women, and elders, and according to the Mexican Census in 2006,

250 members of the community migrated to the United States. Most of those who migrated were young males.

In 1972, 100 members of the community purchased 420 hectares of forest land. Ten years after 57 more members were included as secondary owners. The population of the research consisted of principal and secondary owners and their immediate families. Only people who were at least 18 years old participated in this research project. For a better understanding this document refers to principal and secondary owners and their immediate families as forest owners or participants.

### **3.2 Institutional Review Board Clearance**

The proposal for the interviews and survey was reviewed and approved by the Oklahoma State University Institutional Review Board (IRB). It was approved from April 04, 2008 through April 10, 2009 with assigned IRB number GU084. The population involved was required to sign a consent form.

### **3.3 Research Design**

This research used six different qualitative and quantitative sources of data to answer the research questions: interviews, surveys, field notes, expert input, documents, and Q-sorts from Q-methodology (Stephenson, 1953). Interviews were conducted to create the concourse for Q and to select indicators for the instrument. A longitudinal survey (Creswell, 2002, 2005) was designed to observe changes in preferences with

regard to indicators of sustainable forest management after analysis meeting and after deliberation meeting. The survey was administered to the population three times – baseline (pre-intervention), analysis, and deliberation. Observations (field notes) and expert input were used to understand the history and social context of the research site, to refine the survey and the statements for Q-sorts, and to understand findings. Documents were used to select indicators for the instrument and to provide a foundation for the selection of the indicators.

### **3.3.1 Research Questions**

Q-methodology and the survey were used to answer the following research questions:

General question: Does analysis and deliberation change people's preferences with regard to indicators for sustainable forest management?

Specific questions:

1. What are people's viewpoints toward forest use?
2. What are people's preferences in regard to the forest?
3. What are the changes in preferences for indicators of sustainable forest management resulting from analysis (knowledge) and deliberation?

The following sections provide explanation on each of the methodologies.

## **3.4 Q-Methodology**

For this study, a Q-methodology was used to answer "specific question" No. 1. Q-methodology is a systematic qualitative and quantitative research technique used to

study human subjectivity (P. Dasgupta & Vira, 2005; McKeown & Thomas, 1988). Q-methodology was first introduced in 1930 by the British physicist/physiologist William Stephenson who sought to provide a way to reveal the subjectivity of any situation (Brown, 1996). The Q-methodology is summarized in detail in the *The Study of Behavior: Q-technique and its methodology* (Robbins, 2005; Stephenson, 1953). The underlying assumptions of the methodology are that subjectivity is assumed to be communicable and operant. In other words, subjectivity of individuals is self-reflexive; individuals are aware of their beliefs and motivations, thus they can communicate them in a discourse. “In this sense, subjectivity refers simply to the distinction between ‘your’ point of view and ‘mine,’ as articulated in communication” (Robbins, 2005, p. 210). Subjectivity is also performed anytime someone expresses his or her points of view or agrees with someone else’s points of view (Robbins, 2005).

Q-methodology has been used in a wide range of disciplines such as health science, political science, sociology, psychology, mass communication, and now it has gained special attention in environmental sciences. It has been used to understand stakeholder positions to address and identify environmental conflicts (P. Dasgupta & Vira, 2005; Steelman & Maguire, 1999).

For the purpose of this study, Q-methodology was used to understand the context of forest management in the local community of La Preciosita and to identify the perspectives about what is important to host communities in forest management. Those perspectives were used to frame deliberation (conflict assessments) and develop a forest management strategy aimed at consensus.

### **3.4.1 Instrumentation**

In Q-methodology the technique for data collection is called “Q sorts;” it is a systematic rank-ordering of people’s points of view (McKeown & Thomas, 1988) in a quasi normal distribution panel (van Exel & de Graaf, 2005). The researcher presents the subject with a group of statements on the topic of the research and describes to the subject a condition of instruction within which the statements are to be ranked (Wilson, 2005). The statements are drawn from interviews or from sources other than direct communication with participants such as already rated scales (McKeown & Thomas, 1988). Sorts are subject to statistical analysis with PQMethod software; sorts are factorized to reveal patterns of beliefs among the participants. In other words, Q reveals how individuals with different points of view understand the topic of the research.

#### **The Concourse:**

By definition, concourse is “running together, flowing.” Brown (1991) stated that a concourse in Q-methodology can be described as when ideas run together in thought. “The concourse is all the manifestations or expressions of human response and dialogue, [both] verbal and non-verbal (Wilson, 2005, p. 42). A concourse can be built in different ways, by interviewing people, collecting commentaries from newspapers, talk shows, or essays among others. For the purpose of this research, in-depth interviews with 50 out of 100 forest owners were conducted in April 2008. The purpose of the interviews was to explore the relationship between forest owners and the forest. Five questions were designed to achieve this goal.

1. What is your relationship to the forest?
2. Why do you go to the forest and what do you do there?

3. What products, if any, do you obtain from the forest?
4. How do you think the forest should be managed?
5. What concerns do you have about the forest's future?

Interviews were held in Spanish and tape-recorded. From the interviews, 322 statements were gathered.

### **Q-Sample**

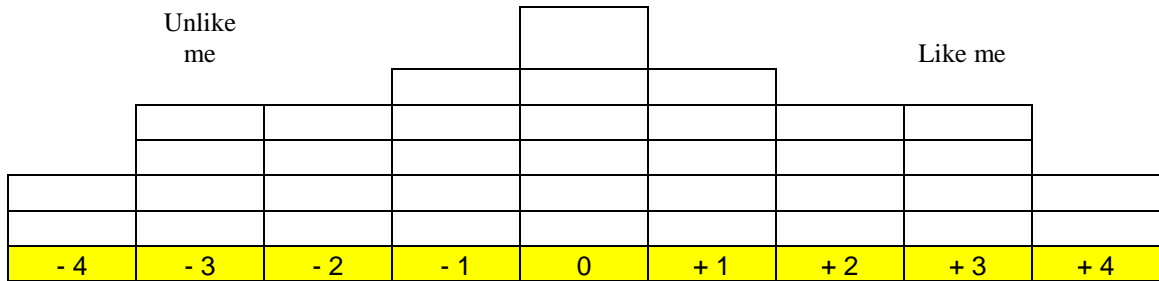
In Q-methodology the Q-sample is the list of statements that represent all the possible views of the participants; it is a set of shared beliefs, understandings, or meanings of a topic within a population (Previte, Pini, & Haslam-McKenzie, 2007). The statements for the Q-sample can be taken as either naturalistic or ready-made (McKeown & Thomas, 1988). Naturalistic sets are drawn primarily from participant interviews; ready-made sets are taken from currently theory that is subdivided into hybrid types, Q-samples drawn from conventional rating scales, or quasi-naturalistic. Quasi-naturalistic sets are drawn from interviews but are developed from sources external to the study. “Items from naturalistic and ready-made Q-samples are combined to form hybrid types” (McKeown & Thomas, 1988, p. 27).

The Q-sample for this study was drawn from the statements obtained from the interviews and is comprised of 36 statements. The statements for the sample were purposely selected to cover different points of view towards forest resources and also economic, ecological, and social implications.

**Q-Sorts**

Twenty participants (P-sample) sorted the statements (Q-sorts) in June 2008 under the condition of the instruction of “How do you relate to the forest?” The distribution of the Q-sort is as shown in figure 2.

**Figure 2: Q-Board**



**3.4.2 Data Collection Q-Methodology**

In April 2008, 50 participants (principal and secondary owners and their immediate family members) were interviewed. The researcher purposely wanted to identify people within the elderly and young population of women and men who had different points of view. La Preciosita is a village of 200 families with traditional community work. Since it is a small village, a snowball sample technique (Goodman, 1961) was used to find 50 participants for the interview and 20 participants (principal and secondary owners and their immediate families) for the Q-sorts who had a wide variety of viewpoints or opinions about forest management.

Before conducting the interviews, the researcher explained to each participant the purpose of the study and read the Informed Consent Form. The researcher then asked for their willingness to help; if the person agreed, the researcher asked if it would be all right to tape record the interview. After this, the Informed Consent Form was signed and the



researcher proceeded with the interview. Interviews were tape recorded and transcribed to be able to extract the statements needed for the concourse. The researcher used manual coding of the interviews to present a fairly full range of people's expressions in relation to the forest. The researcher identified several key terms such as employment, fresh air, reforestation, hay, fuel-wood, wildlife enjoyment, community management, professional management, family recreation, tourism, timber production, administration, ownership, visiting the altars, staying in the huts, it is green, it is peaceful, and it is a place of life. These key phrases helped to extract the 322 statements that were categorized in three different groups: economic, ecological, and social. Then statements that were repetitive were condensed into a single statement, and 36 representative statements were selected for the Q-sample.

The researcher presented the statements to forester and non-forester colleagues to collect opinions in relation to wording, understanding, and effectiveness. Adjustments on wording were made.

In June 2008, 20 volunteer forest owners sorted the statements according to their relation to the forest. In Q-methodology the sample size is typically small and purposely chosen (P. Dasgupta & Vira, 2005; McBryde, 2001; van Exel & de Graaf, 2005) to gather people with different points of view about the same issue. Figure 3 provides an example of a participant conducting the sort.

The sorting was done under the condition of instruction of "*How do you related to the forest?*" Participants were asked to separate the statements in three piles, "like me," "unlike me," and "indifferent or not related." Then the participants sort the statements on a board as the shown in figure 2. starting with "those like me" on the right side of the

board, the participants were asked to place the statements with which they identified the most. The “unlike me” statements were sorted from the left side of the board. The third pile, “indifferent” was sorted on the blanks of the board according to the criteria of the participant. The sorting lasted 30 to 40 minutes each, and while the forest owners sorted, they were also talking about how they felt in relation to the forest and with the procedure (Q-methodology). Several comments were collected from the Q-sorts; those comments further helped to present alternatives for forest management. Q-sort became the data for Q analysis.

### **3.4.3 Q-sorts Data Analysis**

The software PQMethod 2.11 was used for the statistical analysis of Q-sort. PQMethod is the statistical program adapted to the requirements of Q studies. It allows a researcher to easily and systematically enter the Q-sort (data), and to then compute correlations and factor analyze them. The software was developed by John Atkinson who was supervised by Steven Brown at Kent University; Peter Schmolck adapted and revised it to make it easy to use on personal computers. The software is available for the public domain, it can be downloaded free of charge at <http://www.lrz-muenchen.de/~schmolck/qmethod/#PQMethod>.

PQMethod 2.11 calculates the correlation matrix of Q-sorts to represent the level of agreement or disagreement between individual sorts. Then the correlation matrix is subject to factor analysis to identify how Q-sorts are grouped. “The number of factors is therefore purely empirical and wholly dependent on how the Q-sorters actually performed” (Brown, 1991, p. 15). In Q-methodology, factors are related to people’s views, thus, people with similar views will share the same factor.

The software allows for two options of factor analysis, Principal Components and Centroid. It also allows for two forms of factor rotation, Varimax or Manual. Rotation helps the researcher to mix opinions and examine them from different angles. Factor loadings are determined for each Q-sort to express the association of each Q-sort with each Q-factor. Factor loadings above 0.5 (plus or minus) can be considered significant (Brown, 1991). Q-factors represent different perspectives of the same issue. PQMethod 2.11 provides a list of the sorts and the respective loading for each factor. For the purpose of this research, both Centroid and Manual rotation were used.

Factor scores and difference-of-factor scores were also calculated with PQMethod 2.11. “A statement factor score is the normalised weighted average statement score (z-score) of the respondents that define that factor” (van Exel & de Graaf, 2005 p. 9). Base z-score statements can be arranged to the original quasi-normal distribution resulting in an ideal Q-sort for each factor. Thus, the new Q-sort is a hypothetical representation of how respondents loading on that factor would order the statements.

Difference-of-factor scores are the magnitude of difference between a statement's score on any two factors that is required for it to be statistically significant. When a statement's score on two factors exceeds this difference [, the] score is called a distinguishing (or distinctive) statement. A statement that [does] not [distinguish] between any of the identified factors is called a consensus statement (van Exel & de Graaf, 2005 p. 9-10).

Factor scores and differences-of-factor scores provide information on important statements that are crucial in the interpretation of the factors.

Factors from the Q-methodology helped to answer “specific question” No. 1. Furthermore, interviews and factors from the Q-methodology were also used in the selection of the indicators for sustainable forest management and were then used in the survey. Q-factors were also helpful to frame deliberation as a means for community participation to measure people’s satisfaction with the indicators of sustainable forest management that they were rating.

### **3.5 Survey**

This is a trend study that examined people’s preference changes within the same population with regard to indicators for sustainable forest management. Sustainable forest management is a concept that not only includes the value of forest *per se*; it also recognizes the role of people’s knowledge and needs. To understand sustainable management and the role of people in its achievement, researchers have developed criteria and indicators that reflect the principles of sustainability related to social, forest, and economic systems.

There are a large number of indicators for sustainable forest management that have been developed under different projects (Cheng & Durst, 2000; Hunt & McFarlane, 2007; International Tropical Timber Organization, 1998; Lawes & Everard, 1999; Maness & Farrell, 2004; Guillermo A. Mendoza & Prabhu, 2000; Guillermo A. Mendoza & Prabhu, 2005; Montreal Process, 1995, 2001; Mrosek et al., 2006; Stephen R. J. Sheppard & Meitner, 2005; Sherry et al., 2005; Woodley et al., 1999; Wright et al., 2002). However, an instrument that measures their implementation and importance in small forest communities is not available yet. These sets of criteria and indicators usually

present a wide variety of qualitative and quantitative data that are not always relevant in small forest areas. Therefore, the goal of this research was to develop indicators for local forest units where community participation and people's viewpoints become a priority.

Due to the lack of instruments to test for indicators, the researcher designed an instrument based on previously established criteria and indicators for sustainable forest management lists. Sixty-two indicators were selected from a list of 135 indicators of sustainable forest management for North America. The selection of indicators was supported from the interviews. In the interviews, participants were asked to express their concerns, expectations, preferences, and current uses of their forest. This information allowed the researcher to select 32 indicators that have meaning to this particular group of forest owners. These indicators were the items of the survey.

### **3.5.1 Instrumentation**

Due to the relative novelty of this type of research a longitudinal 5 Likert-scale instrument of 66 indicators was designed to captures people's preferences associated with indicators for sustainable forest management. Sixty-two indicators were carefully selected from three already existing lists of indicators of sustainable forest management for North America. Four indicators were paraphrased to test for internal consistency. In total, the survey contains 66 indicators. The mentioned lists of indicators are:

- CIFOR-NA (1999), North American Test of Criteria and Indicators of Sustainable Forest Management. This list contains 54 indicators, grouped by 17 criteria.
- LUCID, The Local Criteria and Indicators Development Test. This list contains 58 indicators grouped by 16 criteria.

- ILO-GTZ (2000), Social Criteria and Indicators for Sustainable Forest Management. This list contains 23 indicators grouped by 15 criteria.

The selection of the indicators was based on a detailed examination of the interviews and the researcher's technical expertise. The indicators were translated to Spanish and reworded to assess a question of importance (i.e. how important is it that forest management contributes to educational research?).

Expert input was a significant contribution to the validity of the survey. Once the researcher selected the indicators, forestry experts were consulted to provide suggestions regarding the size of the instrument and the effectiveness on assessing the question of importance. This panel of experts consisted of two faculty advisors from OSU, two faculty foresters from the Colegio de Posgraduados in Mexico, one Ph.D. environmental science major from Colegio Posgraduados in Puebla, and two social foresters from the Universidad Distrital in Colombia. The panel of experts provided few comments on wording.

The survey also gathered demographics for each participant name, age, gender, occupation, and level of education.

### **3.5.2 Data Collection Survey**

The quantitative longitudinal survey (Creswell, 2002) was designed to answer specific research questions 2 and 3.

1. What are people's viewpoints toward forest use?
2. *What are people's preferences in regard to the forest?*
3. *What are the changes in preferences for indicators of sustainable forest management resulting from analysis (knowledge) and deliberation?*

The survey contained 66 questions to be ranked from 1 to 5; 1 as non-important through 5 as very important. To answer the specific research question No. 2, the survey was administered early in the study, in June 2008, to capture peoples' preference before any intervention.

To answer specific question No. 3, a search conference was conducted in September 2008 to expose the participants to information on available alternatives for forest management. After the meeting, the survey was administered for the second time to capture peoples' changes in preferences after being exposed to the new information (analysis). Right after second survey, forest owners engaged in deliberation to discuss and share ideas and knowledge related to the alternatives and to choose one of the alternatives. Following the deliberation, the survey was administered for the third time to capture peoples' changes in preferences after discussion.

Thirty-five forest owners or participants (principal and secondary owners and their immediate families) voluntarily agreed to participate in the survey during the three times. Although 57 people filled the survey the first time (henceforth baseline survey), and 40 the second time, only 35 made it to the third time. For the analysis of the data, only 35 surveys were considered.

### **3.5.3 Data Analysis Survey**

For the analysis of the survey SPSS<sup>®</sup> program was used. The first step was to test for the internal consistency of the instrument using Cronbach's alpha reliability test. Descriptive statistics frequencies were used to examine people's preferences with regard to indicators before any intervention (baseline survey). The Wilcoxon Signed Rank Test was used to compare differences on ratings after analysis and deliberation.

Each indicator was tested for difference in means after analysis meeting and deliberation; then indicators were grouped in Principles according to the CIFOR-NA grouping to test difference on Principles after analysis survey and deliberation. To go further in the analysis, the indicators were also grouped by the three pillars of sustainability, ecological, economic, and social, providing a common language for understanding sustainable forest management (Wright et al., 2002) to test for their difference after intervention. Significant difference was determined using a two-tailed test with a p-value  $< 0.05$ .



## **CHAPTER IV**

### **FINDINGS FROM Q-METHODOLOGY**

This research was conducted to examine peoples' preferences with regard to indicators of sustainable forest management. To pursue this objective, the study used three research questions to provide a better understanding of peoples' points of view and changes in preferences associated with indicators of forest management after analysis meeting and deliberation.

Q-methodology was used to explore peoples' viewpoints on forest use. This methodology was selected because it helps to obtain a holistic understanding of peoples' values. This chapter presents findings from the application of Q-methodology.

#### **4.1 Subjects and Instrumentation**

For this study, two groups of forest owners were selected. Fifty participants were interviewed to construct the concourse, and 20 forest owners (principal and secondary owners and their immediate families) provided the Q-sorts. Snowball sampling was used to recruit forest owners and thus ensure the diversity of opinions. The research site (La Preciosita) is a small community that provided a good venue to identify forest owners

with different viewpoints. Demographics on gender and age are presented in Table (2). Most of the forest owners are farmers; however, among of the immediate family members who participated in interviews and Q-sorts were business man and college students.

The interviews included to 21 women who were immediate family members with the right to participate in the absence of their husbands. The rest of the interviews included to the male population, four young men participated and there are children of the principal owners, 10 secondary owners and 15 principal owners.

The Q-sorts were eight principal owners, two secondary owner, four principal owners' wives (family members), one principal's wife who is the head of the household and 5 children (two sons who are also secondary owners and three daughters).

**Table 2 Demographics for interviews and Q-sorts**

<b>Demographics</b>	<b>Interviews</b>	<b>Q-sorts</b>
<b>Gender</b>		
Male	29	11
Female	21	9
<b>Age</b>		
18-25	5	2
26-35	12	4
36-45	13	6
46-55	13	7
56-65	4	0
>65	3	1
<b>Education</b>		
Elementary (completed 3 years)	23	3
Elementary (Completed 6 years)	16	11
Secondary	8	5
Post secondary	3	1

From the interviews the researcher identified several key terms such as more sources of employment, fresh air, more reforestation, collection of hay and fuel-wood,

wildlife enjoyment, community management, professional management, family recreation, tourism, timber production, better administration, ownership, visiting the altars, staying in the huts, it is green, it is peaceful, and it is a place of life. These key phrases helped to form the 322 statements that were categorized into three different groups: economic, ecological, and social. Then repetitive statements were condensed into a single statement and 36 representative statements were selected for the Q-sample. It is important to clarify that the community assigned the term “reserve” to the forest. The following is the list of the final statements for the Q-sort.

1. The reserve means a place of life
2. I like to go to the reserve for a pleasant field trip
3. The reserve should have more wild animals
4. The reserve should have more trees
5. I like to go to the reserve to bring flowers to the saints
6. I want to obtain more fuel-wood from the reserve
7. I want to obtain more hay from the reserve
8. I want to spend more time in the reserve huts
9. I would rather stay at home with my family than go to the reserve
10. Others should have access to the reserve
11. I feel ownership of the reserve
12. The reserve provides oxygen to our bodies
13. I like to go to the forest because it has shade, it is green, it is beautiful
14. The reserve keeps us healthier than those who live in the city
15. The community has the ability to manage our reserve
16. I like to bring my family, who live in the city, to the reserve
17. We need to extract logs from the reserve to support our projects
18. I like to go and take care of the reserve
19. I would like the reserve to provide jobs for young people
20. I enjoy watching wild animals in the forest (deer, llamas, birds)

21. I want to participate in reforestation projects
22. The reserve should be kept as a tourist attraction as a source of income for the community
23. I feel more peaceful when I am in the reserve
24. I prefer to be in the city
25. Going to the reserve makes me tired because of the work I have to do
26. I do not need to use to the reserve to collect fuel-wood because I use gas to cook
27. The reserve should remained closed; every time someone needs to go they should ask for permission
28. I have never been to the reserve
29. Wild animals scare me
30. The reserve is in good condition to be used as an economic asset
31. The reserve needs better administration
32. The reserve offers several benefits to me
33. The reserve is a place to bring our animals to pasture
34. I use fresh herbs from the forest in my regular cooking
35. The reserve is important for the well-being of my family
36. People from outside should help us to manage our reserve

## **4.2 Factors**

Twenty Q-sorts were entered into the PQMethod 2.11 Program. Eight centroids were extracted and four were manually rotated to account for four factors that explain 72% of the variance. The factor matrix for the 4-factor-solution is shown in Table (3). As seen in the table, significant load value is of  $CV=0.515$  ( $p > 0.001$ ), all sorts accounted for no-non significant sort; four sorts are confounded<sup>2</sup>; two on A&B, one on A&C, and one on A&D. There are no bipolar factors; two factors are correlated above

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<sup>2</sup> Sorts that have significant loading in more than one factor

0.25 (A&B, and A&D); the factors correlations are shown in Table (4). A second manual rotation on factors A and B was needed to explore consensus and differences. Manual rotation for factors A and D was also conducted; however, the output did not show any significant insight.

**Table 3 Four-Factor Matrix**

Sort Number	Loadings *			
	A	B	C	D
1	<b>0.530</b>	<b>0.621</b>	0.153	0.161
2	<b>0.795</b>	0.014	0.197	0.309
3	<b>0.658</b>	<b>0.549</b>	0.135	0.067
4	<b>0.835</b>	0.009	-0.124	-0.047
5	<b>0.753</b>	0.317	0.179	0.043
6	0.147	<b>0.578</b>	0.438	0.220
7	<b>0.695</b>	0.122	0.088	0.320
8	<b>0.655</b>	0.268	<b>0.545</b>	-0.002
9	<b>0.745</b>	0.046	0.387	0.306
10	<b>0.575</b>	0.094	0.346	0.378
11	<b>0.620</b>	0.330	0.187	0.363
12	0.0628	0.009	<b>0.860</b>	0.026
13	<b>0.515</b>	0.417	0.467	0.118
14	0.326	<b>0.573</b>	0.011	<b>0.621</b>
15	0.123	0.047	0.046	<b>0.901</b>
16	<b>0.552</b>	0.385	0.308	0.403
17	<b>0.610</b>	0.488	0.096	0.242
18	<b>0.685</b>	0.507	0.111	0.153
19	0.429	<b>0.672</b>	-0.051	0.204
20	-0.161	<b>0.834</b>	0.037	-0.071
<b>% expl. Var</b>	33	18	10	11
<b>Significant Loaders</b>	14	6	2	2

*\*Bold indicates a defining sort*

**Table 4: Factor Correlation Matrix**

	A	B	C	D
A	1.000	<b>0.453</b>	0.238	<b>0.400</b>
B		1.000	0.109	0.197
C			1.000	0.094
D				1.000

The factors description rested on interpretation of the Q-statements that distinguished each factor from the others. Q-statements are calculated as weighted z-scores. Then, highest and lowest z-scores for each item within each factor were important for the factor's description. Distinguish statements provide information on items that distinguish each factor from the others.

#### **4.2.1 Factor A: Forest Conservation**

This factor is defined for 14 sorts out of 20; it explains 33% of the variance. As shown in the distinguishing statements for factor A (table 5), the positive value on statement 23 (*I feel more peaceful when I am in the reserve*) indicates that people who represented this factor (or Conservationists) have a strong spiritual connection to the reserve. The negative scores for statements 36 (*people from outside should help us to manage our reserve*) and 6 (*I want to obtain more fuel-wood from the reserve*) indicate that *conservationists* want to administrate the reserve by themselves and want to avoid the collection of fuel-wood. In Table (6), the high values assigned to statements 31 (*the reserve needs better administration*) and 15 (*The community has the ability to manage our reserve*) indicate that there is a problem of administration but the group feels that they are able to fix it on their own.

Having statement 19, *I would like the reserve to provide jobs for young people*, in the +3 pile indicates the strong desire to manage the reserve to obtain economic benefits as well (see fig. 3). The reserve as a tourist attraction to obtain economic benefits is more desirous to *conservationists*.

People who share perspectives in factor A related the health of the forest to their own health. They understand that the forest provides many benefits such as jobs, areas

for family recreation, and enjoyment of wildlife watching. Clean air, shade, and a sense of peace are further important benefits that people in this factor obtain from the forest. The condition of the forest is important for them; as a result, they want to manage the reserve and to participate in reforestation projects to protect the benefits obtained from the forest. They are opposed to grazing animals and collecting hay, logs, and fuel-wood because those activities deteriorate the reserve.

Conservationists seek to have better administration of the reserve to protect the benefits of it and to provide jobs for the young population. They are able to work to improve the conditions of the reserve; reforestation seems to be a good alternative.

**Table 5: Distinguishing Statements for Factor A - Conservationist**

Number	Statement	A Score
23	I feel more peaceful when I am in the reserve	0.67
36	People from outside should help us to manage our reserve	-0.86*
6	I want to obtain more fuel-wood from the reserve	-0.79*

- (asterisk) indicates significance at  $P < 0.01$

**Table 6: z-scores for Q-Statements: Factor A - Conservationist**

Number	Statements	z-Score
4	The reserve should have more trees	1.73
31	The reserve needs better administration	1.48
14	The reserve keep us healthier than those who live in the city	1.38
3	The reserve should have more wild animals	1.35
1	The reserve means a place of life	1.22
19	I would like the reserve to provide jobs for young people	1.02
12	The reserve provides oxygen to our bodies	0.99
15	The community has the ability to manage our reserve	0.82
27	The reserve should remained closed; every time someone needs to go they should ask for permission	0.71
13	I like to go to the reserve because it has shade, it is green, it is beautiful	0.7
23	I feel more peaceful when I am in the reserve	0.67
20	I enjoy watching wild animals in the forest (deer, llamas, birds)	0.66
22	The reserve should be kept as a tourist attraction as a source of income for the community	0.59
21	I want to participate in reforestation projects	0.58
16	I like to bring my family, who live in the city, to the reserve	0.53
32	The reserve offers several benefits to me	0.39
18	I like to go and take care of the reserve	0.37
2	I like to go to the reserve for a pleasant field trip	0.32
30	The reserve is in good condition to be used as an economic asset	0
35	The reserve is important for the economic well-being of my family	0
8	I want to spend more time in the reserve huts	-0.02
10	Others should have access to the reserve	-0.32
26	I do not need to use to the reserve to collect fuel-wood because I use gas to cook	-0.38
11	I feel ownership of the reserve	-0.49
34	I use fresh herbs from the forest in my regular cooking	-0.55
36	People from outside should help us to manage our reserve	-0.86
25	Going to the reserve makes me tired because of the work I have to do	-1.01
5	I like to go to the reserve to bring flowers to the saints	-1.05
28	I have never been to the reserve	-1.08
9	I would rather stay at home with my family than go to the reserve	-1.12
29	Wild animals scare me	-1.23
24	I prefer to be in the city	-1.25
33	The reserve is a place to bring our animals to pasture	-1.33
7	I want to obtain more hay from the reserve	-1.45
17	We need to extract logs from the reserve to support our projects	-1.57
6	I want to obtain more fuel-wood from the reserve	-1.79



**Figure 3: Factor A Sort**

				8				
			36	35	16			
Un like me	7	9	34	30	21	13	19	Like me
	33	28	11	2	22	27	1	
6	24	5	26	18	20	15	3	31
17	29	25	10	32	23	12	14	4
-4	-3	-2	-1	0	+1	+2	+3	+4

#### 4.2.2 Factor B: Community Development

Of the 20 sorts in this study, 6 define factor B. This factor explains 18% of the variance. Distinguishing statements for factor B indicate that this group of people feels ownership of the reserve (positive score on statement 11, *I feel ownership of the reserve*) and thus they have a strong desire to preserve the reserve as a tourist attraction. To accomplish this goal they feel they need professional help as well as personal commitment (as expressed in statement 18, *I like to go and take care of the reserve*). However, this group does not perceive the reserve as a place of personal enjoyment, as the negative scores of statements 20 (*I enjoy watching wild animals in the forest (deer, llamas, birds)*) and 2 (*I like to go to the reserve for a pleasant field trip*) show.

People who define Community Development factor want to use the reserve as a tourist attraction to provide jobs for young people as expressed in statement No. 22 *The reserve should be kept as a tourist attraction as a source of income for the community*, which loaded with the highest score. They also feel ownership of the reserve; therefore, it is a private asset that needs to be managed with the help of the experts, as expressed in statement 36 *people from outside should help us to manage our reserve*. Community

Development group feels a personal commitment to help with the protection of the reserve (as expressed in statement No. 18, *I like to go and take care of the reserve* and statement No. 21, *I want to participate in reforestation projects*).

People in the Community Development factor also identify timber harvesting as a benefit that can be obtained from the reserve. Although the statement 17 (*We need to extract logs from the reserve to support our projects*) is on the +1 pile and seems to be of low importance, it is still a benefit that the loaders of factor B perceive. Community Development factor also show some concern from their quality of life and its relation to the reserve, statements 1 *the reserve means a place of life* and 12 *the reserve provides oxygen to our bodies* sorted on the + 2 pile are an indication of this.

**Table 7: Distinguishing Statements for Factor B – Community Development**

<b>Number</b>	<b>Statement</b>	<b>B z-Score</b>
22	The reserve should be kept as a tourist attraction as a source of income for the community	1.64
36	People from outside should help us to manage our reserve	1.60
11	I feel ownership of the reserve	1.54
18	I like to go and take care of the reserve	1.44
4	The reserve should have more trees	0.05
15	The community has the ability to manage our reserve	-0.53
20	I enjoy watching wild animals in the forest (deer, llamas, birds)	-0.65
2	I like to go to the reserve for a pleasant field trip	-1.26
3	The reserve should have more wild animals	-2.18

\* (asterisk) significance at  $P < 0.01$ ;  $P < 0.05$

**Table 8: z-Scores and Rankings for Statements: Factor B – Community Development**

<b>No.</b>	<b>Statements</b>	<b>Z-Scores</b>
22	The reserve should be kept as a tourist attraction as a source of income for the community	1.637
36	People from outside should help us to manage our reserve	1.603
31	The reserve needs better administration	1.588
11	I feel ownership of the reserve	1.539
19	I would like the reserve to provide jobs for young people	1.450
18	I like to go and take care of the reserve	1.440
21	I want to participate in reforestation projects	1.042
1	The reserve means a place of life	0.936
12	The reserve provides oxygen to our bodies	0.894
27	The reserve should remained closed; every-time someone needs to go they should ask for permission	0.813
14	The reserve keep us healthier than those who live in the city	0.641
17	We need to extract logs from the reserve to support our projects	0.469
32	The reserve offers several benefits to me	0.413
13	I like to go to the reserve because it has shade, it is green, it is beautiful	0.075
4	The reserve should have more trees	0.052
23	I feel more peaceful when I am in the reserve	0.050
3	The reserve should have more wild animals	0.011
35	The reserve is important for the economic well-being of my family	-0.112
28	I have never been to the reserve	-0.156
8	I want to spend more time in the reserve huts	-0.168
26	I do not need to use to the reserve to collect fuel-wood because I use gas to cook	-0.303
30	The reserve is in good condition to be used as an economic asset	-0.323
25	Going to the reserve makes me tired because of the work I have to do	-0.380
5	I like to go to the reserve to bring flowers to the saints	-0.508
6	I want to obtain more fuel-wood from the reserve	-0.521
15	The community has the ability to manage our reserve	-0.535
20	I enjoy watching wild animals in the forest (deer, llamas, birds)	-0.653
24	I prefer to be in the city	-0.726
9	I would rather stay at home with my family than go to the reserve	-0.994
7	I want to obtain more hay from the reserve	-0.997
10	Others should have access to the reserve	-1.012
34	I use fresh herbs from the forest in my regular cooking	-1.139
29	Wild animals scare me	-1.251
2	I like to go to the reserve for a pleasant field trip	-1.257
16	I like to bring my family, who live in the city, to the reserve	-1.440
33	The reserve is a place to bring our animals to pasture	-2.180

**Figure 4: Factor B Sort**

				26				
			15	8	4			
Un like me	2	7	6	28	13	27	18	Like me
	29	9	5	35	32	12	19	
33	34	24	25	3	17	1	11	36
16	10	20	30	23	14	21	31	22
-4	-3	-2	-1	0	+1	+2	+3	+4

### 4.2.3 Factor C: Family Recreation

Factor C is defined by 2 sorts out of 20; it explains 10% of the variance. According to distinguishing statements for factor C, people representing this factor want to spend time in the reserve because it provides them shade and peace (statements 8, 13 and 2)

*8. I want to spend more time in the reserve huts,*

*13. I like to go to the forest because it has shade, it is green, it is beautiful*

*2. I like to go to the reserve for a pleasant field trip*

These statements, along with the negative sign of statement 9, *I would rather stay at home with my family than going to the reserve*, indicate that the reserve is seen as a place for family recreation. The negative sign of statements 22 and 19 indicates that people who represent this factor do not want the reserve to be managed for tourism to provide jobs.

*22. The reserve should be kept as a tourist attraction as a source of income for the community*

*19. I would like the reserve to provide jobs for young people*

However, statement 30, *the reserve is in a good condition to be used as an economic asset,*” is placed on the positive side along with statement 36, *People from outside should help us to manage our reserve,* indicating that some other economic benefits could be obtained from the forest if professionally managed. In this regard, statement 17, *we need to extract logs from the reserve to support our projects,* is located on the 0 pile (indifferent); it seems that people in factor C might consider logging as an activity to obtain some economic benefit.

People who defined Family Recreation factor have a strong family and spiritual relationship to the forest (statement 5 on the +2 pile, *I like to go to the reserve to bring flowers to the saints*); this statement shows that they see the reserve as more than just an economic asset. They feel that with professional help management and personal involvement (statements 21 and 36) the reserve could provide income for their economic well-being.

*21. I want to participate in reforestation projects,*

*36. People from outside should help us to manage our reserve*

**Table 9: Distinguishing Statements for Factor C – Family Recreation**

<b>Number</b>	<b>Statement</b>	<b>Factor C z-Score</b>
26	I do not need to use to the reserve to collect fuel-wood because I use gas to cook	<b>1.77</b>
8	I want to spend more time in the reserve huts	1.33
34	I use fresh herbs from the forest in my regular cooking	0.44
12	The reserve provides oxygen to our bodies	<b>-0.44</b>
31	The reserve needs better administration	-0.89
19	I would like the reserve to provide jobs for young people	<b>-0.89</b>

**Table 10: z-Scores and Ranking for Statements: Factor C – Community Development**

Number	Statements	Factor C z-Score
26	I do not need to use to the reserve to collect fuel-wood because I use gas to cook	1.77
35	The reserve is important for the economic well being of my family	1.77
4	The reserve should have more trees	1.33
8	I want to spend more time in the reserve huts	1.33
13	I like to go to the reserve because it has shade, it is green, it is beautiful	1.33
15	The community has the ability to manage our reserve	1.33
3	The reserve should have more wild animals	0.89
5	I like to go to the reserve to bring flowers to the saints	0.89
21	I want to participate in reforestation projects	0.89
30	The reserve is in good condition to be used as an economic asset	0.89
2	I like to go to the reserve for a pleasant field trip	0.44
11	I feel ownership of the reserve	0.44
20	I enjoy watching wild animals in the forest (deer, llamas, birds)	0.44
34	I use fresh herbs from the forest in my regular cooking	0.44
36	People from outside should help us to manage our reserve	0.44
6	I want to obtain more fuel-wood from the reserve	0
14	The reserve keep us healthier than those who live in the city	0
17	We need to extract logs from the reserve to support our projects	0
18	I like to go and take care of the reserve	0
28	I have never being in the reserve	0
32	The reserve offers several benefits to me	0
1	The reserve means a place of life	-0.44
10	Others should have access to the reserve	-0.44
12	The reserve provides oxygen to our bodies	-0.44
22	The reserve should be kept as a tourist attraction as a source of income for the community	-0.44
23	I feel more peaceful when I am in the reserve	-0.44
7	I want to obtain more hay from the reserve	-0.89
19	I would like the reserve to provide jobs for young people	-0.89
31	The reserve needs better administration	-0.89
33	The reserve is a place to bring our animals to pasture	-0.89
16	I like to bring my family, who live in the city, to the reserve	-1.33
25	Going to the reserve makes me tired because of the work I have to do	-1.33
27	The reserve should remained closed, every time someone needs to go they should ask for permission	-1.33
29	Wild animals scare me	-1.33
9	I would rather stay at home with my family than go to the reserve	-1.77
24	I prefer to be in the city	-1.77

**Figure 5: Factor C Sorts**

				6				
			12	14	36			
<b>Un like me</b>	25	7	10	32	2	30	15	<b>Like me</b>
	29	33	1	28	34	21	13	
9	16	19	23	18	20	5	8	35
24	27	31	22	17	11	3	4	26
-4	-3	-2	-1	0	+1	+2	+3	+4

#### 4.2.4 Factor D: Sustenance

This factor explains 11% of the variance; it is defined by 2 out of 20 sorts. People who represented this factor observe several benefits from the reserve, some of which are associated with spiritual and family recreation and some others with economic well-being.

Table 11 shows the distinguishing statements for factor D. The factor is distinguished from others for two most-like statements and 3 unlike statements.

**Table 11: Distinguishing Statements for Factor D - Sustenance**

<b>Number</b>	<b>Statement</b>	<b>Factor D z-Score</b>
23	I feel more peaceful when I am in the reserve	<b>1.78</b>
31	The reserve needs better administration	0.46
21	I want to participate in reforestation projects	<b>-1.29</b>
15	The community has the ability to manage our reserve	<b>-1.6</b>
26	I do not need to use to the reserve to collect fuel-wood because I use gas to cook	<b>-1.75</b>



Distinguishing statements for factor D (Sustenance) indicate that people who defined this factor think that the community should not manage the reserve (negative sign to statement 15 *The community has the ability to manage our reserve*). People in Sustenance factor do not have a strong commitment to collaborate with the forest improvements (statement 21 has negative sign *I want to participate in reforestation projects*), although they believe that the reserve needs better administration (statement 31 *the reserve needs better administration*).

Z-Scores in table 12 provide more insights on view points for factor D. The fact that statement 19 “*I would like the reserve to provide jobs for young people,*” is on the +3 pile indicates that they see the reserve as a provider of economic benefits (statement 35 *The reserve is important for the well-being of my family* on the +2 pile corroborates this) if people from outside help them to manage it (statement 36 on the +2 pile). People defining factor D agree to use the reserve for tourism and are opposed to obtaining logs from it (statement 22 *the reserve should be kept as a tourist attraction as a source of income for the community* on the +1 pile and statement 17 *We need to extract logs from the reserve to support our projects* on the -3 pile). In addition they see that they can obtain different benefits from the reserve but they do not feel ownership of the reserve; therefore, they do not feel commitment to improve the conditions of the reserve (statements 11 and 18 I on the 0 pile; and statement 21 on the -3 pile).

*11. I feel ownership of the reserve*

*18. I like to go and take care of the reserve*

*21. I want to participate in reforestation projects*

**Table 12: z-Scores and Ranking for Statements: Factor D – Sustenance**

<b>Number</b>	<b>Indicator</b>	<b>z-Score</b>
23	I feel more peaceful when I am in the reserve	1.78
5	I like to go to the reserve to bring flowers to the saints	1.67
14	The reserve keep us healthier than those who live in the city	1.42
4	The reserve should have more trees	1.39
12	The reserve provides oxygen to our bodies	1.38
19	I would like the reserve to provide jobs for young people	1.32
20	I enjoy watching wild animals in the forest (deer, llamas, birds)	0.96
2	I like to go to the reserve for a pleasant field trip	0.9
35	The reserve is important for the economic well being of my family	0.87
36	People from outside should help us to manage our reserve	0.8
13	I like to go to the reserve because it has shade, it is green, it is beautiful	0.5
16	I like to bring my family, who live in the city, to the reserve	0.49
31	The reserve needs better administration	0.46
3	The reserve should have more wild animals	0.44
22	The reserve should be kept as a tourist attraction as a source of income for the community	0.43
32	The reserve offers several benefits to me	0.06
8	I want to spend more time in the reserve huts	-0.04
11	I feel ownership of the reserve	0.03
18	I like to go and take care of the reserve	0
10	Others should have access to the reserve	-0.03
7	I want to obtain more hay from the reserve	-0.04
30	The reserve is in good condition to be used as an economic asset	-0.46
25	Going to the reserve makes me tired because of the work I have to do	-0.5
24	I prefer to be in the city	-0.53
6	I want to obtain more fuel-wood from the reserve	-0.55
9	I would rather stay at home with my family than go to the reserve	-0.56
34	I use fresh herbs from the forest in my regular cooking	-0.86
28	I have never being in the reserve	-0.92
33	The reserve is a place to bring our animals to pasture	-0.96
29	Wild animals scared me	-0.96
1	The reserve means a place of life	-1.21
21	I want to participate in reforestation projects	-1.29
27	The reserve should remained close, every time someone needs to go should ask for permission	-1.33
17	We need to extract logs from the reserve to support our projects	-1.39
15	The community has the ability to manage our reserve	-1.6
26	I do not need to use to the reserve to collect fuel-wood because I use gas to cook	-1.75

**Figure 6: Factor D Sorts**

				7				
			9	10	22			
Un like me	17	29	6	18	3	36	19	Like me
	27	33	24	11	31	35	12	
26	21	28	25	8	16	2	4	5
15	1	34	30	32	13	20	14	23
-4	-3	-2	-1	0	+1	+2	+3	+4

#### 4.2.5 Summary of Factors

Table 13 shows demographics of significant loaders for each factor. All factors indicate a strong relation between the health of the forest and the well-being of the community.

**Table 13: Demographics for People who Significantly Defined Each Factor**

Demographics	Conservationist	Community Development	Family Recreation	Sustenance
<b>Gender</b>				
Male	9	1		1
Female	5	5	2	1
<b>Age</b>				
18-25	1	1		
26-35	4	2		1
36-45	8	2	2	1
46-55				
56-65				
>65	1	1		
<b>Education</b>				
Elementary (completed 3 years)		1	1	1
Elementary (Completed 6 years)	8	1	1	1
Secondary	5	4		
Post secondary	1			

Statements associated with spiritual peace, fresh air, and enjoyment of wildlife (1, 12, 13, 20, and 23) were placed on the positive piles in factor A (Conservationist), C (Family Recreation), and D (Sustenance)

*1. The reserve means a place of life*

*12. The reserve provides oxygen to our bodies*

*13. I like to go to the forest because it has shade, it is green, it is beautiful*

*20. I enjoy watching wild animals in the forest (deer, llamas, birds)*

*23. I feel more peaceful when I am in the reserve*

Factor B (Community Development) places more attention on the economic benefits and the administration of the reserve (statements 11, 18, 19, 22, 31, and 36), however this group does not disregard the benefits associated with their own health (statement 12, 14).

*11. I feel ownership of the reserve*

*18. I like to go and take care of the reserve*

*19. I would like the reserve to provide jobs for young people*

*22. The reserve should be kept as a tourist attraction as a source of income for the community*

*31. The reserve needs better administration*

*36. People from outside should help us to manage our reserve*

*12. The reserve provides oxygen to our bodies*

*14. The reserve keeps us healthier than those who live in the city*

Statement 19 *I would like the reserve to provide jobs for young people* was placed on the +2, and +3 piles in factors A (Conservationist), B (Community Development), and D (Sustenance). Factor C (Family Recreation) does not consider this statement

important. Conservationists, Community Development, and Sustenance (A, B, and D) feel that the *reserve needs better administration*; the statement was placed on piles +4, +3 and +1 respectively. Community Development and Sustenance (B and D) believe that they need professional help to better manage the reserve. However, only Community Development (Factor B) is willing to collaborate with this outside help. Conservationists (factor A) prefer community management and prefer to fix forest damages themselves.

Statement 33, “*The reserve is a place to bring our animals to pasture,*” was placed on the -1 and -2 piles in all factors. This indicates that everyone is opposed to grazing in the reserve. Furthermore, statement 17, *we need to extract logs from the reserve to support our projects*, was placed on the -2 and -3 piles in factors A (*Conservation*) and D (*Sustenance*), which indicates that timber harvesting is not desired.

Forest owners of La Preciosita have had development projects associated with the reserve in the past. A deer-hunting project was brought to the forest and promised to be a good economic asset for the community. However, the project lasted five years and many forest owners were economically hurt. Because this project was administered by outsiders, there is some reluctance to implement future ambitious projects such as the deer hunting project. This explains why the forest conservation factor (Factor A) wants the reserve to be managed by the people themselves. They understand that the reserve provides several benefits and they are conscious of mismanagement, but they want to fix the problem on their own.

The fact that the forestland was purchased to obtain fuel-wood for future generations, along with the strong spiritual relation to the forest, means that intensive timber harvesting is not desired. Unfortunately, the forest of La Preciosita has been the

subject of vandalism (illegal timber harvesting) because of the lack of management. However, some forest owners agree to harvesting timber if there is professional help (Factors B and D). La Preciosita has benefited from income obtained from timber selling. In the past, timber has been sold to pay for some community projects. The problem is that the forest owners were not informed of this activity; it was a decision made by only few of the owners who were in charged of the forest.

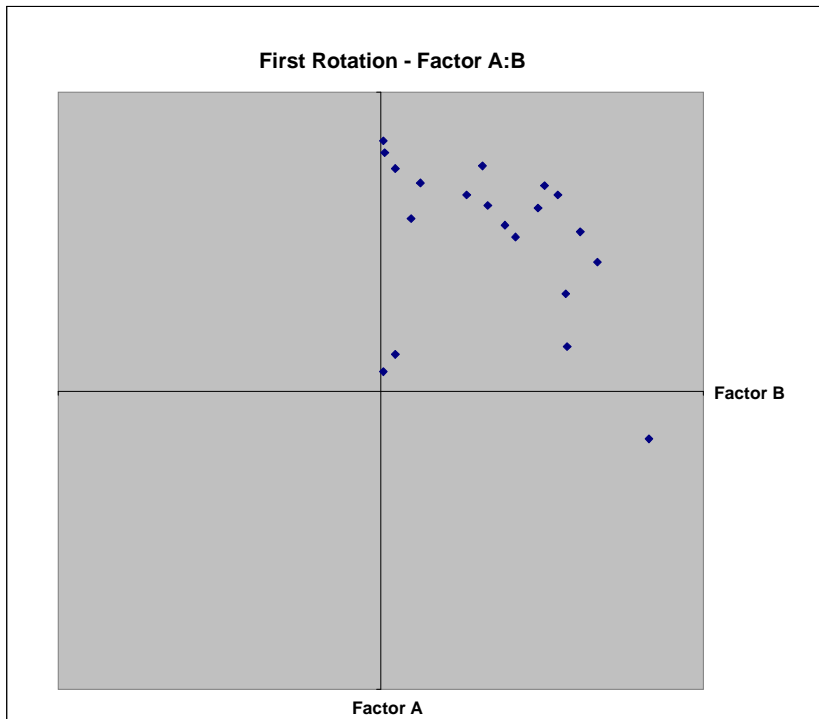
It is clear that people who represented all the factors acknowledge the economic and spiritual benefits of the reserve; however, there is not a clear consensus on how to approach forest management in a way that provides economic benefits without jeopardizing the health of the reserve. To understand the consensus and disagreements, a second manual rotation for factors A (*Conservation*) and B (*Community Development*) was conducted.

#### **4.2.6 Second Rotation Factor A and B**

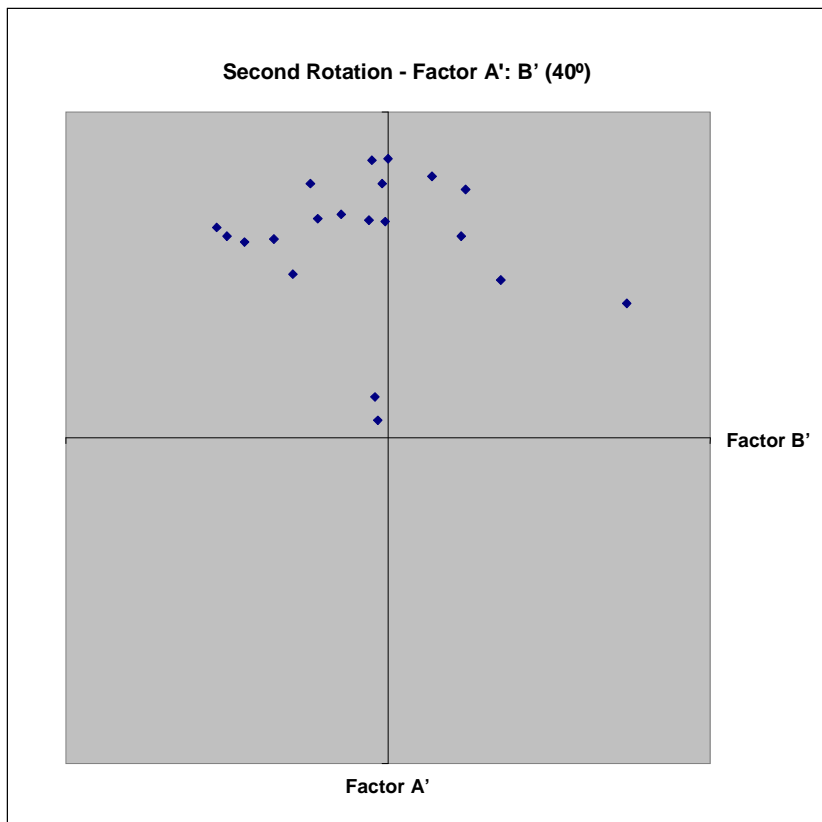
Factor correlation A&B was of 0.453; therefore, a second rotation (40 degrees) was needed to explore consensus and disagreement for factors A and B (figure 8). A new factor is then founded; it is a factor that explains consensus, and for the purpose of this study is called: Factor A' Non- Consumptive Use. At the same time a bipolar factor B' was identified; it provides information on disagreements.

Figures 7 and 8 show the graphic explanation of the factor correlation, the scale is 0-1 and the blue dots represent sorts. In Figure 7 the Y axis is Factor A and the X axis is Factor B. Figure 8 shows a rotation of 40 degrees on axis X (Factor B) that leads to Factor A' on axis Y and Factor B' on axis X.

**Figure 7: Factors A and B**



**Figure 8: Second Rotation Factors A and B (40 degrees)**



### **Factor A': Non-Consumptive Use**

This factor explained 42% of the variance; 16 sorts loaded significant in this factor. People who define this factor agree that the reserve is a place that provides many benefits; therefore, it should not be depleted or damaged for harvesting. Statements related to jobs, health benefits, and administration are placed on the positive side of the sort. The consensus factor A' indicates that the reserve should be better managed to provide jobs for young people, and a good way to do this would be as a tourist attraction.

**Table 14: z-Scores for Factor A'**

<b>Number</b>	<b>Statements</b>	<b>z-Score</b>
31	The reserve needs better administration	1.74
4	The reserve should have more trees	1.71
3	The reserve should have more wild animals	1.42
19	I would like the reserve to provide jobs for young people	1.22
14	The reserve keep us healthier than those who live in the city	1.16
1	The reserve means a place of life	1.08
21	I want to participate in reforestation projects	1.07
27	The reserve should remained close, every time someone needs to go should ask for permission	1.00
12	The reserve provides oxygen to our bodies	0.84
22	The reserve should be kept as a tourist attraction as a source of income for the community	0.80
18	I like to go and take care of the reserve	0.59
20	I enjoy watching wild animals in the forest (deer, llamas, birds)	0.47
15	The community has the ability to manage our reserve	0.35
11	I feel ownership of the reserve	0.33
32	The reserve offers several benefits to me	0.31
35	The reserve is important for the economic well being of my family	0.29
13	I like to go to the reserve because it has shade, it is green, it is beautiful	0.29
23	I feel more peaceful when I am in the reserve	0.27
36	People from outside should help us to manage our reserve	0.11
16	I like to bring my family, who live in the city, to the reserve	0.01
2	I like to go to the reserve for a pleasant field trip	-0.14
8	I want to spend more time in the reserve huts	-0.19
34	I use fresh herbs from the forest in my regular cooking	-0.32
10	Others should have access to the reserve	-0.42
26	I do not need to use to the reserve to collect fuel-wood because I use gas to cook	-0.43
30	The reserve is in good condition to be used as an economic asset	-0.43
5	I like to go to the reserve to bring flowers to the saints	-0.88



29	Wild animals scared me	-1.10
28	I have never being in the reserve	-1.14
25	Going to the reserve makes me tired because of the work I have to do	-1.16
9	I would rather stay at home with my family than go to the reserve	-1.26
24	I prefer to be in the city	-1.34
17	We need to extract logs from the reserve to support our projects	-1.44
33	The reserve is a place to bring our animals to pasture	-1.44
7	I want to obtain more hay from the reserve	-1.57
6	I want to obtain more fuel-wood from the reserve	-1.77

### **Factor B'(+) : Professional Timber Management**

Bipolar factor B' on the positive side shows that there is a desire for professional management to obtain logs to support projects (statements 17 *We need to extract logs from the reserve to support our projects* and 36 *People from outside should help us to manage our reserve* ). There is also a strong commitment to help with the management of the reserve due to the sense of ownership (statements 18 *I like to go and take care of the reserve* and 11 *I feel ownership of the reserve*). Tourism is an activity that people in B'+ agree to pursue.

### **Factor B'(-) : Community Management for Non-timber Benefits**

On the negative side (B'-), those who share common perspective want to manage the reserve by themselves and also oppose timber harvesting. They feel that the reserve is not only an economic asset; it is also a place for family enjoyment and extraction of non-timber products for domestic consumption.

**Table 15: z-Scores for Factor B' (+ and -)**

<b>Number</b>	<b>Statements</b>	<b>z-Score</b>
17	We need to extract logs from the reserve to support our projects	1.93
36	People from outside should help us to manage our reserve	1.93
18	I like to go and take care of the reserve	1.79
11	I feel ownership of the reserve	1.75
22	The reserve should be kept as a tourist attraction as a source of income for the community	1.08
6	I want to obtain more fuel-wood from the reserve	0.94
13	I like to go to the reserve because it has shade, it is green, it is beautiful	0.81
32	The reserve offers several benefits to me	0.81
21	I want to participate in reforestation projects	0.76
28	I have never being in the reserve	0.76
31	The reserve needs better administration	0.49
19	I would like the reserve to provide jobs for young people	0.45
27	The reserve should remained close, every time someone needs to go should ask for permission	0.27
12	The reserve provides oxygen to our bodies	0.22
9	I would rather stay at home with my family than go to the reserve	0.18
5	I like to go to the reserve to bring flowers to the saints	0.18
1	The reserve means a place of life	0.04
24	I prefer to be in the city	0.00
25	Going to the reserve makes me tired because of the work I have to do	0.00
35	The reserve is important for the economic well being of my family	-0.04
23	I feel more peaceful when I am in the reserve	-0.18
34	I use fresh herbs from the forest in my regular cooking	-0.27
14	The reserve keep us healthier than those who live in the city	-0.36
26	I do not need to use to the reserve to collect fuel-wood because I use gas to cook	-0.58
8	I want to spend more time in the reserve huts	-0.58
10	Others should have access to the reserve	-0.63
29	Wild animals scared me	-0.67
20	I enjoy watching wild animals in the forest (deer, llamas, birds)	-0.81
30	The reserve is in good condition to be used as an economic asset	-0.94
7	I want to obtain more hay from the reserve	-1.03
15	The community has the ability to manage our reserve	-1.12
2	I like to go to the reserve for a pleasant field trip	-1.21
33	The reserve is a place to bring our animals to pasture	-1.25
4	The reserve should have more trees	-1.35
3	The reserve should have more wild animals	-1.57
16	I like to bring my family, who live in the city, to the reserve	-1.79

## **CHAPTER V**

### **FINDINGS FROM THE SURVEY**

The survey for indicators was designed to understand people's preferences in relation to indicators for sustainable forest management before and after analysis and deliberation. The study was designed to explore the relevance of the already established indicators for sustainable forest management at the local level. The analysis and deliberation framework as means for community participation served two purposes, 1) to educate forest owners about different forest management alternatives and indicators for sustainable forest management (analysis); and 2) to assure that the policy outcome (Forest Management Plan) would satisfy people's preferences and values, and that the indicators would actually be accepted and implemented (deliberation).

This section presents the findings in four parts: description of the subject and the instrument, findings from the baseline, findings through analysis, and findings from deliberation. For better understanding findings from analysis will be labeled analysis survey.

## 5.1 Subjects and Instrumentation

For this study, 35 participants (principal and secondary owners and their immediate families) were selected. Only principal and second forest owners and their immediate families were asked to fill the survey. Demographics on gender and age are shown in table 16. It is important to clarify that the female population was consulted because their husbands or fathers empower them to decide in their absent. Out of the 21 male on the survey 13 are principal owners, 6 secondary owners, and 2 sons of the principal owners. For the purpose of this document the term participants refers to people who participate in the survey and meetings who in turn are forest's shareholders. The survey was distributed three times: before analysis meeting and deliberation (here forth baseline), after analysis meeting, and after deliberation.

**Table 16: Demographics for the Survey**

<b>Demographics</b>	<b>Survey</b>
<b>Gender</b>	
Male	21
Female	14
<b>Age</b>	
18-25	5
26-35	8
36-45	12
46-55	7
56-65	2
>65	1
<b>Education</b>	
Elementary (completed 3 years)	22
Elementary (Completed 6 years)	8
Secondary	4
Post secondary	1

Q-methodology was used to select indicators that have some meaning to the population in question. The indicators were selected from three different sources, Center for International Forestry Research – North America (CIFOR-NA), Local Unit Criteria and Indicators Development (LUCID), and International Labor Organization-German Technical Cooperation (ILO-GTZ). Sixty-six indicators comprised the instrument (see table 16). Participants (forest owners) ranked the indicators in a 5 point Likert Scale; a value of 1 signified non-important, 2 somehow important, 3 indifferent, 4 important, and 5 very important. Table 17 shows the survey.

**Table 17: Selected Indicators for Sustainable Forest Management**

		1	2	3	4	5
		Non- important	Somehow important	Indifferent	Important	Very important
	<b>How important is?</b>					
1	Protection of ecologically sensitive areas, especially buffer zones along water courses					
2	Extent and severity of area burned					
3	Extent and severity of insect attacks and disease infestations					
4	Protection of hydrological functions					
5	Road network density, type, use, and location					
6	Protected areas are maintained to protect rare, unique, and representative species and features					
7	Population of indigenous species are likely to persist					
8	Percentage and extent, in area, of vegetation types and structural classes relative to the historical condition and total forest area					
9	Pollutant levels in the ecosystem					
10	Population sizes and reproductive success are adequate to maintain levels of genetic diversity					
11	Management does not significantly change gene frequency					
12	Use of scientifically-based seed transfer rules and seed orchard zones in planting native species					
13	Percentage of harvested area having greater than 25% of the area with degraded soil quality, including soil compaction, displacement, erosion, puddling, and loss of organic matter					
14	Trends and timing of events in stream flows from forest catchments					
15	Policy and planning are based on recent and accurate information					
16	Objectives are clearly stated in terms of the major functional areas of the forest with respect to their spatial distribution					
17	Silvicultural systems prescribed are appropriate to forest type, production of desired products, and condition, and assure forest establishment, composition, and growth					
18	Productive capacity is protected					
19	Air, soil, and water quality are protected					
20	Harvesting systems and equipment are prescribed to match forest conditions in order to reduce impact on wildlife, soil productivity, residual stand conditions, and water quality and quantity					
21	Annual and periodic removals calculated by area and/or volume prescribed					
22	Distribution of and changes in the land-base available for timber production are identified					

<b>Table 17 Continuation: Selected Indicators for Sustainable Forest Management</b>		<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
	<b>How important is?</b>	Non- important	Somehow important	Indifferent	Important	Very important
23	An effective monitoring and control system audits management's conformity with planning					
24	Continuous forest inventories are established and measured regularly					
25	Documentation and records of all forest management activities are kept in a form that makes monitoring possible					
26	Effective instruments for inter-institutional co-ordination on land use and forest management exist					
27	There is sustained and adequate funding and staff for the management of forest					
28	Institutions responsible for forest research are adequately funded and staffed					
29	Contribution of local and traditional ecological knowledge					
30	Access to forest resources is perceived to be fair and secure					
31	The process should be inclusive with all interests represented					
32	Stakeholders should have detailed and meaningful reciprocal background information necessary to provide quality input into the public participation process					
33	Management staff and stakeholders should recognize and respect the interests and rights of each other					
34	The decision making processes must be transparent such that participants are confident that their opinions and values will be considered during the process and be reflected in the final product					
35	Forest managers co-operate with public health authorities regarding illnesses related to forest management and potable water related concerns					
36	Forest management contributes to educational research					
37	Extent to which forest planning and management processes consider and meet legal obligations with respect to duly established aboriginal and treaty rights					
38	Extent to which forest management planning takes into account the protection of unique or significant indigenous (local) social, cultural, or spiritual sites					
39	Area of forest land available for subsistence purposes					
40	Special places for aesthetics and solitude					
41	Forest provides a place for gathering					
42	Places for education and research					
43	Respect for customs and culture					
44	Community resilience					

**Table 17 Continuation: Selected Indicators for Sustainable Forest Management**

	How important is?	1	2	3	4	5
		Non- important	Somehow important	Indifferent	Important	Very important
45	Institutional adequacy					
46	Government-to-government relationship (ejido-government)					
47	Existence of mechanisms for sharing the economic benefits derived from forest management					
48	Wages and other benefits conform to national and/or international standards					
49	Employment of local population in forest management					
50	Strictly comply to international and national law related to the minimum age to work					
51	Individuals under 18 years old should not do hard work					
52	Number of population with a significant forestry component in the economic base					
53	Availability and use of recreational opportunities are maintained					
54	Total expenditures by individuals on activities related to non-timber use					
55	Existence of economic rents: Total harvesting revenues exceed harvesting costs					
56	Build infrastructure, recreational facilities					
57	Production of marketed good and services					
58	Workforce diversity					
59	Fair income distribution from the products extracted from the forest					
60	Secure and stable income					
61	Salaries should not be less than the minimum wage. Salary for managers and independent contractors should be consistent with similar employments in the region					
62	Local population who depend on the forest should have the same opportunity of getting a jobs and training					
63	Extent of places for solitude and recreation					
64	Cultural and traditional values are respected					
65	Access to traditional practices for subsistence are guaranteed					
66	Rights of local communities to access the forest are respected					



## 5.2 Findings from Baseline Survey

The instrument was distributed to the participants before any intervention was done. Thus, specific research question 2 was addressed (*What are people's preferences in regard to the forest?*) The Cronbach's alpha reliability test was used to check internal consistency of the instrument. Cronbach's is a coefficient of reliability; it is a function of the number of items and the average intercorrelation among them. It measures how well a set of items (or variables) measures a single unidimensional construct. Cronbach's alpha increases when the correlation of the items also increases, that is why it is used to test for internal consistency.

$$\alpha = \frac{N\bar{c}}{\bar{v} + (N-1)\bar{c}}$$

Where N is the number of items, c-bar is the average of the covariance items, and v-bar is the average of the variance between the components.

Cronbach's was used to test for the reliability of the whole instrument; it was also used to test for the three pillars of sustainability (social, economic, and ecological) and for the three principles in which the indicators were grouped:

- *Principle 1:* Ecological integrity is maintained
- *Principle 2:* Yield and quality of forest goods and services are sustainable
- *Principle 3:* Society accepts responsibility for sustainability

For data analysis, the researcher chose to address indicators as economic, ecological, and social according to the most popular components of sustainable forest management, thus to use a common language throughout of the chapter.

Table 18 shows the indicators associated with each Principle and components of SFM; it also gives the source of each indicator.

**Table 18: Indicators for Sustainable Forest Management, Sources, and Grouping**

<b>Number</b>	<b>Indicators</b>	<b>Principle</b>	<b>Pillars</b>	<b>North America</b>	<b>LUCID</b>	<b>ILO-GTZ</b>
1	Protection of ecologically sensitive areas, especially buffer zones along water courses	P1	Ecol	x		
2	Extent and severity of area burned	P1	Ecol	x		
3	Extent and severity of insect attacks and disease infestations	P1	Ecol	x		
4	Protection of hydrological functions	P1	Ecol		x	
5	Road network density, type, use, and location	P1	Ecol	x		
6	Protected areas are maintained to protect rare, unique, and representative species and features	P1	Ecol	x		
7	Population of indigenous species are likely to persist	P1	Ecol	x		
8	Percentage and extent, in area, of vegetation types and structural classes relative to the historical condition and total forest area	P1	Ecol	x		
9	Pollutant levels in the ecosystem	P1	Ecol	x		
10	Population sizes and reproductive success are adequate to maintain levels of genetic diversity	P1	Ecol	x		
11	Management does not significantly change gene frequency	P1	Ecol	x		
12	Use of scientifically-based seed transfer rules and seed orchard zones in planting native species	P1	Ecol	x		
13	Percentage of harvested area having greater than 25% of the area with degraded soil quality, including soil compaction, displacement, erosion, puddling, and loss of organic matter	P1	Ecol	x		
14	Trends and timing of events in stream flows from forest catchments	P1	Ecol	x		
15	Policy and planning are based on recent and accurate information	P2	Soc	x		
16	Objectives are clearly stated in terms of the major functional areas of the forest with respect to their spatial distribution	P2	Soc	x		
17	Silvicultural systems prescribed are appropriate to forest type, production of desired products and condition, and assure forest establishment, composition, and growth	P2	Ecol	x		
18	Productive capacity is protected	P1	Ecol		x	
19	Air, soil, and water quality are protected	P1	Ecol		x	
20	Harvesting systems and equipment are prescribed to match forest conditions in order to reduce impact on wildlife, soil productivity, residual stand conditions, and water quality and quantity	P2	Ecol	x		
21	Annual and periodic removals calculated by area and/or volume prescribed	P2	Ecol	x		
22	Distribution of and changes in the land-base available for timber production are identified	P2	Ecol	x		

<b>Number</b>	<b>Indicators</b>	<b>Principle</b>	<b>Pillars</b>	<b>North America</b>	<b>LUCID</b>	<b>ILO-GTZ</b>
23	An effective monitoring and control system audits management's conformity with planning	P2	Soc	x		
24	Continuous forest inventories are established and measured regularly	P2	Soc	x		
25	Documentation and records of all forest management activities are kept in a form that makes monitoring possible	P2	Soc	x		
26	Effective instruments for inter-institutional co-ordination on land use and forest management exist	P2	Soc	x		
27	There is sustained and adequate funding and staff for the management of forest	P2	Soc	x		
28	Institutions responsible for forest research are adequately funded and staffed	P2	Soc	x		
29	Contribution of local and traditional ecological knowledge	P3	Soc		x	
30	Access to forest resources is perceived to be fair and secure	P3	Soc	x		
31	The process should be inclusive with all interests represented	P3	Soc	x		
32	Stakeholders should have detailed and meaningful reciprocal background information necessary to provide quality input into the public participation process	P3	Soc	x		
33	Management staff and stakeholders should recognize and respect the interests and rights of each other	P3	Soc	x		
34	The decision making processes must be transparent such that participants are confident that their opinions and values will be considered during the process and be reflected in the final product	P3	Soc	x		
35	Forest managers co-operate with public health authorities regarding illnesses related to forest management and potable water related concerns	P3	Soc	x		
36	Forest management contributes to educational research	P3	Soc			created
37	Extent to which forest planning and management processes consider and meet legal obligations with respect to duly established aboriginal and treaty rights	P3	Soc	x		
38	Extent to which forest management planning takes into account the protection of unique or significant indigenous (local) social, cultural, or spiritual sites	P3	Soc	x		
39	Area of forest land available for subsistence purposes	P3	Soc	x		
40	Special places for aesthetics and solitude	P2	Soc		x	
41	Forest provides a place for gathering	P3	Soc		x	
42	Places for education and research	P2	Soc		x	
43	Respect for customs and culture	P3	Soc		x	
44	Community resilience	P3	Soc		x	

**Table 18 Continuation: Indicators for Sustainable Forest Management, Sources, and Grouping**

Number	Indicators	Principle	Pillars	North America	LUCID	ILO-GTZ
45	Institutional adequacy	P2	Soc		x	
46	Government-to-government relationship (ejido-government)	P2	Soc		x	
47	Existence of mechanisms for sharing the economic benefits derived from forest management	P3	Econ	x		
48	Wages and other benefits conform to national and/or international standards	P3	Econ	x		
49	Employment of local population in forest management	P3	Econ	x		
50	Strictly comply to international and national law related to the minimum age to work	P3	Econ	x		
51	Individuals under 18 years old should not do hard work	P2	Soc			x
52	Number of population with a significant forestry component in the economic base	P3	Econ	x		
53	Availability and use of recreational opportunities are maintained	P2	Soc	x		
54	Total expenditures by individuals on activities related to non-timber use	P2	Econ	x		
55	Existence of economic rents: Total harvesting revenues exceed harvesting costs	P2	Econ	x		
56	Build infrastructure, recreational facilities	P2	Econ		x	
57	Production of marketed good and services	P2	Econ		x	
58	Workforce diversity	P2	Soc		x	
59	Fair income distribution from the products extracted from the forest	P3	Econ		x	
60	Secure and stable income	P3	Econ		x	
61	Salaries should not be less than the minimum wage. Salary for managers and independent contractors should be consistent with similar employments in the region	P3	Econ			x
62	Local population who depend on the forest should have the same opportunity of getting a jobs and training	P3	Econ			x
63	Extent of places for solitude and recreation	P2	Soc			
64	Cultural and traditional values are respected	P3	Soc			
65	Access to traditional practices for subsistence are guaranteed	P3	Soc			
66	Rights of local communities to access the forest are respected	P3	Soc			

Table 19 shows values of Cronbach’s alpha for the baseline survey. Cronbach’s alpha value for the instrument indicates that the selection of the indicators was accurate. Thus, the items of the instrument are measuring the same characteristic, in this case, sustainable forest management. Cronbach’s alpha values in all cases are higher than 0.7, which shows that the indicators associated with each principle and each pillar of sustainability are measuring the same characteristic as well.

**Table 19: Cronbach’s Alpha Values for Baseline Survey**

	<b>Cronbach's Alpha Based on Standardized</b>		
	<b>Cronbach's Alpha</b>	<b>Items</b>	<b>No. of Items</b>
<b>Instrument</b>	0.937	0.947	66
<b>Principle 1</b>	0.768	0.780	16
<b>Principle 2</b>	0.867	0.882	24
<b>Principle 3</b>	0.855	0.881	26
<b>Ecological</b>	0.811	0.826	20
<b>Economic</b>	0.849	0.857	13
<b>Social</b>	0.875	0.898	33

*Principle 1: Ecological integrity is maintained*

*Principle 2: Yield and quality of forest goods and services are sustainable*

*Principle 3: Society accepts responsibility for sustainability*

To analyze results for the baseline survey the frequencies from the descriptive statistics were used. Indicators that were ranked 5 (very important) for more than 50% of the population are shown in Table 20.

**Table 20: Indicators Ranked 5 (Very Important for more than 50% of the Population)**

<b>Number</b>	<b>Indicator</b>
1	Protection of ecologically sensitive areas, especially buffer zones along water courses
4	Protection of hydrological functions
5	Road network density, type, use, and location
9	Pollutant levels in the ecosystem
12	Use of scientifically-based seed transfer rules and seed orchard zones in planting native species
13	Percentage of harvested area having greater than 25% of the area with degraded soil quality, including soil compaction, displacement, erosion, puddling, and loss of organic matter
18	Productive capacity is protected
19	Air, soil, and water quality are protected
25	Documentation and records of all forest management activities are kept in a form that makes monitoring possible
26	Effective instruments for inter-institutional co-ordination on land use and forest management exist
31	The process should be inclusive with all interests represented
32	Stakeholders should have detailed and meaningful reciprocal background information necessary to provide quality input into the public participation process
33	Management staff and stakeholders should recognize and respect the interests and rights of each other
34	The decision making processes must be transparent such that participants are confident that their opinions and values will be considered during the process and be reflected in the final product
35	Forest managers co-operate with public health authorities regarding illnesses related to forest management and potable water related concerns
36	Forest management contributes to educational research
40	Special places for aesthetics and solitude
41	Forest provides a place for gathering
42	Places for education and research
44	Community resilience
45	Institutional adequacy
46	Government-to-government relationship (ejido-government)
47	Existence of mechanisms for sharing the economic benefits derived from forest management
49	Employment of local population in forest management
53	Availability and use of recreational opportunities are maintained
55	Existence of economic rents: Total harvesting revenues exceed harvesting costs
57	Production of marketed good and services
59	Fair income distribution from the products extracted from the forest
60	Secure and stable income
61	Salaries should not be less than the minimum wage. Salary for managers and independent contractors should be consistent with similar employments in the region
62	Local population who depend on the forest should have the same opportunity of getting a jobs and training
63	Extent of places for solitude and recreation
64	Cultural and traditional values are respected
66	Rights of local communities to access the forest are respected

*Note: Indicators in grey were ranked 5 (very important) for more than 70% of the population*

**Table 21: Indicator Ranked 4 for more than 50% of the Population**

<b>Number</b>	<b>Indicator</b>
14	Trends and timing of events in stream flows from forest catchments
16	Objectives are clearly stated in terms of the major functional areas of the forest with respect to their spatial distribution
20	Harvesting systems and equipment are prescribed to match forest conditions in order to reduce impact on wildlife, soil productivity, residual stand conditions, and water quality and quantity
21	Annual and periodic removals calculated by area and/or volume prescribed
23	An effective monitoring and control system audits management's conformity with planning
27	There is sustained and adequate funding and staff for the management of forest
28	Institutions responsible for forest research are adequately funded and staffed
29	Contribution of local and traditional ecological knowledge
37	Extent to which forest planning and management processes consider and meet legal obligations with respect to duly established aboriginal and treaty rights
50	Strictly comply to international and national law related to the minimum age to work
56	Build infrastructure, recreational facilities

Most of the indicators were ranked 5 and 4, which implies that indicators for sustainable forest management were relevant for forest owners. Out of the 20 ecological indicators, the 8 that were highly ranked were those associated with water quality, soil and road protection, and the quality of the seeds to be planted. Twenty percent of the population ranked as somewhat important (2) indicator No. 6 “*Protected areas are maintained to protect rare, unique, and representative species and features.*” Currently, there is no indication of unique or rare species on the reserve; therefore, this indicator is relatively non-important to the participants (forest owners).

Concerning social indicators, 18 out of 33 were ranked as very important. Indicators 31, 32, and 34 provided evidence of the need for a participatory process in which individuals are able to participate in a transparent deliberation in which they can express their values and ideas.

*31. The process should be inclusive with all interests represented*



*32. Stakeholders should have detailed and meaningful reciprocal background information necessary to provide quality input into the public participation process*

*34. The decision making processes must be transparent such that participants are confident that their opinions and values will be considered during the process and be reflected in the final product*

Indicators related to cultural values, spiritual places for solitude, and rights to access the forest were also ranked as very important.

For the forest owners in this study, indicator 39 “*areas of forest land available for subsistence purposes*” means that traditional agricultural practices (such crops and cattle grazing) can be implemented in the reserve. The indicator was ranked 1 for more than 50% of the population, which means that agricultural activities are not desired in the reserve. This is also consistent with Q-factors, all factors opposed to grazing.

Eight economic indicators out of 13 were ranked as very important. Those indicators are related to employment, salaries, distribution of income, and forest products. These findings are also consistent with factors A, B, D, and A’ of the Q-methodology, which indicated the desire for more jobs associated with forest activities.

### **5.3 Findings from Analysis Survey**

The analysis part of the research consisted of a search meeting in which forest owners were exposed to three different alternatives for forest management. The researcher presented advantages and disadvantages of implementing each alternative. Participants were able to ask and to share their comments in relation to the alternatives.

The three alternatives presented were 1) to keep the forest in the current state (status quo), 2) to implement the approved plan for harvesting, and 3) to pursue a forest plan for tourism. Although all the alternatives included indicators for sustainable management, only the plan for tourism considered all the viewpoints obtained from the Q-methodology. Details of the alternatives can be found in the Appendix 4.

After the search meeting the survey was administered to the participants; the researcher read aloud indicator-by-indicator, meanwhile participants were filling out the survey. Participants asked for an explanation of some of the indicators; the researcher provided answers in a clear and simple way for better understanding.

The Cronbach's alpha test was obtained again to corroborate previous findings; Table 22 presents the values of Cronbach's alpha.

**Table 22: Cronbach's Alpha Values for Analysis Survey**

	<b>Cronbach's Alpha</b>	<b>Cronbach's Alpha Based on Standardized Items</b>	<b>No. of Items</b>
<b>Instrument</b>	0.945	0.952	66
<b>Principle 1</b>	0.752	0.758	16
<b>Principle 2</b>	0.900	0.940	24
<b>Principle 3</b>	0.798	0.802	26
<b>Ecological</b>	0.780	0.794	20
<b>Economic</b>	0.881	0.882	13
<b>Social</b>	0.924	0.930	33
<i>Principle 1: Ecological integrity is maintained</i>			
<i>Principle 2: Yield and quality of forest goods and services are sustainable</i>			
<i>Principle 3: Society accepts responsibility for sustainability</i>			

The Wilcoxon Signed Rank Test was used to compare differences in ratings between the baseline and analysis survey. Wilcoxon does not assume normality in data; it assumes that the observation in each group comes from populations with the same shape distribution. The test is used for nominal data and the hypothesis is that the median difference between the pairs of observations is zero. The absolute value of the differences between observations are ranked from smallest to largest; the difference closest to 0 is assigned a rank of 1, the next larger difference getting a rank of 2, and so on. Ties are given average ranks. The ranks of all differences in one direction are summed, and the ranks of all differences in the other direction are summed. The smaller of these two sums is the test statistic. Then significance is given in how the samples change either to the positive sign or the negative (Navidi, 2008) .

The significance of the test provides information about whether the rankings went up or down, which is what this study wanted to pursue. The hypothesis to be tested is that there is no difference in rankings after analysis survey. In other words *median analysis – median base = 0*, or  $H_0 : A = B$ . The following table (23) shows indicators that are significantly different ( $p < 0.05$ ) from zero, in other words, indicators that drastically changed on importance.

**Table 23: Indicators Significantly Different after Analysis Survey**

Number	Indicator	Test (A-B)	Z	P-value
2	Extent and severity of area burned	A2 - B2	-2.494b	0.013
39	Area of forest land available for subsistence purposes	A39 - B39	-2.850b	0.004
40	Special places for aesthetics and solitude	A40 - B40	-2.445a	0.015
65	Access to traditional practices for subsistence are guaranteed	A65 - B65	-2.888b	0.004

*a = based on negative signs; meaning significantly decline after analysis survey*

*b = based on positive signs; meaning significantly increase after analysis survey*

For 62 indicators, the hypotheses ( $H_0$ ) that  $A = B$  cannot be rejected. However, indicators shown in table 22 are significantly different; therefore,  $H_0$  can be rejected. The sign provided in the Wilcoxon output gives information on whether the indicator is ranked higher or lower after the intervention.

According to Table 23, indicators 2, 39, and 65 tended to be ranked higher after the search meeting (analysis meeting). Indicator 40 tended to be ranked lower. The analysis meeting was important for forest owners to understand forest density and its relation to fire hazard. During the discussion of alternatives for forest management, issues of forest fire hazard were discussed. It was necessary to explain the importance of controlling forest density using appropriated silvicultural methods.

Descriptive statistics provides information to compare indicators that were ranked higher regardless the degree of significance. Table 24 presents indicators that were ranked higher and those that kept high degree of importance after analysis meeting.

**Table 24: Indicators that Increase on Ranking after the Analysis Survey**

<b>Number</b>	<b>Indicators</b>
1	Protection of ecologically sensitive areas, especially buffer zones along water courses
2	Extent and severity of area burned
4	Protection of hydrological functions
8	Percentage and extent, in area, of vegetation types and structural classes relative to the historical condition and total forest area
10	Population sizes and reproductive success are adequate to maintain levels of genetic diversity
14	Trends and timing of events in stream flows from forest catchments
15	Policy and planning are based on recent and accurate information
16	Objectives are clearly stated in terms of the major functional areas of the forest with respect to their spatial distribution
17	Silvicultural systems prescribed are appropriate to forest type, production of desired products and condition, and assure forest establishment, composition, and growth
20	Harvesting systems and equipment are prescribed to match forest conditions in order to reduce impact on wildlife, soil productivity, residual stand conditions, and water quality and quantity
23	An effective monitoring and control system audits management's conformity with planning
24	Continuous forest inventories are established and measured regularly
25	Documentation and records of all forest management activities are kept in a form that makes monitoring possible
27	There is sustained and adequate funding and staff for the management of forest
28	Institutions responsible for forest research are adequately funded and staffed
29	Contribution of local and traditional ecological knowledge
30	Access to forest resources is perceived to be fair and secure
31	The process should be inclusive with all interests represented
34	The decision making processes must be transparent such that participants are confident that their opinions and values will be considered during the process and be reflected in the final product
35	Forest managers co-operate with public health authorities regarding illnesses related to forest management and potable water related concerns
37	Extent to which forest planning and management processes consider and meet legal obligations with respect to duly established aboriginal and treaty rights
38	Extent to which forest management planning takes into account the protection of unique or significant indigenous (local) social, cultural, or spiritual sites
39	Area of forest land available for subsistence purposes
43	Respect for customs and culture
44	Community resilience
45	Institutional adequacy
46	Government-to-government relationship (ejido-government)
47	Existence of mechanisms for sharing the economic benefits derived from forest management
48	Wages and other benefits conform to national and/or international standards
49	Employment of local population in forest management
50	Strictly comply to international and national law related to the minimum age to work
51	Individuals under 18 years old should not do hard work
52	Number of population with a significant forestry component in the economic base
53	Availability and use of recreational opportunities are maintained
58	Workforce diversity
59	Fair income distribution from the products extracted from the forest

60	Secure and stable income
61	Salaries should not be less than the minimum wage. Salary for managers, and independent contractors should be consistent with similar employments in the region
62	Local population who depend on the forest should have the same opportunity of getting a jobs and training
64	Cultural and traditional values are respected
65	Access to traditional practices for subsistence are guaranteed

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*Note: Indicators on grey did not change importance*

From the Table 24, 37 indicators increase in ranking 8 were ecological; most of them are associated with forest harvesting and water protection. Indicator 2, *extent and severity of area burned* gained importance due to the better understanding of controlling forest density to avoid undesired fires. Indicators associated to good silvicultural practices also increased in importance (17 and 20).

*17. Silvicultural systems prescribed are appropriate to forest type, production of desired products, and condition, and assure forest establishment, composition, and growth*

*20. Harvesting systems and equipment are prescribed to match forest conditions in order to reduce impact on wildlife, soil productivity, residual stand conditions, and water quality and quantity*

Twenty social indicators increased in importance and 4 remained very important. Indicators related to administration (23, 24, 25, 27, 28, 45, and 46) gained importance; during the analysis meeting issues of community organization and forest administration were discussed.

*23. An effective monitoring and control system audits management's conformity with planning*

*24. Continuous forest inventories are established and measured regularly*

*25. Documentation and records of all forest management activities are kept in a form that makes monitoring possible*

- 27. There is sustained and adequate funding and staff for the management of forest*
- 28. Institutions responsible for forest research are adequately funded and staffed*
- 45. Institutional adequacy*
- 46. Government-to-government relationship (ejido-government)*

Some members forest owners alleged that previous attempts to manage the forest had failed because the administrators did not have enough training on how to keep books and records of the activities developed in the forest.

Accordingly, indicators related to community participation increased in importance (31, 34, and 38); the analysis meeting showed that forest management is a community effort.

- 31. The process should be inclusive with all interests represented*
- 34. The decision making processes must be transparent such that participants are confident that their opinions and values will be considered during the process and be reflected in the final product*
- 38 Extent to which forest management planning takes into account the protection of unique or significant indigenous (local) social, cultural, or spiritual sites*

Three different alternatives that include forest and peoples' values were exposed to forest owners; this created a forum for discussion where the community understood the importance of having all the parties involved to decide which alternatives met the community's needs and values.

Rankings for 9 economic indicators increased; those are indicators associated with employment and marketing good and services from the forest (48, 49, 50, 52, 58, and 62).

- 48. Wages and other benefits conform to national and/or international standards*
- 49. Employment of local population in forest management*

- 50. *Strictly comply to international and national law related to the minimum age to work*
- 52. *Number of population with a significant forestry component in the economic base*
- 58. *Workforce diversity*
- 62. *Local population who depend on the forest should have the same opportunity of getting a jobs and training*

Two of the alternatives (timber harvesting and tourism) showed that many of the activities could be done by members of the community because in the past some of them had been involved in timber harvesting. Additionally, the tourism plan implies a long-term commitment, thus activities different from timber harvesting are considered; in this sense indicators 53, 59, and 62 were most important.

- 53. *Availability and use of recreational opportunities are maintained*
- 59. *Fair income distribution from the products extracted from the forest*
- 62. *Local population who depend on the forest should have the same opportunity of getting a jobs and training*

The three alternatives for management indicated that the forest owners could perceive some economic benefit; therefore, indicator 47 gained importance. There was a concern about how this benefit could be distributed among the forest owners.

La Preciosita is a rural community who highly respect their internal rules. One of the most important rules is that people under 18 years should not do hard work; therefore, indicator 51, *individuals under 18 years old should not do hard work* was ranked very important before and after the analysis meeting.



Indicators that lower on ranking are shown in Table 25. During the search meeting issues of reforestation were brought. The density of the forest of La Preciosita is high; therefore, for the near future, reforestation will not be a necessary activity; as a consequence indicator 12 decreased (*Use of scientifically-based seed transfer rules and seed orchard zones in planting native species*). On the other hand, harvesting non-timber products were also discussed, there is a high potential to obtain non-timber products; however, due to forest owners' disagreements this activity is not desired for commercial purpose. The use of non-timber products seems to be more appealing at the domestic level (indicator 54, *Total expenditures by individuals on activities related to non-timber use*). Economic benefits from timber harvesting are a critical topic among forest owners. During the search meetings forest owners learned that the cost of some activities (marking trees, load and upload timber, and transportation) and the management plan are relatively high compared with the net revenue. Therefore, there is a degree of demoralization in obtaining benefits from timber harvesting this is one of the reasons indicators 55 and 57 decreased.

55. *Existence of economic rents: Total harvesting revenues exceed harvesting costs*

57. *Production of marketed good and services*

**Table 25: Indicators that Decreased on Ranking after Analysis Survey**

<b>Number</b>	<b>Indicator</b>
3	Extent and severity of insect attacks and disease infestations
5	Road network density, type, use, and location
6	Protected areas are maintained to protect rare, unique and representative species and features
7	Population of indigenous species are likely to persist
9	Pollutant levels in the ecosystem
11	Management does not significantly change gene frequency
12	Use of scientifically-based seed transfer rules and seed orchard zones in planting native species
13	Percentage of harvested area having greater than 25% of the area with degraded soil quality, including soil compaction, displacement, erosion, puddling, and loss of organic matter
18	Productive capacity is protected
19	Air, soil and water quality are protected
21	Annual and periodic removals calculated by area and/or volume prescribed
22	Distribution of and changes in the land base available for timber production are identified
26	Effective instruments for inter-institutional co-ordination on land use and forest management exist
31	The process should be inclusive with all interests represented
32	Stakeholders should have detailed and meaningful reciprocal background information necessary to provide quality input into the public participation process
33	Management staff and stakeholders should recognize and respect the interests and rights of each other
36	Forest management contributes to educational research
40	Special places for aesthetics and solitude
41	Forest provides a place for gathering
42	Places for education and research
54	Total expenditures by individuals on activities related to non-timber use
55	Existence of economic rents: Total harvesting revenues exceed harvesting costs
56	Built infrastructure, recreational facilities
57	Production of marketed good and services
63	Extent of places for solitude and recreation
66	Rights of local communities to access the forest are respected

Further analysis of the indicators was conducted to understand how indicators as groups change in importance. The hypotheses to be tested are

$$H_0: P1A = P1B;$$

$$H_0: P2A = P2B;$$

$$H_0: P3A = P3B;$$

Where

P1, P2 and P3 = Principles

A = Analysis Survey

B = Baseline

The following table (26) shows p-values for principles. It indicates that there is no significant difference in any of the principles after analysis meeting. Therefore,  $H_0$  cannot be rejected.

**Table 26: P-values for Principles**

	<b>P1</b>	<b>P2</b>	<b>P3</b>
Z	-1.113 <sup>a</sup>	-0.206 <sup>b</sup>	-0.581 <sup>b</sup>
P-value. Sig. (2-tailed)	0.266	0.837	0.561

*a= based on negative sign; meaning significantly decline after analysis survey*

*b = based on positive sign; meaning significantly increase after analysis survey*

*Principle 1: Ecological integrity is maintained*

*Principle 2: Yield and quality of forest goods and services are sustainable*

*Principle 3: Society accepts responsibility for sustainability*

The researcher also grouped the indicators into the three pillars of SFM, ecological, economic, and social (see Table 18). The following table (27) shows the p-values for the Wilcoxon test which indicate that there is no significant difference for the ecological and economic indicators. Social indicators tend to be ranked higher after analysis survey.

$H_0$ : Ecological A = Ecological B;

$H_0$ : Economic A = Economic B;

$H_0$ : Social A = Social B;

Where

A = Analysis survey

B = Baseline

**Table 27: P-values for Three Pillars of Sustainability**

	<b>Ecological</b>	<b>Economic</b>	<b>Social</b>
Z	-0.525 <sup>a</sup>	-0.179 <sup>b</sup>	-2.018 <sup>b</sup>
P-value. Sig. (2-tailed)	0.600	0.858	0.044

*a= based on negative signs; meaning significantly decline after analysis survey*

*b = based on positive signs; meaning significantly increase after analysis survey*

Indicators classified in Principles 1 and 2 overlapped with social indicators. This provides insights on how forest owners understand and rank indicators. Indicators associated with administration, participation, and cultural values are part of the social indicators; for this population, forest administration is a social endeavor.

#### **5.4 Findings from Deliberation Survey**

The deliberation part of this project consisted of a forest owners meeting to decide which of the three alternatives for forest management would be selected for further implementation. Forest owners deliberated for about one hour, and concerns and question were exposed and solved during the meeting. Finally, they chose the plan for tourism, which was prepared with the analysis of the data from Q-methodology. The survey was given to the participants (forest owners) again after the meeting; surveys were filled out at participants' homes.

Cronbach's alpha was also tested for the deliberation survey to corroborate consistency of the survey. Table 28 shows the Cronbach's alpha values for deliberation.

**Table 28: Cronbach's Alpha Values for Deliberation**

	<b>Cronbach's Alpha</b>	<b>Cronbach's Alpha Based on Standardized Items</b>	<b>No. of Items</b>
<b>Instrument</b>	0.941	0.942	66
<b>Principle 1</b>	0.798	0.802	16
<b>Principle 2</b>	0.859	0.856	24
<b>Principle 3</b>	0.907	0.910	26
<b>Ecological</b>	0.818	0.824	20
<b>Economic</b>	0.872	0.875	13
<b>Social</b>	0.883	0.883	33

*Principle 1: Ecological integrity is maintained*

*Principle 2: Yield and quality of forest goods and services are sustainable*

*Principle 3: Society accepts responsibility for sustainability*

For this part of the analysis, the hypothesis to be tested is that there is no difference in rankings after deliberation. In other words, *median deliberation – median analysis = 0* or  $H_0 : D = A$ . The following table (29) shows indicators that are significantly different from zero ( $p < 0.05$ ), thus indicators that have positive or negative change.

**Table 29: Indicators Significantly Different after Deliberation**

Number	Indicators	Test (D-A)	Z	P-value
1	Protection of ecologically sensitive areas, especially buffer zones along water courses	D1 - A1	-2.578a	0.01
6	Protected areas are maintained to protect rare, unique, and representative species and features	D6 - A6	-2.309b	0.021
26	Effective instruments for inter-institutional co-ordination on land use and forest management exist	D26 - A26	-1.999a	0.048
28	Institutions responsible for forest research are adequately funded and staffed	D28 - A28	-1.943b	0.045
29	Contribution of local and traditional ecological knowledge	D29 - A29	-2.100a	0.036
41	Forest provides a place for gathering	D41 - A41	-2.143b	0.032
45	Institutional adequacy	D45 - A45	-2.465a	0.014
53	Availability and use of recreational opportunities are maintained	D53 - A53	-2.055a	0.04
54	Total expenditures by individuals on activities related to non-timber use	D54 - A54	-2.735a	0.006
61	Salaries should not be less than the minimum wage. Salary for managers and independent contractors should be consistent with similar employments in the region	D61 - A61	-2.239a	0.025
64	Cultural and traditional values are respected	D64 - A64	-3.097a	0.002

*a = based on negative signs; meaning significantly decline after deliberation*

*b = based on positive signs; meaning significantly increase after deliberation*

Indicators 6, 28, and 41 were ranked higher after the deliberation meeting. The other indicators shown in the above table were ranked lower. Only two indicators in table 28 are in the ecologic category; the others are either social (administration) or economic. During the analysis meeting, it was explained that the plan for tourism could also include harvesting non-timber products. However, during deliberation forest owners agreed that harvesting non-timber products would only be for domestic purposes such as picking mushrooms or medicinal plants. Indicator 54 (*Total expenditures by individuals on activities related to non-timber use*) shows that after deliberation, preferences concerning non-timber products decreased.

During the process of analysis and deliberation, the participants expressed that respect for traditional knowledge is important only if they are using the right techniques to manage the forest. Indicator 29 (*Contribution of local and traditional ecological knowledge*) was always measured under that concept; because participants observed two ways to manage the forest different from what they were doing, they felt that their traditional way of managing was not the only and accurate way; that is why indicator 29 decreased.

Table 30 shows indicators that increased their ranking after deliberation; this information was taken from the descriptive statistics. The number of ecological indicators that gained importance increased after deliberation. Twelve ecological indicators increased their rankings. This indicates that peoples' preferences associated with ecological indicators changed due to the decision to pursue a forest management plan for tourism. Indicator 5 (*Road network density, type, use, and location*) was ranked higher because a plan for tourism requires high levels of road maintenance for tourists to have access to the forest.

**Table 30: Indicators that Increase on Ranking after Deliberation**

<b>Number</b>	<b>Indicators</b>
2	Extent and severity of area burned
4	Protection of hydrological functions
5	Road network density, type, use, and location
6*	Protected areas are maintained to protect rare, unique, and representative species and features
7	Population of indigenous species are likely to persist
8	Percentage and extent, in area, of vegetation types and structural classes relative to the historical condition and total forest area
10	Population sizes and reproductive success are adequate to maintain levels of genetic diversity
11	Management does not significantly change gene frequency
14	Trends and timing of events in stream flows from forest catchments
19	Air, soil, and water quality are protected
20	Harvesting systems and equipment are prescribed to match forest conditions in order to reduce impact on wildlife, soil productivity, residual stand conditions, and water quality and quantity
21	Annual and periodic removals calculated by area and/or volume prescribed
22	Distribution of and changes in the land-base available for timber production are identified
24	Continuous forest inventories are established and measured regularly
28*	Institutions responsible for forest research are adequately funded and staffed
31	The process should be inclusive with all interests represented
32	Stakeholders should have detailed and meaningful reciprocal background information necessary to provide quality input into the public participation process
33	Management staff and stakeholders should recognize and respect the interests and rights of each other
35	Forest managers co-operate with public health authorities regarding illnesses related to forest management and potable water related concerns
37	Extent to which forest planning and management processes consider and meet legal obligations with respect to duly established aboriginal and treaty rights
39	Area of forest land available for subsistence purposes
40	Special places for aesthetics and solitude
41*	Forest provides a place for gathering
48	Wages and other benefits conform to national and/or international standards
57	Production of marketed good and services
63	Extent of places for solitude and recreation
66	Rights of local communities to access the forest are respected

*Note: Indicators on grey did not change importance*

*\* Significantly different*

Indicators associated with water quality continued to be very important for forest owners. Indicators 22 and 24 increased in importance because the plan for tourism requires the identification of areas for timber harvesting, as well as a continuous inventories.



22. *Distribution of and changes in the land-base available for timber production are identified*

24. *Continuous forest inventories are established and measured regularly*

In relation to economic indicators, only two indicators were ranked higher; during the deliberation meeting the participants discussed their lack of knowledge about national and regional regulations to maintain a forest for tourism, thus they agreed to meet national standards for wages (indicator 48). They also acknowledged their desire to apply for a government incentive named ‘payment for environmental services’ because they have preserved the forest for more than 4 decades. In this sense, participants understood that there are other forest services from which they can obtain some extra income (indicators 57, *production of marketed good and services*).

As for the social indicators, ten were ranked higher and most of them are related to community participation. After deliberation, indicators 40 and 41 became important again (*special places for aesthetics and solitude and Forest provides a place for gathering*). This indicates that the decision to pursue a plan for tourism allows them to obtain personal benefits such as places for solitude and places for family gatherings. Indicator 39, *area of forest land available for subsistence purposes* kept gaining importance; the plan for tourism opens the door to explore different uses of the forest.

Table 31 shows indicators that decreased in importance after deliberation. The economic indicators severely decreased in rankings. As mentioned before, the fact that the management of the forest is now to enhance the health and aesthetics of the forest for tourism, forest owners do not expect high revenues for timber sells. Forest owners of La Preciosita expects revenues for non-consumptive uses of the forest such as fees for

tourism and positive externalities associated to. Timber harvesting is not seen as a business, it is a means to establish another profitable business, tourism.

Research activities in the forest was an issue discussed during the deliberation meeting. Forest's owners are reluctant to admit researchers (to establish sample plots) because of the negative experience on the past. Researchers did not pay fees for using the forest or provided information of the benefits of their research. Additionally, forest's owners discussed the lack of support from the government agencies during the past decades. Therefore, they do not want to work in cooperation with government (indicator 26, *effective instruments for inter-institutional co-ordination on land use and forest management exist*). It is important to clarify that for local communities in Mexico, institutions means government agencies.

Although some of the indicators decreased in ranking; this not necessarily means that they are not important. Rankings moved from 5 to 3 the most. Significantly changes were shown on Table 29.

**Table 31: Indicators that Decrease in Ranking after Deliberation**

<b>Number</b>	<b>Indicators</b>
1*	Protection of ecologically sensitive areas, especially buffer zones along water courses
3	Extent and severity of insect attacks and disease infestations
9	Pollutant levels in the ecosystem
12	Use of scientifically-based seed transfer rules and seed orchard zones in planting native species
13	Percentage of harvested area having greater than 25% of the area with degraded soil quality, including soil compaction, displacement, erosion, puddling, and loss of organic matter
15	Policy and planning are based on recent and accurate information
16	Objectives are clearly stated in terms of the major functional areas of the forest with respect to their spatial distribution
17	Silvicultural systems are prescribed are appropriate to forest type, production of desired products and condition, and assure forest establishment, composition, and growth
18	Productive capacity is protected
23	An effective monitoring and control system audits management's conformity with planning

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25	Documentation and records of all forest management activities are kept in a form that makes monitoring possible
26*	Effective instruments for inter-institutional co-ordination on land use and forest management exist
27	There is sustained and adequate funding and staff for the management of forest
29*	Contribution of local and traditional and ecological knowledge
30	Access to forest resources is perceived to be fair and secure
34	The decision making processes must be transparent such that participants are confident that their opinions and values will be considered during the process and be reflected in the final product
36	Forest management contributes to educational research
38	Extent to which forest management planning takes into account the protection of unique or significant indigenous (local) social, cultural or spiritual sites
42	Places for education and research
43	Respect for Customs and culture
44	Community resilience
45*	Institutional adequacy
46	Government to government relationship (ejido-government)
47	Existence of mechanisms for sharing the economics benefits derived from forest management
49	Employment of local population in forest management
50	Strictly comply to international and national Law related to the minimum age to work
51	Individuals under 18 years old should no do hard work
52	Number of population with a significant forestry component in the economic base
53*	Availability and use of recreational opportunities are maintained
54*	Total expenditures by individuals on activities related to non-timber use
55	Existence of economic rents: Total harvesting revenues exceed harvesting costs
56	Built infrastructure, recreational facilities
58	Workforce diversity
59	Fair income distribution from the products extracted from the forest
60	Secure and stable income
61*	Salaries should not be less than the minimum wage. Salary for managers, and independent contractors should be consistent with similar employments in the region
62	Local population who depend on the forest should have the same opportunity of getting a jobs and training
64*	Cultural and traditional values are respected
65	Access to traditional practices for subsistence are guaranteed

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\* *Significantly different*

Tables 32 and 33 show p-values for both the principles and the pillar of sustainability. The hypotheses to be tested are

$$H_0: P1D = P1A;$$

$$H_0: P2D = P2A;$$

$H_0: P3D = P3A;$

Where

P1, P2 and P3 = Principles

A = Analysis Survey

D = Deliberation

**Table 32: P-values for Principles**

	<b>P1</b>	<b>P2</b>	<b>P3</b>
Z	-0.549 <sup>b</sup>	-1.967 <sup>a</sup>	-1.252 <sup>b</sup>
P-value. Sig. (2-tailed)	0.583	0.049	0.211

*a= based on negative signs*

*b = based on positive signs*

*Principle 1: Ecological integrity is maintained*

*Principle 2: Yield and quality of forest goods and services are sustainable*

*Principle 3: Society accepts responsibility for sustainability*

**Table 33: P-values for Three Pillars of Sustainability**

	<b>Ecological</b>	<b>Economic</b>	<b>Social</b>
Z	-0.638 <sup>b</sup>	-1.488 <sup>b</sup>	-1.972 <sup>a</sup>
P-value. Sig. (2-tailed)	0.524	0.137	0.048

*a= based on negative signs*

*b= based on positive signs*

Tables 32 and 33 show that both *Principle 2* and the social indicators significantly changed after deliberation, tending toward being ranked lower. After the deliberation meeting there was more interest in the ecological indicators because people related their personal health to the health of the forest, and because the future of their tourism plan would not be successful if the forest was depleted.

## **CHAPTER VI**

### **DISCUSSION**

This chapter presents the discussion of findings; it is divided in four sections. The first section provides a discussion of how findings from the analysis of Q-methodology; were integrated into management plans. Viewpoints which were systematically organized into factors helped to develop a strategy for management that included values. The second section discusses findings from the indicators' survey; at this point the role of analysis and deliberation in changes in preferences toward indicators of SFM is analyzed. The third section provides a compilation of findings from both the analysis of Q-methodology and the analysis of the survey of indicators and their implications for SFM. The last section presents a non-statistical assessment of participants satisfaction with the plan for tourism.

#### **6.1 Consensus Strategy for Sustainable Forest Management**

Recalling Q-factors, people who defined factors A and B (Conservationist and Community Development respectively) agreed on their desire for a non-consumptive use of the forest, and disagree in the issue of who was responsible for management. Factors C (Family Recreation) showed that people who defined this factor see the forest as more than an economic asset; therefore, any kind of management given to the forest needs to assure the permanence of forest cover and they feel commitment to cooperate in this

endeavor. People who defined Factor D (Sustenance) desire professional help to manage the forest because the forest provides many benefits.

The analysis of the Q-factors indicates that a Sustainable Forest Management Plan should attempt to preserve the forest' ecological conditions and restrict its use only for non-consumptive purposes. Timber harvesting will be allowed only to encourage biodiversity and to improve the health of the forest ecosystem. Forest owners will control forest access and participate in forest maintenance. The use of non-timber products is restricted to small businesses, and professional help will seek to provide a timber-harvesting license and identify trees to be cut. If those requirements are met, the probability of the Plan being implemented will be high, since it would embody forest owners' desires and viewpoints.

For this group of forest owners a plan for tourism was the most appropriate, they want to manage their forest for non-consumptive use, they also do not desire to implement grazing or harvesting non-timber products. The plan for tourism considers non-intensive timber harvesting to enhance the structure and composition of the forest and also to reduce risk of fire hazard and insect infestations. At the same time timber can be used as an economic asset. Additionally, the plan can be implemented by forest owners; although, this will require professional help. In this sense, the plan fits the expectations of people who defined each factor.

Q-methodology assists the understanding of local perspectives in forest management. Factors are expressions of peoples' viewpoints on their relationship to the forest, and identify points of agreement and disagreement. However, an important component of a sustainable forest management plan is the actual implementation of the

plan and the understanding of peoples' preferences associated with the indicators. The analysis and deliberation framework as a means for community participation is another part of this research to assure that the sustainable forest management plan actually includes peoples' viewpoints and preferences, and that its implementation is successful.

In this sense, factors from Q-methodology were a key component in the development of alternatives for forest management that were presented in the analysis meeting part of this project. Factors helped the researcher to understand areas of conflict and agreement and allowed the researcher to prepare alternatives for forest management that respond to these issues.

Q-methodology also provided information that was used in deliberation. The interviews from the Q-methodology were used to select and modify indicators for sustainable forest management that had meaning for forest owners.

The next section is devoted to explaining the findings obtained from the survey of indicators, which was applied during the analysis and deliberation process.

## **6.2 The Role of Analysis and Deliberation**

This section is devoted to a discussion of the findings from the survey to document people's preferences for indicators of sustainable forest management. Analysis and deliberation provide a framework to explore indicators of sustainable forest management and to relate them to the forest owners' needs, values, and management objectives. At this point findings from the Q-methodology analysis are recalled to obtain a more holistic understanding of people's viewpoints and their relation to preferences for indicators.

Before any discussion, the alternatives of forest management indicators were valued as very important or important, except for indicators 39 and 65 that were ranked non-important

*39. Area of forest land available for subsistence purposes,*

*65. Access to traditional practices for subsistence are guaranteed*

In Chapter 4, it was explained that those indicators are in essence the same and their meaning is associated with the establishment of crops or cattle into the reserve. The fact that people did not value those indicators as important is consistent with people who defined Factors A (*Forest Conservation*) and C (*Family Recreation*) on the Q-methodology analysis; who were also opposed to grazing into the reserve.

A comparison of the baseline indicator ratings and Q-factors shows that viewpoints are consistent with baseline preferences. Q-factor interpretations disclosed the concern for better administration of the reserve; therefore, indicators related to administration were ranked highly. Family recreation and spiritual values were also concerns on the list of the most important indicators, as well as employment and income from the forest. High rankings on ecological indicators suggest that forest condition occupies an important place in the forest owner's preferences. This finding is consistent with all the factors extracted from Q; forest owners related their health to the health of the forest. Indicators associated with water quality and community participation were important before the analysis and deliberation process.

There is a controversy because CIFOR-NA and LUCID indicators were developed on a 'top-down' approach (Sherry et al., 2005), the analysis of the baseline survey shows that before any intervention, the indicators were already important for the



population. Recalling that interviews and Q-sorts helped with the selection of indicators, it is possible to infer that for this particular population there was an intrinsic knowledge of forest sustainability that was expressed through the different viewpoints of forest management. In this respect, this finding is consistent with Adam and Kneeshaw's (2008) argument on the importance of the inclusion of forest values in criteria and indicators frameworks because aboriginal communities do not disassociate forest values from forest conditions. In this regard, the key point is to understand peoples' values in the context of forest management goals and translate them into indicators.

After the analysis survey only four indicators were significantly different from baseline.

2. *Extent and severity of area burned (+)*
39. *Area of forest land available for subsistence purposes (+)*
40. *Special places for aesthetics and solitude (-)*
65. *Access to traditional practices for subsistence are guaranteed (+)*

Concerns for fire hazard increased, according to Q-analysis people were more concerned to plant more trees; however, after education of silvicultural methods and explanation of the high density of the forest and its implication for forest fire their preferences changed significantly; indicator 2 tended to be ranked higher. During the same meeting forest owners learned basic concepts of agro-forestry and its contribution to sustainability, this is why ranking on indicators 39 and 65 (which it was paraphrased from 39) were significantly different after the analysis survey. Explanation of why indicator 40 significantly changed can not be draw from the analysis meeting.

The analysis of frequencies indicates that peoples' preferences drastically changed; 37 indicators increased their importance, with eight ecological, nine economic, and 20 social. The analysis meeting was important for understanding the complex technical concepts of forest management, such as silvicultural systems, genetic diversity, forest fires, vegetation types, and forest inventories (indicators 2, 8, 10, 17, and 24).

2. *Extent and severity of area burned*
8. *Percentage and extent, in area, of vegetation types and structural classes relative to the historical condition and total forest area*
10. *Population sizes and reproductive success are adequate to maintain levels of genetic diversity*
17. *Silvicultural systems prescribed are appropriate to forest type, production of desired products, and condition, and assure forest establishment, composition, and growth*
24. *Continuous forest inventories are established and measured regularly*

These indicators were relevant before the analysis meeting, but because of the lack of understanding about the concepts, they were not ranked high on the baseline. Additionally, the act of presenting a structured plan unveiled the relevance of including science in managing the forest. During the analysis meeting, forest owners also realized the importance of having accurate information for planning (indicator 15). Indicator 16 is good evidence that the alternatives of management were clearly understood (*Objectives are clearly stated in terms of the major functional areas of the forest with respect to their spatial distribution*). As seen in Appendix 4, the forest was divided into compartments for management, and the selection of compartments was divided by forest age, development stage, and type. This helped participants to understand that the forest can be spatially organized to achieve management goals. At first glance, indicators 16, 17, 20,

23, and 24 have a strong technical connotation, which would imply the need of a professional forester for their implementation. This finding is consistent with the desire of some forest owners to obtain professional help to manage the reserve as expressed in factors B, D, and B'+ from the Q-methodology analysis.

- 16. Objectives are clearly stated in terms of the major functional areas of the forest with respect to their spatial distribution*
- 17. Silvicultural systems prescribed are appropriate to forest type, production of desired products, and condition, and assure forest establishment, composition, and growth*
- 20. Harvesting systems and equipment are prescribed to match forest conditions in order to reduce impact on wildlife, soil productivity, residual stand conditions, and water quality and quantity*
- 23. An effective monitoring and control system audits management's conformity with planning*
- 24. Continuous forest inventories are established and measured regularly*

Indicators 39 and 65 have the same connotation; indicator 65 was rephrased to test for internal consistency.

- 39. area of forest land available for subsistence purposes,*
- 65. Access to traditional practices for subsistence are guaranteed*

In the analysis survey, both indicators were ranked high at the same time providing more evidence of forest owners concerns for allowing grazing and agricultural practices on the reserve. The indicators increased in importance because, while discussing forest management alternatives, forest owners understood that besides timber harvesting the forest can provide some other products that can be consumed domestically such grass for cattle, mushrooms, medicinal plants, and a home for some wild animals.

Table (23), illustrates the consistency of the indicators in the pursuing of an objective based on planning, best silvicultural practices, good administration, and collaboration from other institutions, public participation, economic benefit, and respect for culture. This indicates that analysis framed peoples' values (as reflected in the plan for tourism) in a more systematic way (indicators) to achieve sustainable forest management. In this sense, analysis was based on facts and values; the latter were expressed in the form of indicators. In this regard, the concern for analysis being only about facts (Webler, 1998) can be lessened because the forest management plans presented in the analysis meeting included peoples view points and values (Q-Plan). Q-methodology played an important role in analysis phase; it helped identify people's perspectives toward forest management that were later used to educate people on the meaning of forest sustainability. Before analysis meeting, people had a holistic view of the forest; therefore, indicators were randomly ranked very important or important. However, after analysis survey, the holistic view of the forest persists because the values are still constant, but the systematic approach to management is exposed.

Eleven of the indicators were significantly different after deliberation;

1. *Protection of ecologically sensitive areas, especially buffer zones along water courses (-)*
6. *Protected areas are maintained to protect rare, unique, and representative species and features (+)*
26. *Effective instruments for inter-institutional co-ordination on land use and forest management exist (-)*
28. *Institutions responsible for forest research are adequately funded and staffed (+)*
29. *Contribution of local and traditional ecological knowledge (-)*
41. *Forest provides a place for gathering (+)*

45. *Institutional adequacy (-)*
53. *Availability and use of recreational opportunities are maintained (-)*
54. *Total expenditures by individuals on activities related to nontimber use (-)*
61. *Salaries should not be less than the minimum wage. Salary for managers and independent contractors should be consistent with similar employments in the region (-)*
64. *Cultural and traditional values are respected (-)*

Three indicators were significantly ranked higher, those are indicators associated with the protection of rare species, funding of the institution responsible for forest management, and forest as a place for gathering. After deliberation the need for funding to implement the plan for tourism was exposed. Although there is a concern for institutional funding, the indicators 26 and 45 were ranked lower

Indicator 53, decreased significantly in ranking; forest owners place more emphasis in forest for recreation for tourism not for their own enjoyment. Revenue for non-timber products also decreased because during the deliberation meeting, forest owners agreed to use non-timber products only for domestic consumption. Salaries also decreased because the plan for tourism in the short term supposes investment not revenue.

The analysis of the frequencies shows that indicators ranked higher after deliberations were consistent with the alternative selected during the deliberation meeting. Twelve ecological indicators, 10 social, and 2 economic increased in importance. Higher rankings for indicators 5, 21, and 22 revealed the commitment to implement the plan for tourism.

##### *5. Road network density, type, use, and location*

*21. Annual and periodic removals calculated by area and/or volume prescribed*

*22. Distribution of and changes in the land-base available for timber production are identified*

As explained before, the plan for tourism requires some timber harvesting and road maintenance. Furthermore, looking at ecological indicators, there is a preference for those indicators related to the condition of the forest after harvesting such as protection of species, gene diversity and frequency, definition of areas for timber production, removals, and harvesting systems.

Social indicators that were ranked higher are those associated with administration and stakeholders' participation. Indicator 28 along with ecological indicator 20, showed the interest in applying professional silvicultural practices. Indicators related to personal enjoyment were also ranked higher.

*28. Institutions responsible for forest research are adequately funded and staffed*

*20. Harvesting systems and equipment are prescribed to match forest conditions in order to reduce impact on wildlife, soil productivity, residual stand conditions, and water quality and quantity*

*40. Special places for aesthetics and solitude*

*41. Forest provides a place for gathering*

*63. Extent of places for solitude and recreation*

Only two economic indicators were ranked higher – those related to marketing forest products and wages. These findings are consistent with the Q-factors, particularly consensus factor A' which indicated that there is agreement that the forest can produce benefits but management should not deplete it. Indicators ranked higher after

deliberation showed the ease with which forest owners agreed to timber removals if professional management could guarantee the protection of the ecosystem; this finding is very consistent with factors A, B, and A+ from the analysis of Q-methodology. This implies that the condition of the forest is relevant as expressed on the analysis survey.

The deliberation process unveiled the importance of forest administration and the need for professional help. The fact that economic indicators were ranked lower after deliberation indicates that the major concern relies on administration, forest management, and stakeholders' participation, which in turn will lead to obtaining better economic benefits and jobs.

Table 34 shows indicators that were ranked very important (5) for more than 60% of the population along the three times (baseline, analysis, and deliberation). Clearly, there is a need for more participatory approaches in which values and opinions are considered (indicators 31 and 34).

*31. The process should be inclusive with all interests represented*

*34 The decision making processes must be transparent such that participants are confident that their opinions and values will be considered during the process and be reflected in the final product*

Indicator 35 is very consistent with factor A (Forest Conservation) from Q.

*35. Forest managers co-operate with public health authorities regarding illnesses related to forest management and potable water related concerns*

The health of the forest is highly ranked because it is associated with personal health. This is evident through the strong preference for ecological indicators related to water availability and its quality. Indicators linked to community participation,

information, and transparency in decision-making are also strongly preferred. Employment and income distribution from forest management are highly important for the forest owners of La Preciosita; these indicators are consistent with Q-factors A (Forest Conservation), B (Community Development), and D (Sustenance) in which people who defined those factors expressed their desire to create jobs from forest management, as well as to obtain more economic benefits from the reserve.

The indicator community resilience (44) is understood as the ability to cope with previous problems among forest owners generated from forest mismanagement. The indicator was ranked as very important, which reveals the strong desire to pursue forest management as a community responsibility as it was also expressed in factors A (Forest Conservation) and C (Family Recreation). Indicator 25, related to forest administration, is also consistent with findings from the Q-methodology. All Q-factors revealed that the community agreed on the lack of management.

*25. Documentation and records of all forest management activities are kept in a form that makes monitoring possible*

Indicator 19 was ranked very important for 90% of the participants after deliberation. Indicators 19, 31, 34 and 35 were ranked very important for 70% of the participants in the three surveys.



**Table 34: Indicators Ranked Very Important (5) for More than 60% of the Population in Each of the Surveys**

<b>Number</b>	<b>Indicators</b>
19	Air, soil, and water quality are protected
31	The process should be inclusive with all interests represented
34	The decision making processes must be transparent such that participants are confident that their opinions and values will be considered during the process and be reflected in the final product
35	Forest managers co-operate with public health authorities regarding illnesses related to forest management and potable water related concerns
1	Protection of ecologically sensitive areas, especially buffer zones along water courses
4	Protection of hydrological functions
25	Documentation and records of all forest management activities are kept in a form that makes monitoring possible
32	Stakeholders should have detailed and meaningful reciprocal background information necessary to provide quality input into the public participation process
33	Management staff and stakeholders should recognize and respect the interests and rights of each other
44	Community resilience
49	Employment of local population in forest management
59	Fair income distribution from the products extracted from the forest
62	Local population who depend on the forest should have the same opportunity of getting jobs and training
66	Rights of local communities to access the forest are respected

Analysis and deliberation is an important mechanism not only in decision-making, but also in examining how people framed the indicators of sustainable forest management according to their preferences and a common management objective. People's preferences changed as they were exposed to knowledge and deliberation because of the desire to implement a management plan that meets their social needs. However, fundamental values did not change. Indicators were always ranked as very important and important. Social indicators tended to be ranked differently after analysis and after deliberation as a response to the commitment to pursue a plan that would benefit the community without jeopardizing their values.

Table (35) shows indicators that gained importance both after analysis and after deliberation. Forest owners ranked the indicators higher each time because of the importance of the indicators for the future of their forest and the development of the community. The table shows that indicators associated with the future condition of the forest after harvesting gained importance during the process. There is also evidence that this particular group considers sustainable forest management as an opportunity to operate globally (indicator 48).

**Table 35: Indicators that Increased Importance after both Analysis Survey and Deliberation**

<b>Number</b>	<b>Indicators</b>
2	Extent and severity of area burned
4	Protection of hydrological functions
10	Population sizes and reproductive success are adequate to maintain levels of genetic diversity
20	Harvesting systems and equipment are prescribed to match forest conditions in order to reduce impact on wildlife, soil productivity, residual stand conditions and water quality and quantity
37	Extent to which forest planning and management processes consider and meet legal obligations with respect to duly established aboriginal and treaty rights
48	Wages and other benefits conform to national and/or international standards

### **6.3 Findings and Implications**

The need for community participation to identify and implement local indicators of sustainable forest management has been widely discussed (Guillermo A. Mendoza & Prabhu, 2000; Mrosek et al., 2006; Sherry et al., 2005; Wright et al., 2002). Participation provides a forum in which forest owners and interested parties deliberate on forest management; however, it is not the only condition to achieve sustainable management (Stoll-Kleemann & O'Riordan, 2002). A procedure that provides reliable information on forest management will strengthen deliberation and consequently its outcome. The analysis and deliberation (A&D) framework considers participation and information as

two interdependent components for good policy making (Stern & Fineberg, 1996). For this study, A&D served to understand preferences concerning indicators of SFM and also became a good mechanism for responsiveness and legitimacy about forest management alternatives.

Community based forest management (CBFM) is a concept in which analysis and deliberation can be exercised at the local level. It effectively contributes to the understanding of people's and forestry practices. It also facilitates communication among different stakeholders, thus ensuring legitimacy and easing agreement on actions for forest management (Menziés, 2007).

This project unveiled the importance of analysis and deliberation to develop and implement sustainable forest management plans that satisfied people's values and preferences, while incorporating ecological indicators.

There is no common concept on how to incorporate people's values during the analysis phase. This research presents a systematic procedure to involve both the people's values and forestry planning in analysis using Q-methodology. Q-methodology helped to identify viewpoints toward the forest that then were used to design a forest management plan to be discussed in the analysis meeting.

Previous studies have used Q-methodology to identify current conflicts among stakeholders in forest management (P. Dasgupta & Vira, 2005; Steelman & Maguire, 1999; Swedeen, 2006); this research aimed to understand areas of agreement and disagreement before planning and policy-making to avoid future conflict. Thus, Q-methodology is a potential instrument for successful forestry planning. It helps to reveal

participants preferred management direction (Steelman & Maguire, 1999) that assures the sustainability of the forest.

There is a demand to develop indicators for sustainable forest management at the local level (Cheng & Durst, 2000; Lawes & Everard, 1999; Guillermo A. Mendoza & Prabhu, 2000; Montreal Process, 2001; Mrosek et al., 2006; Sherry et al., 2005; Woodley et al., 1999; Wright et al., 2002). Studies emphasize the need to develop these indicators under a participatory process in which local and traditional values are considered. Findings in this research expose the importance of delivering clear and complete information on forest management practices as well as the relevance of a good participatory method for decision-making. Its contribution rests on the inclusion of people values in forest management strategies and their translation into indicators for sustainable forest management. In their publication, Adam and Kneeshaw (2008) expressed that the C&I frameworks offer a good platform to include aboriginal values and needs; however, there was a concern over how to translate values into effective management strategies. This research provides an answer for Adam and Kneeshaw. Q-methodology can be used to understand people's values so that the values can be included in management strategies. Q-methodology also helps to identify "unanticipated or underlying social discourse" (P. Dasgupta & Vira, 2005, p. 3) in which values are shared; thus a participatory forum such as analysis and deliberation can serve as a mechanism to explain, communicate, and implement forestry science, and people's preferences associated with SFM. A&D increases legitimacy and trustworthiness.

This research demonstrates that ecological, economic, and social indicators of SFM at the local level are important because forest owners have a holistic view of the

forest, which in turn is associated with the condition of the forest and cultural, spiritual, and traditional values. However, how indicators are perceived and implemented rest on the understanding of the goals of management and the benefits obtained from the forest. If the goals of management meet people's values and needs, SFM goals are more likely to be pursued.

Although, it is true that indicators of SFM provide information on its progress, this research demonstrates that forest management goals need to be established and clearly understood before indicators are developed. More effort should be devoted to the development of forest management plans that include people's values and needs. The role of forest managers is not to develop long lists of indicators; their role is to understand how to incorporate people's values into management plan. Thus indicators will provide better information on progress toward SFM.

This research clearly shows that social and ecological indicators are more relevant than economic indicators to the population under study; there is a need to protect the forest because of the large benefit it provides to society. In this particular research site, forest owners understand that the forest provides economic benefits, but there is an urgency to first solve social problems so that people can enjoy the economic benefits. The attachment of the forest owners to the forest has more than social and ecological components; the health of the forest is highly respected because the forest represents community pride, spiritual enjoyment, personal health, family cohesion, and it is a very important reservoir of water. The economic benefit of the forest is of course important, but forest practices that jeopardize the health of the forest will not be pursued.

Berninger et al., (2009) concluded that the dichotomy of economic vs. nature worked in regions in which forestry is economically significant; however, in regions where the economic role of forestry activities is marginal the social dimensions of sustainability are more important. This study is consistent with Berninger et al. findings; social and ecological indicators were ranked more important than economic. In addition, this research shows that social indicators are more sensitive to changes, this is in part because the nature of the population under study, which is characterized for having serious internal social problems that have constrained the use of the resource.

This research (and the research site) is a clear example of how the three pillars of sustainable forest management are interrelated and expressed as part of people's values and preferences. There is no doubt that SFM is understood at the local level. Community based-forest management has proven to be effective in this regard. Local communities have different values and expectations; a policy process, in which those differences are recognized, such as analysis and deliberation, represents an enormous contribution to achieve SFM. The analysis and deliberation process not only empowers people to decide the future of their forest, it also provides good science and accounts for both the forest's and peoples' values.

#### **6.4 Postscript on the Acceptance of Forest Management Plan for Tourism**

As mentioned in previous chapters, the forest management plan chosen by consensus was the Plan for Tourism, which accounts for people's values and also includes indicator of SFM. The plan was prepared by the researcher and presented at a community meeting on February 07, 2009. The meeting was attended by the authorities

of the reserve and the ejido (22 forest owners and related families), the General Secretary of SEMANART Puebla, the Vice-president for Outreach of UPAEP, Director of Rural Communities Program UPAEP, four OSU delegates, and a group of visitors among students and representatives of private companies. After the presentation of the New Plan, an Agreement of Cooperation was signed between the Forest owners of La Preciosita and UPAEP. The agreement expressed the commitment of UPAEP to support the implementation of the forest management plan as part of the community development project around the forest reserve. The commitment of forest owners is to elaborate a document with all the rules and regulations for forest owners. This document is of high importance to implement projects in the reserve because it will help to avoid future social problems. It will also facilitate the process of implementing a Tourism Development Project for the Community of La Preciosita and it will ease the process to apply for rural economic incentives conceded by the government of Mexico.

Additionally, the researcher distributed a 5 questions survey (see Annex 6) to capture satisfaction with the plan. Questions also intended to value Q-factors; due to the small number of responses (10), the questionnaire is only used to obtain general information of satisfaction and it does not pretend to statistically prove satisfaction. However, it is important to consider that only the authorities of the reserve attended the meeting because the other forest's owners elected for them for this purpose. This non-statistical analysis only considers 11 of the respondents that did not participate in the deliberation meeting, to show how people different for participants agree to the new plan. All of the respondents answered yes to the question "*Do you like the new plan?*" The reasons were:

- Ecological (5 respondents)
  - *Because it improves the health of the forest,*
  - *it was elaborated with solid bases and knowledge;*
- Socio-ecological (5 respondents)
  - *it will bring benefits to the community*
  - *it will bring jobs*
  - *it helps to organize work activities into the forest*
  - *it is a way to decision-making*

To the question “*Do you think that the New Plan satisfies your preferences of forest management?*” All of the respondents answered ‘yes’. The reasons are:

- *We can make the most of the forest (3 respondents)*
- *It will help with the creation of jobs (6 respondents)*
- *The reserve will look beautiful and tourists will come (5 respondents)*
- *It is a systematic (organize) way to use and protect the forest (3 respondents)*

Satisfaction with the Plan was reached because the plan included people’s preferences and values, and the process of analysis and deliberation helped forest owners to understand what a forest management plan actually means. This was the first time that forest owners of La Preciosita have learned in detail the different alternatives of forest management and the importance of reducing forest density to allow healthy natural regeneration and to avoid fire and insect hazards. During the interviews most of the participants expressed an interest for planting more trees; according to them, the reserve needed more trees. However, after the analysis meeting they were able to understand that



more trees does not mean good health per se. They understood the concept of reforestation and its implications. They were able to identify places where reforestation is needed and places in where thinning is needed.

Forest owners also understood and recognized the lack of rules in all the matters of the reserve, especially those associated with the distribution of benefits and responsibilities. This was one of the extra contributions of the research project and the lessons learned from all the participants of the project. Although the major concern for why this research project was conceived was the lack of forest owners' participation in the elaboration of the forest management plan, one of the key weaknesses was the absence of regulations. During the analysis meeting this issue was brought out, then in deliberation participants agreed to start activities to elaborate a document. This decision along with the adoption of a New Plan increased hope, trustworthiness, and legitimacy. The implementation of the Plan promises to be a good start for the socio-economic development of La Preciosita and the preservation of the forest reserve.

## **CHAPTER VII**

### **SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS**

This chapter is divided in three sections first section presents a summary of the research, purpose of the study, research question, methodology, and major findings. The second and third section conclusions and recommendation are based on summarization and interpretation of findings of the research.

#### **7.1 Summary**

The purpose of the study was to examine the impact of analysis and deliberation on changes in preferences associated with indicators of sustainable forest management (SFM). To achieve this goal three research questions were formulated:

1. What are people's viewpoints toward forest use?
2. What are people's preferences in regard to forest?
3. What are the changes in preferences for indicators of sustainable forest management resulting from analysis (knowledge) and deliberation?

Question 1 was addressed using Q-methodology, which in turn required in-depth interviews of 50 forest owners. The interviews served to build the concourse for Q-methodology and to explain findings. Q-methodology was used to understand the context of forest management in the community of La Preciosita and to identify

perspectives about what is important to forest owners in forest management. These perspectives were used to select indicators that were relevant to forest owners, to frame analysis and deliberation, and to develop a forest management strategy that included people's values and that aimed at consensus. Preferences and changes in preferences associated with indicators of SFM (questions 2 and 3) were examined with a 5 Likert-scale longitudinal survey. The survey contained 66 indicators selected from the CIFOR-NA, LUCID, and ILO-GTZ lists of Criteria and Indicators for SFM that were ranked on a 1-5 scale; 1 as "non-important" through 5 as "very important". Surveys were distributed 3 different times to the same 35 participants. The first survey, named *baseline*, was distributed early in the study to capture people's preferences toward SFM indicators before any intervention. The second survey, named *analysis survey*, was distributed after a search meeting in which alternatives for forest management were exposed. The third survey, named *deliberation*, was distributed after a deliberation meeting in which forest owners deliberated about the plan they wanted to pursue and finally selected one; the selected plan was a plan for tourism.

### **7.1.1 Findings**

Findings in this document are explained in two sections; one section is devoted to explain findings from Q-methodology, to explain people's viewpoints of forest use, and the second section is dedicated to describing findings from the survey, to explain preferences before and after informed deliberation.

## **Findings from Q-Methodology**

Interviews with 50 forest owners were used to construct the Q-concourse needed to select statements for the Q-sample. Three hundred and twenty-two statements were extracted from interviews, where 36 of the most representative statements were used in the Q-sample. Then 20 forest owners sorted the statements (Q-sorts) under the instruction of “how do you relate to the forest?” The analysis of the Q-sorts used PQMethod 2.11 software. The software is a statistical program adapted to the requirements of Q-methodology; it computes correlations and factor analyzes them. The analysis of the sort led to 4 factors, two of them A and B were highly correlated; therefore, a second manual rotation was applied to understand how the factors correlated and to explore areas of agreement and disagreement.

### ***Factor A – Forest Conservation:***

This factor explains 33% of the variance. It identifies people who perceive different non-consumptive and consumptive benefits from the forest, such jobs, shade, recreation, spiritual places, clean air, and wildlife watching. Consequently, the people feel a strong commitment to protect the forest; reforestation and guarding are some of the activities they want to engage in to protect the reserve. People in this factor also relate the health of the forest with their own health; they oppose activities that depleted the forest such as grazing and timber harvesting. Conservationists also believe that the reserve needs better management and they want to manage it on their own.

### ***Factor B – Community Development:***

This factor explains 18% of the variance; people who define this factor have a strong sense of ownership of the reserve. They see the reserve as an economic asset that

needs to be better managed to maximize the potential economic benefits. They want the reserve to be used as a tourist attraction to create jobs for young people. They partially agree with timber harvesting as a source of income. They want to obtain professional help to manage the reserve and they also want to cooperate with activities associated with management (co-management).

***Factor C – Family Recreation:***

This factor explains 10% of the variance. People in this factor see the reserve as a place of family enjoyment. Although they acknowledge the economic benefit, they believe that it can be obtained if the reserve is managed in cooperation with outsiders and forest owners. People who defined this factor have a close spiritual relationship with the reserve; consequently, they want to keep the reserve healthy, and reforestation is one of the activities they would pursue.

***Factor D – Sustenance:***

This factor explains 11% of the variance. Loaders in this factor perceive the reserve as a place of family recreation, spiritual fulfillment, and economic asset. They do not feel commitment to manage the reserve, but they would like to have professional help to enhance the state of the reserve. People in this factor also want the reserve to provide jobs for young people and they agree that the reserve can be used as a tourist attraction.

A second manual rotation of factors A and B was helpful to understand areas of agreement and disagreement. From the second rotation, three factors were identified:

***Factor A' – Non-consumptive Use:***

The factor explains 42% of the variance, and shows that between A and B there is an agreement that the reserve provides many benefits to the community. Consequently, it should be protected from deforestation or damage. This group also agrees that the reserve should be better managed to provide jobs for the young population, and a good way to pursue this would be as a tourist attraction.

***Factor B' (+) – Professional Timber Management:***

It is a bipolar positive factor, people in this factor desire professional management to support projects. This group has a strong sense of ownership; therefore, they have a strong commitment to help with management.

***Factor B' (-) – Community Management for Non-Timber Benefits:***

It is a bipolar negative factor, as loaders in this factor oppose timber harvesting, and they want community management. This group believes that the reserve is not only an economic asset but also a place for family recreation and provider of non-timber products for domestic consumption.

In summary, findings from Q-methodology provided the information needed to develop a management strategy. Important considerations in the plan are:

- Non-consumptive use of the reserve as a primary source of income
- Professional and community management (co-management)
- Timber harvesting only to improve the health of the forest and to avoid fire and insect hazard
- The use of non-timber products only for small business

- Reforestation where needed

If those requirements are presented in a single plan, the likelihood that the plan will be accepted is higher because multiple viewpoints will be included, and people will feel the inclusion of their values in the plan.

### **Findings from Survey**

The indicators survey was distributed 3 times during the research project. Thirty-five participants filled out the indicators survey. The survey contained 66 indicators of sustainable forest management that were rewritten in a way to address the question of importance. Participants were able to rank the indicators in a scale 1 to 5, where 1 was "non-important" and 5 was "very important".

For the purpose of this research, the three different points in time were named. *Baseline* was the name selected for the time where the population filled out the survey without any knowledge or previous information on the process. *Analysis survey* was the name for the survey filled out after the population was exposed to knowledge, where three different alternatives of management were exposed. *Deliberation* was the name of the survey filled out after the forest owners deliberated to make choices related to the forest management plan they wanted to pursue.

### ***Baseline assessment***

The analysis of the baseline showed that all the indicators were ranked as “very important” or “important” (5 and 4), except for indicator 39 *areas of forest land available for subsistence purposes* that was ranked 1 (non-important). Out of 20 ecological indicators, 8 were ranked “very important”; those indicators are associated with water quality, soil protection, and quality of seeds to be planted. Eighteen out of 33 social

indicators were also ranked “very important”. Those indicators are associated with cultural values, spiritual places for solitude, rights to access the forest, and community participation. Eight economic indicators were ranked “very important” out of the 13 that comprised the survey. Those indicators were related to employment, salaries, and distribution of income, as well as forest products.

### ***Analysis survey assessment***

Only four indicators were statistically significant different. Three social indicators tended to be ranked higher and were associated with the availability of areas of forestland for grazing and other agricultural activities. One ecological indicator decreased in importance – special places for aesthetics and solitude.

The analysis of frequencies helped to clarify the changes in rankings from *baseline* to *analysis survey*. Thirty-seven indicators increased in ranking, 8 ecological, 9 economic, and 20 social. The social indicators that increased in ranking were related to forest administration and community participation on decision-making. The economic indicators that increased in ranking were associated with employment, marketing of forest products, and distribution of economic benefits. The ecological indicators that were ranked higher were related to forest and water quality. The analysis meeting was important for understanding the complex technical concepts of forest management such silvicultural systems, genetic diversity, forest fires, vegetation types, and forest inventories.

The analysis meeting helped to frame forest planning; indicators that were ranked higher showed consistency with an objective (tourism), which is based on best silvicultural practices, good administration, collaboration among institutions, public



participation for decision-making, respect for cultural values, and economic benefits. The analysis meeting was important because values and facts were shared. The values were systematically expressed when ranking the indicators; questions and concerns also unveiled values.

### ***Deliberation assessment***

The deliberation survey was filled out after forest owners decided to pursue a plan for tourism. Eleven indicators were statistically significantly different after the deliberation meeting: 2 ecological, 7 social, and 2 economic. The ecological indicators were associated with protection of ecologically sensitive areas and rare species. The economic indicators were related to salaries and revenues from non-timber products. Social indicators were associated with institutional coordination, traditional knowledge, and availability of places for family gatherings.

The analysis of frequencies indicated that after deliberation the number of ecological indicators increased in importance. This indicates that ecological indicators changed due to the decision to pursue a forest plan for tourism. Social indicators also changed in preferences. Indicators that were ranked higher were related to community participation for decision-making and administration. Two economic indicators increased in ranking and those were related to wages and production of forest products.

The deliberation process unveiled the importance of forest administration and the need for professional help to pursue a forest management plan. Additionally, deliberation made the process legitimate and transparent.

Analysis and deliberation were important to understand how people framed indicators of sustainable forest management according to their preferences and a common

management objective. Peoples' preferences concerning indicators changed as they were exposed to knowledge and deliberation because of the desire to implement a consistent management plan that met social needs without jeopardizing the ecological sustainability of the forest.

## **7.2 Conclusions**

From the findings of this research, several conclusions have been developed.

- Forest owners of La Preciosita have their own holistic view of sustainable forest management, which includes ecological, social, and economic components.
- People's preference concerning indicators changed according to the goal of management and to the information they were exposed to.
- Social indicators were sensitive to significant changes
- Indicators that significantly changed following both analysis meeting and deliberation indicate that forest owners change preferences and are responsive to new knowledge and also to a commitment with the future of the forest (as reflected in the selection of plan for tourism in deliberation process).
- Economic indicators that were significantly ranked lower after deliberation reflect that forest owners change preferences consistently with how they perceive the plan for tourism which is an investment for their future. This is consistent with the goal set during the acquisition of the

land. The fact that the forest has not been used for intensive harvesting to obtain economic revenue provides evidence of it.

- Sustainable forest management can be accomplished at the local level if people's values are included in forest planning.
- Indicators of sustainable forest management must be translated into local people's language for better understanding and acceptability.
- Conflicts can be avoided if values are included in forest planning.
- A decision-making process that contains knowledge (analysis) and community participation (deliberation) can serve as means to achieve sustainable forest management.
- The process of analysis and deliberation was responsible for to the acceptance of the forest plan for tourism.
- It is important to explain to forest owners what a forest management plan is and allow them to express their concerns.
- A clear goal for forest management helps to refine indicators and thus eases the way to accomplish SFM.
- Forest owners in the community of La Preciosita are willing to make trade offs. La Preciosita is considered the most economically underdeveloped area of the region; however, forest owners put more value on ecological and social indicators. Furthermore, the initial reluctance to harvest trees diminished when technical information on the importance of opening the canopy and reducing forest density to maintain health of the forest was explained. This indicates that maintaining a healthy forest cover is a

priority for this particular population. Forest owners have strong spiritual, personal, and social relations to the forest.

- This research is a solid contribution to the ongoing research aiming to understand best practices to assess SFM at the local level in which community participation plays an important role.

### **7.3 Recommendations and Reflections upon the Process**

The researcher perceived a common community concern for water availability and its relation to forest cover. However, indicators selected failed to capture this issue in a comprehensive manner. Therefore, it is recommended to invest extra effort to develop indicators that address water availability and quality in a way that shows the relationship among forest, water, and society.

It is recommended to forestry professionals and legislators to include people's values in forest planning and forest management plans. Foresters and legislators tend to believe that economic development is important to communities; this is not always a priority. Therefore, understanding local values helps to address the economic problem in an efficient way without jeopardizing social and ecological values.

It is also important to inform forest's owners what a forest management plan means. Taking for granted that forest's owners already have information might hurt process of community participation and, therefore, progress towards SFM.

During this research project, the researcher experienced some challenges. Working on interdisciplinary projects not only requires a good knowledge of the

disciplines but also requires an understanding of how the disciplines differ. At the same time, working with different stakeholders requires understanding and conciliation. It is important to always remember who the final beneficiaries of the project are. In this sense, a good key point is to be able to identify if the parties are affected or interested; this helps to prioritize goals and also to accommodate different stakeholders.

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# APPENDICES

## Appendix 1: IRB

### Oklahoma State University Institutional Review Board

Date: Friday, April 11, 2008  
IRB Application No: GU084  
Proposal Title: The Role of Knowledge and Deliberation on the Development of Local Indicators for Sustainable Forest Management

Reviewed and Processed as: Exempt

**Status Recommended by Reviewer(s): Approved Protocol Expires: 4/10/2009**

Principal Investigator(s):

Sandra Rodriguez	David Lewis
003 LSE	022 Ag Hall
Stillwater, OK 74078	Stillwater, OK 74078

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The IRB application referenced above has been approved. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in section 45 CFR 46.

The final versions of any printed recruitment, consent and assent documents bearing the IRB approval stamp are attached to this letter. These are the versions that must be used during the study.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be submitted with the appropriate signatures for IRB approval.
2. Submit a request for continuation if the study extends beyond the approval period of one calendar year. This continuation must receive IRB review and approval before the research can continue.
3. Report any adverse events to the IRB Chair promptly. Adverse events are those which are unanticipated and impact the subjects during the course of this research; and
4. Notify the IRB office in writing when your research project is complete.

Please note that approved protocols are subject to monitoring by the IRB and that the IRB office has the authority to inspect research records associated with this protocol at any time. If you have questions about the IRB procedures or need any assistance from the Board, please contact Beth McTernan in 219 Cordell North (phone: 405-744-5700, [beth.mcternan@okstate.edu](mailto:beth.mcternan@okstate.edu)).

Sincerely,



Sheila Kennison, Chair  
Institutional Review Board



**Appendix 2: Interview for Q-Methodology English**

Name \_\_\_\_\_ Gender \_\_\_\_\_

Age \_\_\_\_\_

Occupation \_\_\_\_\_

Educational Level \_\_\_\_\_

1. What are the products that you obtain from the forest?

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2. How is your relation to the forest?

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3. Tell me all the benefits that you obtain from the forest

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4. Would you like to inherit the forest to your children? Why?

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### Appendix 3: Interview for Q-Methodology Spanish

Nombre \_\_\_\_\_

Genero \_\_\_\_\_

Edad \_\_\_\_\_

Ocupación \_\_\_\_\_

Nivel de Escolaridad \_\_\_\_\_

1. Cuáles son los productos que usted obtiene del bosque?

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2. Cómo/Cuál es su relación con el bosque?

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3. Cuáles son los beneficios que usted obtiene del bosque?

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Le gustaría heredarle el bosque a sus hijos? Por qué?

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## Appendix 4: Spanish Survey

Nombre

Edad

Nivel de Educación

Por favor marque con una X la importancia que tiene para usted cada uno de los enunciados numerados

Asigne 1 cuando el enunciado no representa ninguna importancia y 5 para los muy importantes

Ex: que tan importante es el proteger las áreas frágiles y zonas de amortiguamiento a lo largo de los cauces de los ríos?

Qué tan importante es?						
		1	2	3	4	5
		Sin importancia	Algo importante	Indiferente	Importante	Muy importante
1	Protección de áreas frágiles y zonas de amortiguamiento a lo largo de los cauces de los ríos					
2	Áreas y severidad de áreas con fuego					
3	Área y severidad de ataque por insectos y enfermedades					
4	Protección de las funciones hidrológicas					
5	Densidad, tipo, uso, uso de las carreteras forestales					
6	Protección de áreas para conservar especies raras, únicas, y representativas					
7	Persistencia de la población de especies nativas					
8	Porcentaje y extensión en área de los tipos de vegetación y las clases estructurales relativas a la condición histórica del bosque					
9	Niveles de contaminación en el ecosistema					
10	El tamaño de la población y la reproducción del bosque son adecuados para mantener niveles de diversidad genética					
11	El manejo forestal no cambia la frecuencia genética					
12	Uso de técnicas científicas para transplantar especies nativas					
13	Porcentaje de áreas cosechadas con mas del 25% de la calidad del suelo degradado, compactado, erosionando o con perdida de materia orgánica					
14	Tendencia y regularidad de los eventos ocurridos en las cursos de agua pertenecientes a la cuenca					
15	Las políticas y la plantación son basadas en información reciente y precisa					

	<b>Indicador</b>	Sin importancia	Algo importante	Indiferente	Importante	Muy importante
16	Los objetivos son claramente expresados en relación con las áreas del bosque mas funcionales y su respectiva distribución espacial.					
17	Los sistemas silviculturales aplicados son apropiados para el tipo de bosque, la producción y condición de productos deseados, y la seguridad en el establecimiento, composición, y crecimiento del bosque.					
18	Seguridad en la capacidad de producción del bosque					
19	Calidad del aire, suelo, y agua					
20	El equipo de extracción es adecuado con las condiciones del bosque con el animo de reducir los impactos en el hábitat silvestre, la productividad del suelo, y las condiciones del bosque en pie, y la calidad y la cantidad del agua					
21	Los aprovechamientos anuales y/o periódicos son calculados por área y/o volumen prescritos en el plan					
22	Identificación de la distribución y cambios en la tierra disponible para bosque de producción					
23	Sistema de control eficiente para auditar el manejo en conformidad con el plan					
24	Inventarios frecuentemente establecidos y revisados					
25	Toda la documentación del manejo forestal es archivada y guardada en una forma en que pueda ser monitoreada					
26	Existencia de instrumentos para la coordinación inter-institucional en relación con el uso de la tierra y el manejo del bosque					
27	Suficiente y adecuado presupuesto y personal para el manejo del bosque					
28	La institución responsable de la investigación forestal posee presupuesto y personal adecuados					
29	Contribución de el conocimiento y tradiciones locales					
30	El acceso al bosque es percibido como seguro y justo					
31	El proceso debe de ser inclusivo con todos los interesados presentes					
32	Los interesados debe tener información detallada y significativa recíprocamente necesaria para proveer la calidad de la contribución en el proceso de participación publica					
33	Los interesados y los administradores deben reconocer y respetar el interés y los derechos de cada uno					
34	El proceso de decisión debe ser tan transparente que los participantes se sientan seguros que sus opiniones y valores sean considerados durante el proceso y las decisiones y el producto final					
35	Los administradores forestales cooperan con las autoridades de salud publica en relación con las enfermedades relacionadas con el manejo del bosque y el agua potable					
36	El manejo del bosque contribuye con la educación y la investigación					
37	Extensión en la que la plantación y el proceso de manejo considera y reúne las obligaciones con respeto para asegurar el establecimiento de los derechos indígenas					

	Indicador	Sin importancia	Algo importante	Indiferente	Importante	Muy importante
38	Extensión en la que el manejo del bosque considera la protección de los lugares espirituales y valores de cultural indígena					
39	Área del bosque disponible para actividades de subsistencia					
40	Lugares especiales para disfrutar de la belleza escénica y la soledad					
41	El bosque provee lugares de reunión					
42	El bosque provee lugares para la educación y la investigación					
43	Respeto por las costumbres y la cultura local					
44	Resiliencia en la comunidad					
45	Adecuada capacidad institucional					
46	Relación gobierno-gobierno					
47	Existencia de mecanismos para repartir los beneficios económicos derivados del manejo del bosque					
48	Los salarios y otros beneficios son acordes con los estándares nacionales e internacionales					
49	Empleo para la población local asociado al manejo del bosque					
50	Cumplimiento estricto con las leyes internacionales y nacionales relacionadas con la edad mínima de los trabajadores					
51	Personas menores de 18 años no pueden hacer trabajos pesados					
52	Numero de personas para las que su economía esta significativamente relacionada con el bosque					
53	Disponibilidad y uso de áreas recreacionales					
54	Gasto total por individuo en actividades relacionadas con el uso de los productos no maderables					
55	Existencia de rentabilidad económica: Total del ingreso del aprovechamiento excede el gasto					
56	Infraestructura para recreación					
57	Producción de bienes y servicios comerciales					
58	Diversidad en la mano de obra					
59	Distribución justa del ingreso obtenido de los productos extraídos del bosque					
60	Ingreso seguro y estable					
61	Los salarios no deben estar por debajo del salario mínima de la región. El salario del administrador y los contratistas independientes debe ser consistente con empleados de la misma categoría en la región.					
62	La población local que depende del bosque debe tener las mismas oportunidades de capacitación y empleo					
63	Extensión de lugares para la recreación y la soledad					
64	Respeto por la cultura, tradición, y valores					
65	El acceso a practicas tradicionales de subsistencia debe ser garantizado					
66	Respeto al derecho de la comunidad local para acceder al bosque.					



## Appendix 5: Alternatives of Management

This appendix briefly presents the advantages and disadvantages of the three alternatives for forest management discussed at the analysis meeting.

1. **Status Quo:** Currently the forest is fenced; nobody is allowed to access the forest unless they are granted an authorization from the administration. The collection of mushrooms, hay, and medicinal plants is permitted only for domestic consumption. Timber harvesting is not allowed. There are some advantages of continuing these activities.

- The forest will keep its natural cycle.
- Population of fauna and flora will increase.

However, there are also some disadvantages:

- Forest density will become a fire hazard.
- The forest will be more susceptible to insect infestation.
- The forest will become a place for vandalism.
- The population of wild dogs also increases because of increases in fauna.
- The community will lose economic benefits.

2. **Approved Plan (Intensive Timber Harvesting):** There is an approved plan for timber harvesting (Programa de Manejo Forestal para el Aprovechamiento de Recursos Forestales en la Sociedad Productora Rural La Preciosita) which was approved by SEMARNAT in October 2006. The plan only considers timber harvesting. It was designed to harvest 230

ha to extract 28,060 m<sup>3</sup> of timber over a period of 6 years. The next possible harvest is in 2050.

Advantages:

- The plan is already approved and it follows technical requirements.
- There is an economic benefit from selling the timber.
- According to market prices of timber in the region, the net benefit could be US\$420,000 dollars for the six years of harvesting (US\$70,000/year).
- The community can access training to become forestry entrepreneurs.
- If the forest is well managed, the government will grant an incentive for SFM.

Disadvantages:

- Cost of labor is high at approximately US\$520,000/year, from which US\$20,000/year goes to the technician.
- After the last harvest, a new inventory and a new plan are needed. However, the possibilities to harvest the same amount of timber again are very low. The forest requires around 50 years to reach a mature, harvestable stage.
- A reforestation is needed right after the forest is harvested each year.
- Reforestation is labor and cost intensive.

- Timber prices fluctuate rapidly, and there is risk associated with the investment.

**3. Plan for Tourism:** Q-methodology indicated that the community desired to preserve the forest and at the same time have economic assets for the near future. The view of the community is to manage the forest to make it attractive to tourists. To this end, guided tours to different areas of the forest can be done; tourist will enjoy of a day of recreation and then will spend time in family houses where they will learn more about traditional cooking, medicinal plants, and will use the Aztec traditional spa (Temaxcal). The community envisions this holistic plan because they want all the members to benefit. Not everyone in the community likes forestry activities; additionally, the community has a large population of women who are more likely to work at home hosting the tourists. In this sense, the community already acknowledges the extrinsic benefits that the forest offers. This is more appealing to them because the forest will be preserved and the community obtains a benefit from it. To achieve community desires, the management plan for tourism proposed in this project addresses forest management from the silvicultural viewpoint; or in other words, how to improve the health of the forest based on the desired future conditions of the forest reserve area.

Advantages:

- There is an inventory that was obtained from the approved plan.

- There is an economic incentive for timber harvesting, if the community organizes the activities.
- Timber harvesting will not be intensive.
- There will be a reduction in fire and insect hazard.
- There will be improvements in the health of the forest.
- Opening the canopy will allow natural regeneration and new species to establish themselves.
- The forest structure will be enhanced.
- There will be an economic return from tourism.
- If the reserve is well managed, the government will pay incentives for environmental services.
- Non-timber products can also be obtained.

Disadvantages:

- Labor intensive.
- Economic benefits from timber are not large.
- The current structure of the forest will change; therefore, aesthetics will change.

**Appendix 6: New Forest Management Plan (Amendment to the “Programa de Manejo Forestal para el Aprovechamiento de Recursos Forestales en la Sociedad Productora Rural La Preciosita”**

During the General Assembly on September 07, 2009, from the three alternatives of forest management, alternative No. 3 “Plan for Tourism” was selected to be implemented. It was agreed to elaborate a management plan for tourism that restricted the use of non-timber products to domestic use. The final plan is an amendment to the already approved plan; the following section provides a summary of the plan.

General Objective: Elaborate an amendment to the current Plan which is entitled “Programa de Manejo Forestal con fines de Turismo para el Bosque de la Sociedad de Producción Rural de la Preciosita Sangre de Cristo, Municipio de Tlahuapan, Estado de Puebla.”

Specific Objectives:

- To inform forest users about the development of the plan.
- To assure that the forest of La Preciosita provides healthy ecological conditions to develop tourism.
- To enhance forest conditions using adequate silvicultural systems to harvest all diameter classes.

Considerations

The management plan seeks for a heterogeneous structure of the forest stand that will allow trees in all the diameter classes. It also asks for adequate spacing between trees to guarantee natural regeneration and to allow activities aimed at tourism.

The forest was divided into 13 compartments (keeping the same division of the approved plan) for management (see attached map). Data for the prescription is taken from the inventory presented in the approved plan; the researcher needed to use a new formula to estimate the number of trees per hectare in order to recommend a prescription for trees within the diameter classes 2-20 centimeter of breast diameter height (dbh). A detailed analysis of the inventory presented in the approved plan suggested implementing a thinning program to promote natural regeneration, to reduce the current over-density of small stems and dominant trees, and to avoid fire and insect hazard.

The silvicultural system and treatment remain the same as recommended in the approved plan, Metodo Mexicano de Ordenación de Bosques Irregulares (MMOBI) and selection, respectively. The rotation period is 50 years and the harvesting cycle is 13 years. The plan focuses on the desired future conditions of the forest. The plan seeks to

- Control forest density
- Preserve the floral and faunal composition of the forest
- Provide an attractive place for tourists

To achieve these goals it is necessary to apply a silvicultural system and a prescription that account for species, number of trees per specie, spatial distribution of the trees, and the mean annual increment.

Due to the lack of guidelines in Mexico for harvesting a forest with tourism purposes, it is recommended to use the concept of spacing to optimize the use of the land and also to assure the ecological sustainability. The plan recommends 6 x 6 meters of space between trees greater than 20 centimeters of dbh, and 3 x 3 meters of space between trees within the diameter classes 2-20 centimeters dbh. The plan also recommends leaving trees of all species distributed in all the diameter classes. The following table shows the prescription of trees larger than 20cm dbh according to the Mexican standards and guidelines.

- No. = number of compartments
- Specie = specie to be harvested
- Net area = Net area for each compartment in hectares
- Real existence = current volume of timber in cubic meters per hectare (up to Feb, 2009)
- TV= Total volume of the compartment in cubic meters
- Intensity = Percentage of timber to be harvested in each compartment
- Extraction = volume of timber to be removed per hectare and per compartment in meters<sup>3</sup>.
- Residual = Total volume left in cubic meters per hectare

No.	Specie	Net area	Real Existences	TV	Intensity	Extraction		Residual
		Hectare	m <sup>3</sup> /ha	m <sup>3</sup>	% (compartment)	m <sup>3</sup> /ha	m <sup>3</sup> /compartment	TV m <sup>3</sup> /ha
2	P. leiophylla	27 (17)	73.7	2063	6.9	8.4	142.8	
	P. montezumae		18.9	529.2	5.8	1.8	30.6	
	Quercus		13.2	369.6	11.5	2.5	42.5	
	<b>Subtotals</b>		<b>105.8</b>	<b>2961.8</b>	<b>24.2</b>	<b>12.7</b>	<b>215.9</b>	
3	P. leiophylla	14	170.3	2384.2	9.7	16.6	232.4	153.7
	P. montenzumae		3	42	0.0	0	0	3
	Quercus		29.8	417.2	23.5	7	98	22.8
	<b>Subtotals</b>		<b>203.1</b>	<b>2843.4</b>	<b>33.2</b>	<b>23.6</b>	<b>330.4</b>	<b>179.5</b>
4	P. leiophylla	11	84.9	933.9	10.8	9.2	101.2	75.7
	P. montezumae		18.6	204.6	5.4	1	11	17.6
	Quercus		5.1	56.1	19.6	1	11	4.1
	<b>Subtotals</b>		<b>108.6</b>	<b>1194.6</b>	<b>35.8</b>	<b>11.2</b>	<b>123.2</b>	<b>97.4</b>
5	P. leiophylla	12	101.9	1222.8	10.8	11	132	90.9
	P. montezumae		12.2	146.4	9.0	1.1	13.2	11.1
	Quercus		12.3	147.6	18.7	2.3	27.6	10
	<b>Subtotals</b>		<b>126.4</b>	<b>1516.8</b>	<b>38.5</b>	<b>14.4</b>	<b>172.8</b>	<b>112</b>
6	P. pseudostrobus	3	34.8	104.4	7.5	2.6	7.8	32.2
	Quercus		66.7	200.1	17.4	11.6	34.8	55.1
	<b>Subtotals</b>		<b>101.5</b>	<b>304.5</b>	<b>24.9</b>	<b>14.2</b>	<b>42.6</b>	<b>87.3</b>
7	P. leiophylla	17	72.2	1227.4	12.0	8.7	147.9	63.5
	Quercus		5.1	86.7	21.6	1.1	18.7	4
	<b>Subtotals</b>		<b>77.3</b>	<b>1314.1</b>	<b>33.6</b>	<b>9.8</b>	<b>166.6</b>	<b>67.5</b>
9	P. leiophylla	8	35.4	283.2	14.7	5.2	41.6	30.2
	P. montezumae		11.6	92.8	7.8	0.9	7.2	10.7
	Quercus		10.6	84.8	23.6	2.5	20	8.1
	<b>Subtotals</b>		<b>57.6</b>	<b>460.8</b>	<b>46.0</b>	<b>8.6</b>	<b>68.8</b>	<b>49</b>
10	P. leiophylla	42	71.6	3007.2	12.2	8.7	365.4	62.9
	P. montezumae		2.8	117.6	0.0	0	0	2.8
	P. pseudostrobus		0.7	29.4	0.0	0	0	0.7
	Quercus		7	294	21.4	1.5	63	5.5
	<b>Subtotals</b>		<b>82.1</b>	<b>3448.2</b>	<b>33.6</b>	<b>10.2</b>	<b>428.4</b>	<b>71.9</b>
11	P. leiophylla	12	17.8	213.6	10.1	1.8	21.6	16
	Quercus		26.2	314.4	19.1	5	60	21.2
	<b>Subtotals</b>		<b>44</b>	<b>528</b>	<b>29.2</b>	<b>6.8</b>	<b>81.6</b>	<b>37.2</b>
12	P. leiophylla	16	111.5	1784	8.2	9.1	145.6	102.4
	Quercus		4.9	78.4	24.5	1.2	19.2	3.7
	<b>Subtotals</b>		<b>116.4</b>	<b>1862.4</b>	<b>32.7</b>	<b>10.3</b>	<b>164.8</b>	<b>106.1</b>
13	P. leiophylla	11	138.4	1522.4	7.5	10.4	114.4	128
	Quercus		7.6	83.6	17.1	1.3	14.3	6.3
	<b>Subtotals</b>		<b>146</b>	<b>1606</b>	<b>24.6</b>	<b>11.7</b>	<b>128.7</b>	<b>134.3</b>

There was a reduction of more than 50% of volume harvesting compared with the approved plan. The plan recommends having a prompt inventory of compartment No. 2; 10 hectares were subject to harvesting in 2007. Although the prescription is estimated to



the 17 hectares that have been left alone, the residual volume could not be estimated because there is not information on the number of trees left after the 2007 harvesting.

For stems smaller than 20 cm, bdh the prescription is provided in number of trees. The following table shows the prescription for compartment No. 4.

CD = diameter class in centimeters

Actual = number of current trees

Desire = number of desired trees

Trees to harvest = Number of trees to be harvested

BA = Basal area

<b>DC (cm)</b>	<b>Actual (BA = 14.2)</b>	<b>Desire (BA = 14.8)</b>	<b>Trees to harvest</b>
2	2682	996	1687
4	1472	669	803
6	808	449	358
8	443	302	141
10	243	203	40
12	133	136	-3
14	73	92	-18
16	40	62	-21
18	22	41	-19
20	12	28	-16

A negative number indicates that there are not enough trees in that diameter class to meet the BA required in the compartment. This is a constant situation in the forest of La Preciosita; it is a forest with a large number of dominant trees and a large number of small stems. Medium size trees are sparse, and their development has been disturbed

because the density of the canopy does not allow enough light through; additionally there is a high competition for space among trees within the small diameter classes and they do not grow tall enough to succeed.

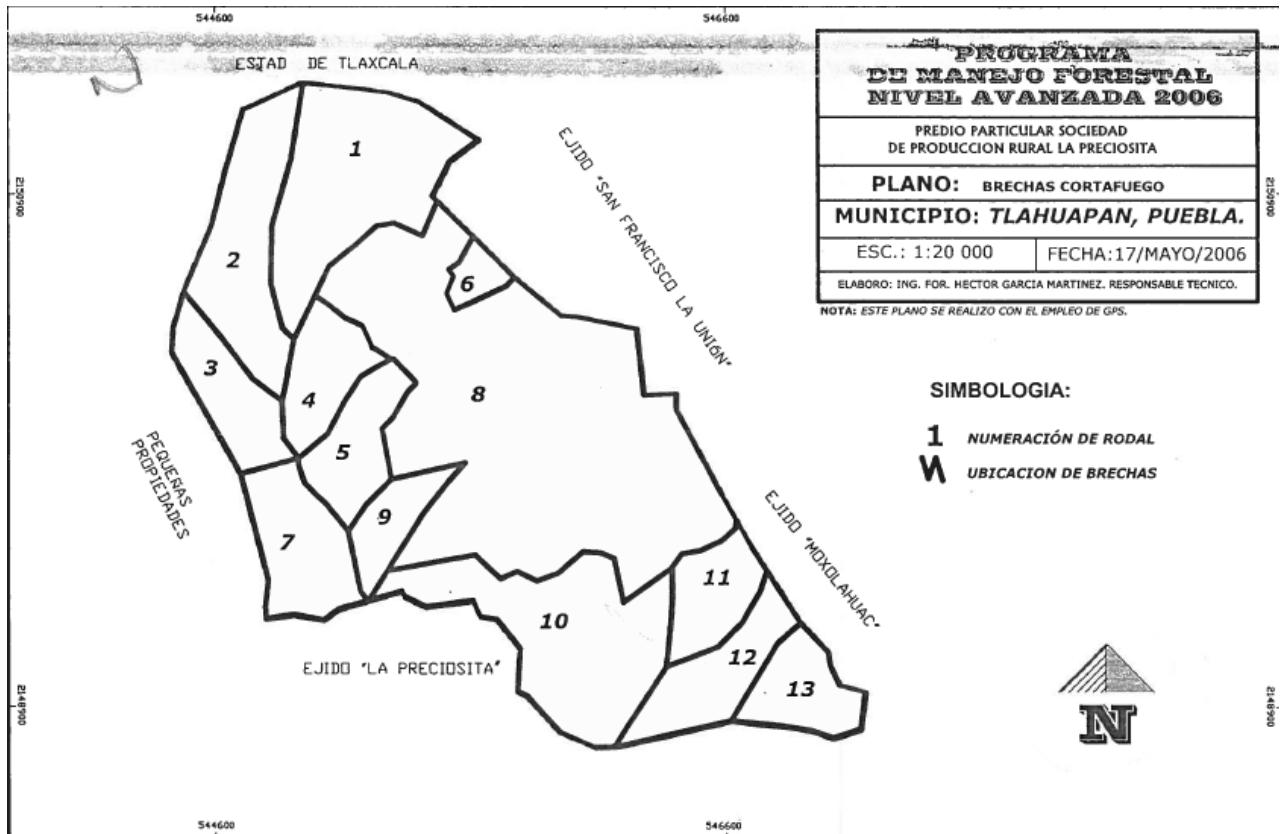
The prescription presented encourages the opening of the canopy to allow more light in and to reduce the competition to allow more space between trees. The next round of trees will have enough space and light to successfully grow. The structure of the forest is enhanced because small trees are going to be able to reach medium sizes and develop better. The prescription also regulates the production function of the forest. Additionally, the forest will have open space to see through; tourist will enjoy watching wild animals and will be able to hike.

#### Recommendations

- It is recommended to make an inventory for compartment 8 in all the diameter classes.
- An inventory for compartments one and three are also recommended. Those compartments were harvested in 2007. It is important to know whether the compartments meet the desired future condition in terms of number of trees and species.
- It is recommended to make an inventory immediately after the harvesting to guarantee that the number of trees and species left meet the specification in the prescription.

- Because of the large number of mother trees, it is recommended to establish a nursery as another source of income for the community.
- Due the high density of the forest, it is important to open fire lines around the compartments to avoid accidents.
- It is important to clarify the legal area of the forestland; the study observed that different institutions register different areas.
- A document with rules and regulations as well as distribution of benefits has to be one of the priorities of forest owners, before they become engaged in any activity. The study also shows that the lack of this document has been the cause of misunderstandings.
- Timber obtaining from extraction can be used domestically.
- Small trees that are going to be extracted can be used as fuel-wood.
- It is highly recommend that forest owners assist in training associated with administration, equipment manipulation, and business.
- Finally, it is recommended to start programs to organize the general plan for tourism; the present forest management plan provides guidance for where to start activities.

The Plan for Tourism used cartography provided from the previous “Programa de Manejo Forestal – 2006). The following map, shows the number and localization of the compartment. It was elaborated for the Forestry Engineer Hector Garcia.



## Appendix 7: Final Interview -English

Name \_\_\_\_\_ Gender \_\_\_\_\_

Age \_\_\_\_\_

Education Level \_\_\_\_\_

4. Do you like this New Plan? Please check the correspondent answer.

Yes \_\_\_\_\_

No \_\_\_\_\_ Why? \_\_\_\_\_

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5. Do you think that the Plan satisfies your preferences in relation to forest management? Please check the answer.

Si \_\_\_\_\_

No \_\_\_\_\_ Why? \_\_\_\_\_

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6. In a scale 1 to 5 please check how do you like these provisions?

- The New Plan allows for the use of non timber products \_\_\_\_\_
- The forest is going to be preserved \_\_\_\_\_

- The New Plan helps with the community's economic development \_\_\_\_\_
- Managing the forest as a tourism place will help to generate jobs \_\_\_\_\_
- We as community can use the forest as a place for recreation \_\_\_\_\_
- We can obtain fuel wood without jeopardizing the wealth of the forest  
\_\_\_\_\_
- The community can actively participate in forest management \_\_\_\_\_

## Appendix 8: Final Interview Spanish

Nombre \_\_\_\_\_

Edad \_\_\_\_\_

Nivel de Escolaridad \_\_\_\_\_

7. Le gusta el Nuevo Plan? Marque la respuesta correspondiente

Si \_\_\_\_\_ No \_\_\_\_\_

Por qué? \_\_\_\_\_

\_\_\_\_\_

8. Considera que el Nuevo Plan satisface sus preferencias en relación con el manejo del bosque? Marque la respuesta correspondiente

Si \_\_\_\_\_ No \_\_\_\_\_

Por qué? \_\_\_\_\_

\_\_\_\_\_

9. En escala de 1 a 5 califique las siguientes actividades

- El Nuevo Plan permite el uso de los productos no maderables \_\_\_\_\_
- El Nuevo Plan ayuda a conservar el bosque \_\_\_\_\_

- El Nuevo Plan ayuda con el desarrollo económico de la comunidad \_\_\_\_\_
- El manejo del bosque para turismo nos ayudará a generar empleos \_\_\_\_\_
- Podemos usar el bosque como lugar de descanso \_\_\_\_\_
- Podemos extraer leña sin deteriorar el bosque \_\_\_\_\_
- La comunidad puede participar activamente en el manejo del bosque \_\_\_\_\_



## Appendix 9: Copy of the Agreement UPAEP – Forest Owners



# CONVENIO DE COLABORACION

UPAEP –RESERVA FORESTAL (UMA) DE LA PRECIOSITA

1.-La UPAEP acepta continuar apoyando en el desarrollo comunitario de la Preciosita en sus diferentes proyectos de vida y en ellos lo que corresponde a su UMA o reserva forestal.

2.-La UPAEP esta dispuesta a dar la asesoría necesaria en organización , capacitación y sobre todo en la formación de las futuras generaciones para que la UMA sea una alternativa sustentable para un desarrollo comunitario de la Preciosita, esto en coordinación con las diferentes instituciones federales y estatales ,fundaciones y organismos civiles que participen.

3.-La UPAEP esta dispuesta a participar activa y permanentemente siempre y cuando los dueños y socios de la UMA tengan un reglamento debidamente elaborado por ellos mismos que norme sus diferentes situaciones que les permita tener la seguridad de que las inversiones en capital humano y forestal que se realicen encuentren una garantía de sostenibilidad organizativa.

La UMA de la preciosita se compromete a partir de la firma de este convenio a empezar las acciones necesarias para tener su reglamento en un plazo no mayor de 4 meses empezando con la formación de un comité nombrado por su asamblea de socios.

Dicho comité elaborara un borrador el cual llevara a su asamblea de socios las veces que sea necesario hasta que dicha asamblea este satisfecha de su contenido para ser aprobado por mayoría.

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El reglamento por ser interno deberá contemplar todas las situaciones propias por las que han pasado sus socios y que conocen perfectamente como son la definición de socio, traslado de derechos, faenas, permisos para uso de la reserva, que instituciones o personas pueden hacer trabajos y otras mas.

Este reglamento puede o no ser diferente al que se les exige oficialmente como UMA dado que esta UMA fue comprada por sus socios en su totalidad o mayoría ejidatarios de el ejido de la Preciosita.

La UPAEP se compromete como fue mencionado en la primera parte del convenio a acompañar a los directivos y socios de la UMA en la organización para la elaboración del reglamento.

4.-La UPAEP estará dispuesta a dar sus apoyos en el presente y futuro siempre y cuando se de una coordinación bien especificada con la UMA y con otras instituciones que deseen participar para bien de la UMA en el desarrollo de la misma

5.-Los firmantes de este convenio UPAEP y UMA de la preciosita se comprometen a cumplir este convenio a partir de su firma y en 4 meses mas en una asamblea de socios rectificarlo o modificarlo para continuar en una alianza para bien de el desarrollo de la comunidad de la Preciosita.

Siendo las 13 horas del día 8 de febrero de 2009 firman en los bosques de la UMA ubicados en el municipio de Santa Rita Tlahuapan en el estado de Puebla, México :

Por la UMA su directiva :

Presidente

Nombre Gilberto Caballero Moga

Firma Gilberto Moga

Secretario

Nombre Margarito Juarez Caballero

Firma \_\_\_\_\_



Tesorero

Nombre Guillermo Guzman Martinez

Firma Guillermo Guzman Martinez

Por la UPAEP

El Vicerector de Vinculación y Desarrollo

Nombre Augusto Ganda Garcia

Firma Augusto Ganda Garcia

Testigos

Nombre y firma

1.- Ing. Carlos Albuquer Carlos Albuquer

2.- Dr David Lewis David Lewis

3.- Sandra Rodriguez Sandra Rodriguez

4.- Ing Abelardo Sanchez Abelardo Sanchez

5.- CBE Pablo Martinez Mendis Pablo Martinez Mendis

6.- Pablo Caballero Martinez Pablo Caballero Martinez

D. Bonita Caballero Martinez Bonita Caballero

Mikel Caballero P. JTB Mikel Caballero

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## VITA

**Title:** The Role of Analysis and Deliberation in Changing Community Preferences for Strategies and Indicators of Sustainable Forest Management

**Major Field:** Environmental Science

**Education:** Graduate from Colegio Cooperativo de Maria Auxiliadora, Bogotá, Colombia in December 1989; received Bachelor degree in Forestry Engineer from Universidad Distrital Francisco Jose de Caldas, Bogotá Colombia in December 1996. Master of Sciences in Forest Management, Oklahoma State University 2004. Completed the requirements for the Doctor of Philosophy in Environmental Science July, 2009.

**Experience:** Undergraduate Teacher Assistant in Road Localization and Soil Conservation 1993 and 1994-1995 respectively. Corporación Autónoma Regional de Cundinamarca CAR, Professional Consulter 1996. Ministerio del Medio Ambiente and International Tropical Timber Organization, Professional Consulter 1996-1999. Graduate Research Assistant, Oklahoma State University 2002 - 2009 to present. Summer Trainee IUFRO 2007.

- **Awards:**

Summer 2009 Dissertation Fellowship. Graduate College, Oklahoma State University  
Outstanding Environmental Science Graduate Student Research 2009.  
Environmental Science Graduate Program, Oklahoma State University  
James R. Esbenshade II Rural Sustainability Research Assistantship 2007. Environmental Science Graduate Program, Oklahoma State University  
Diversity Fellowship, NAAEE (North America Association for Environmental Education), Albuquerque, New Mexico, October 25-29 2005  
Freezailah Fellowship 2001, International Tropical Timber Organization.

**Professional Membership:**

Member of Phi Kappa Phi Honor Society, Initiated in OSU 2008  
Member of the National Scholars Honor Society, Magna Cum Laude 2008  
Member of Xi Sigma Phi since 2003  
Member of the International Society of Tropical Foresters since 2002

Name: Sandra Rodriguez-Piñeros

Date of Degree: July, 2009

Institution: Oklahoma State University

Location: Stillwater, Oklahoma

Title of Study: THE ROLE OF ANALYSIS AND DELIBERATION IN CHANGING  
COMMUNITY PREFERENCES FOR STRATEGIES AND  
INDICATORS OF SUSTAINABLE FOREST MANAGEMENT

Pages in Study: 183

Candidate for the Degree of Ph.D.

Major Field: Environmental Science

Scope and Method of Study:

This research investigates changes in preferences for indicators of sustainable forest management, while a sustainable forest management plan is developed in a participatory process of analysis and deliberation (A&D).

A forestry community of 200 families in the State of Puebla, Mexico provided the venue for this research. The analysis of Q-methodology provided the basis for understanding subjective perspectives associated with forest management. Indicators of sustainable forest management were summarized in a survey to capture the difference in preferences before and after analysis and deliberation.

Findings and Conclusions:

A&D serves as a mechanism to incorporate values and preferences during planning; A&D also assures that the final outcome, as reflected by the adoption of a forest management plan, meets people's preferences, includes their values, and ensures that the indicators for SFM are fully understood and embraced.

This research presents a systematic procedure to involve both the people's values and forestry planning in analysis using Q-methodology. Q-methodology helped to identify viewpoints toward the forest that then were used to design a forest management plan to be discussed in the analysis.

This research demonstrates that ecological, economic, and social indicators of SFM at the local level are important because forest owners have a holistic view of the forest, which in turn is associated with the condition of the forest and cultural, spiritual, and traditional values. How indicators are perceived and implemented rest on the understanding of forestry concepts and the goals of management associated to benefits obtained from the forest. If the goals of management meet people's values and needs, SFM goals are more likely to be pursued.

More effort should be devoted to the development of forest management plans that include people's values and needs.

ADVISER'S APPROVAL: Dr. David K. Lewis

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