

REFRAMING ECOLOGICAL IDENTITY: ECOLOGICAL MANAGEMENT PRACTICES AND
SOCIAL-ECOLOGICAL SYSTEMS RESILIENCE IN THE MID-HILLS OF NEPAL

A Thesis

Presented to the Faculty of the Graduate School

of Cornell University

In Partial Fulfillment of the Requirements for the Degree of

Master of Science

by

Jessie Hughes

December 2024

© 2024 Jessie Hughes

ABSTRACT

Worldwide, social-ecological systems (SES) are facing unprecedented challenges stemming from global environmental change, and the ways in which individuals and communities respond to these changes and challenges have sparked intense interest from the research community. Social scientists seeking to understand individual and community responses to global environmental change have explored methods of assessing environmental stewardship, and whether individuals and communities may be changing their stewardship practices over time. One of these assessment concepts, dubbed Ecological Identity, or “EI,” explores the degree to which individuals and communities view themselves as an integrated component of their natural environment, engage in environmental stewardship, or associate with others who do the same. All of these traits have implications for the efficacy of resource management and conservation initiatives. To this end, researchers have produced a variety of scales which assess and evaluate various aspects of EI. However, though debated and refined within separate fields, EI has yet to be examined through an interdisciplinary SES lens. Nor have researchers considered EI as a mechanism by which individuals and communities maintain biocultural diversity and resilience to disturbances within SES.

This research examined the relationships between EI, Traditional Ecological Knowledge (TEK), and social-ecological systems resilience (SESR) within a specific social-ecological system in Nepal. Fieldwork was conducted through interviews with resource-proximate study participants within the Magar indigenous ethnic community in the rural mid-hills region of Nepal. Interviews sought to determine the extent to which individual study participants view themselves as a member of an integrated SES through assessing the “strength” of their Ecological Identities. Additionally, in my fieldwork I sought to uncover how EI might or might not operate as a social mechanism of resilience in SES.

I utilized a mixed methodology towards answering three main research questions, pertaining towards (1) the efficacy of existing EI assessment scales, (2) potential methods by which researchers might mitigate the shortcomings of existing scales, and (3) proposing EI as a mechanism of SESR in its own right. This included evaluating EI using an existing peer-validated scale, and collecting a series of short answer questions, a demographic questionnaire, field observation notes, and the creation of individual Seasonal Rounds. In particular, Seasonal Rounds are a participatory method novel to this

field and were created in collaboration with each study participant, seeking to mitigate drawbacks to contemporary EI assessment scales and inform on food and ecological management practices which may contribute towards the maintenance of biocultural diversity and social-ecological systems resilience within systems in general.

The study discovered that the resource-proximate individuals in the case study community score lower than the global average on Clayton et al.'s (2021) Environmental Identity (EID) questionnaire, and express confusion about the structure of the questions, as well as their nature. However, study participants concurrently demonstrate through the remaining analyses that contrary to their relatively low EID scores, they view themselves as an integrated and vital component of their surrounding social-ecological system. These outcomes suggest that if our goal in assessing EI is to determine the likelihood and efficacy of environmental stewardship initiatives, then existing methods for assessing EI are not yet sufficient, at least when working with resource-proximate individuals and communities, such as smallholder farmers, herders, and hunter/gathers in the mid-hills of Nepal. The findings also imply a role for individuals and communities to act as both benefactor and beneficiary within a complex system by leveraging EI and subsequent ecological management practices. In this way, strong Ecological Identities aid individuals and communities in meeting their needs, while contributing to the welfare and functionality of a bioculturally diverse and resilient social-ecological landscape.

I recommend further inquiry into the operation and description of social mechanisms of social-ecological systems resilience, such as Ecological Identity, Traditional Ecological Knowledge (TEK), and the structure and dynamics of institutions in the future. Additionally, further experimentation and refinement is needed concerning methodologies centered on Seasonal Rounds and their application towards the assessment and description of TEK, ecological management practices, and their potential as a tool for building adaptive capacity to social and environmental disturbance and perturbation.

BIOGRAPHICAL SKETCH

Jessie Dearing is from Ovid NY and holds a Bachelor of Science in Architecture from the Georgia Institute of Technology, and a Master of Professional Studies in Global Development from Cornell University. Her myriad interests have guided her in a diversity of pursuits around the world, all of which inform her present work. Following the completion of her undergraduate degree she spent several years in the practice of architecture. Eventually her desire to pursue more holistic work which incorporates the natural, social, and spatial environments led her to leave the architecture profession and pivot into work in agriculture and natural resource management. She served as a Peace Corps Volunteer in two countries: briefly in Burkina Faso, then as a food security volunteer in Nepal. While serving in Nepal, she taught and facilitated work in sustainable farming, community agroforestry, and soil conservation practices with smallholder farmers and community resource managers. She also witnessed the same smallholders endure the challenges levied upon them by social and ecological change. These experiences catalyzed her desire to pursue further education within the College of Agriculture and Life Sciences at Cornell University, where she has coalesced her interdisciplinary interests into studies which center human beings within their environment, whether that be through the lens of agriculture, natural resource management, Ecological Identity, or resilience of social-ecological systems to increasingly frequent disturbances. In her free time, she enjoys being walked by her dog, yoga, rock climbing, and knitting for friends and family.

ACKNOWLEDGMENTS

This paper would not have been possible without the generous support and funding of the United States Department of Education Foreign Language and Area Studies (FLAS) Fellowship. I would also like to recognize Cornell University's South Asia Program, for providing intellectual and programmatic support during the process of preparing for and conducting my fieldwork. Thank you to Dr. Hom Prasad Acharya within the South Asia Program, for your patient and enthusiastic instruction in the Nepali language. My work greatly benefits from your teaching, and your friendship here in Ithaca keeps me present to the ongoing importance of research in Nepal.

Thank you to Dr. Keith Tidball, my graduate advisor. Your ability to channel my energy and ideas into concrete plans and lines of inquiry proved fundamental to this research. I am grateful for your habit of challenging me to consider new perspectives regarding the human dimensions of natural resource management and being a sounding board for anything and everything.

Thank you to Dr. David Lee for your service on my committee as I navigated this interdisciplinary work, particularly in subjects where I initially lacked sufficient knowledge. Your continued advice, particularly during my coursework and analysis, was so very appreciated. With much gratitude to Dr. Ginger Allington, who brings a perspective to the fields of SES and resilience that I find refreshing, illuminating, and challenging all at once. Asking you to serve on my committee was one of the best decisions I have made in this program. Additional thanks to Dr. Karim Aly S. Kassam for your patience and the generous gift of your time and advice as I worked through the methods for this research. Your influence is clearly seen in this work.

To my husband Adam, who just gets it. I am endlessly grateful for your support and your sense of humor.

Finally, an eternal thanks to the People of Nepal - specifically those I have had the privilege to work with in past and present collaborations. In a country of kind-hearted people who greet each other as family, you welcomed me with especially open arms. I look forward to the day I can return.

TABLE OF CONTENTS

ABSTRACT	iii
BIOGRAPHICAL SKETCH	v
ACKNOWLEDGMENTS	vi
LIST OF FIGURES	ix
LIST OF TABLES	xv
LIST OF ABBREVIATIONS	xvi
I. INTRODUCTION	1
II. REVIEW OF LITERATURE	6
A. ECOLOGICAL IDENTITY	6
<i>ECOLOGICAL IDENTITY – A BASIC UNDERSTANDING</i>	6
<i>ECOLOGICAL IDENTITY ASSESSMENT & ENVIRONMENTAL STEWARDSHIP</i>	7
<i>EVOLUTION OF THE ECOLOGICAL IDENTITY ASSESSMENT LITERATURE</i>	8
<i>POTENTIAL DRAWBACKS AND CRITIQUES WITHIN THE ECOLOGICAL IDENTITY LITERATURE</i>	9
B. SEASONAL ROUNDS	10
<i>SEASONAL ROUNDS – A BASIC UNDERSTANDING</i>	10
<i>DOCUMENTING PHENOLOGICAL USE OF NATURAL RESOURCES</i>	14
<i>THEORETICAL LINKS BETWEEN SEASONAL ROUNDS & ECOLOGICAL IDENTITY</i>	16
C. SOCIAL MECHANISMS OF SOCIAL-ECOLOGICAL SYSTEMS RESILIENCE	17
<i>SOCIAL-ECOLOGICAL SYSTEMS RESILIENCE – A BASIC UNDERSTANDING</i>	17
<i>SOCIAL-ECOLOGICAL SYSTEMS RESILIENCE & THE ADAPTIVE CYCLE</i>	19
<i>SOCIAL MECHANISMS OF SESR</i>	21
D. RESEARCH SETTING	23
<i>THE MID-HILLS OF WESTERN NEPAL – A BIOCULTURALLY DIVERSE SOCIAL-ECOLOGICAL SYSTEM</i>	23
<i>EXISTING RESEARCH IN THE MID-HILLS OF WESTERN NEPAL</i>	25
III. METHODS & ANALYSIS	34
A. INTRODUCTION & RESEARCH DESIGN	34
<i>OVERVIEW</i>	34
<i>RESEARCH SITE</i>	35
<i>ONTOLOGY, EPISTEMOLOGY, METHODOLOGY, & PERSONAL VALUES</i>	37
<i>IRB EXEMPTION STATEMENT</i>	39

B. DATA COLLECTION & ANALYSIS	40
<i>SAMPLING PLAN</i>	40
<i>DATA COLLECTION</i>	41
<i>DATA ANALYSIS</i>	57
IV. RESULTS	66
A. SUMMARY OF MIXED METHODS FINDINGS	66
B. RESEARCH OBJECTIVE 1: PATTERNS & CORRELATIONS BETWEEN EI & OTHER TRAITS HELD BY STUDY PARTICIPANTS.....	69
C. RESEARCH OBJECTIVE 2: PERCEIVED SHORTCOMINGS OF EXISTING EI ASSESSMENT SCALES RESULTING FROM THIS STUDY	80
D. RESEARCH OBJECTIVE 3: DESCRIBING THE RELATIONSHIP BETWEEN FOOD PRACTICES & TIME 82	
E. RESEARCH OBJECTIVE 4: THE USE OF SEASONAL ROUNDS TO DESCRIBE HOW FOOD PRACTICES CONTRIBUTE TO TRADITIONAL ECOLOGICAL KNOWLEDGE & MANAGEMENT PRACTICES.....	94
F. RESEARCH OBJECTIVE 5: THE USE OF SEASONAL ROUNDS IN DESCRIBING ECOLOGICAL IDENTITY	101
G. RESEARCH OBJECTIVES 6&7: SITUATING AND OPERATIONALIZING ECOLOGICAL IDENTITY WITHIN THE SOCIAL ECOLOGICAL SYSTEMS RESILIENCE LITERATURE AND PRACTICE.....	106
V. DISCUSSION & FUTURE RESEARCH	108
A. ECOLOGICAL IDENTITY IN THE NON-WESTERN, SMALLHOLDER CONTEXT.....	108
B. THE VERSATILE APPLICATIONS OF SEASONAL ROUNDS, TEK, & ECOLOGICAL MANAGEMENT PRACTICES.....	109
C. FRAMING ECOLOGICAL IDENTITY AS A SOCIAL MECHANISM OF SESR	113
D. IMPLICATIONS FOR HUMAN DIMENSIONS RESEARCH & CONSERVATION MANAGEMENT PRACTICES.....	114
VI. CONCLUSION	117
VII. REFERENCES	119
I. APPENDICES.....	133
APPENDIX A: SURVEY INSTRUMENTS	133
APPENDIX B: SUPPLEMENTARY ANALYSES	139

LIST OF FIGURES

Figure 1. Personal and group pathways to predict pro-environmental behavior (Wang et al., 2021).....	8
Figure 2. An example of an early seasonal round (Evans-Pritchard, 1939).....	11
Figure 3. Ruelle et al.'s (2022) Seasonal Rounds.....	12
Figure 4. Seasonal profile of subsistence harvesting in Wainwright, Alaska (Kassam, Baumflek, Ruelle, & Wilson, 2011)	13
Figure 5. A conceptualization of a social-ecological system, it's external influences and internal components (Virapongse, et al., 2016)	18
Figure 6. The adaptive cycle demonstrating its four phases of growth, conservation, release, and reorganization (adapted from (Wahl, 2020))	20
Figure 7. A listing of the current social mechanisms and ecological management practices contributing to resilience, as they are established in the literature.	22
Figure 8. A visualization of how social mechanisms and ecological management practices of SESR contribute to the iterative process of maintaining and enhancing resilience within SES, as SES move through the adaptive cycle in an infinite process of adjustment, evolution, and maintenance of resilience	22
Figure 9. The three main ecological regions of Nepal	23
Figure 10. An ethnographic map of Nepal with the Magar community shown in purple (Gurung, 1998)	26
Figure 11. A group of Magar women walk through hillside rice terraces	27
Figure 12. A formal dancing group of Magar women partake in the celebrations for Saun Sakranti, a major holiday that occurs in the middle of monsoon season	27
Figure 13. A Magar man plays with his chicken	27
Figure 14. The Magar community celebrating Bhume Puja, a major Magar holiday, at the research site	28
Figure 15. A young girl assisting in the festivities for Bhume Puja, a major Magar holiday	29
Figure 16. A young girl assisting in the festivities for Bhume Puja, a major Magar holiday, at the research site	29
Figure 17. Community members at the research site line up next to the community temple with offerings of chickens for the Bhume Puja festivities, a major Magar holiday	29
Figure 18. Men perform the Maruni Naach during Bhume Puja, a major Magar holiday	29
Figure 19. A small village at the research site	36
Figure 20. A study participant's home, providing a typical demonstration of traditional Nepali agroforestry	36
Figure 21. A farmer has transplanted wild "khole saag" (water cress) into a spare area in his fields.....	36
Figure 22. Agricultural terraces at the research site during winter. In the monsoon	36
Figure 23. An example of a hilltop grazing area for goats, sheep, cows and water buffalo.	36
Figure 24. Traditional and modern agroforestry plots, side by side.....	36
Figure 25. An illustration of the Nepali Tithi, the amount of time it takes for the moon to travel 1/30th of its revolution around the Earth	46
Figure 26. An illustration of the two Pakshas of the Nepali month, with all 30 tithis displayed.	46
Figure 27. A further demonstration of the two pakshas shown as distinct phases of the moon	47
Figure 28. The tithis and pakshas superimposed onto a contemporary calendar month for the purpose of modern timekeeping and translation into Gregorian time	47
Figure 29. An example of the typical modern representation of the Nepali month.....	48

Figure 30. A representation of the ancient Bikram Sambat calendar, shown with the six Nepali seasons and with a key for the Gregorian calendar in the center and major holidays indicated	48
Figure 31. Months are displayed in a circular manner and meant to be read clockwise. The months of both the Bikram Sambat and the Gregorian calendar are included for legibility	50
Figure 32. Ideally, the beginning of the Bikram Sambat month falls on the new moon, with the full moon occurring roughly halfway through the month. At the same time, the Nepali year is measured by the time it takes to complete one revolution around the sun, represented in our calendar by a circle. Because many Nepalis base their gathering and consumption practices on the phases of the sun and moon, these are shown on the calendar.	50
Figure 33. The six seasons of the Bikram Sambat (spring, hot, monsoon, early autumn, late autumn, and winter) are shown on the calendar to make it easier for the reader to interpret the seasonality and ideal weather conditions for various items on the calendar such as wild fruits, hunting seasons, or planting times	51
Figure 34. The completed Nepali Seasonal Round, with the months of the Bikram Sambat, the six Nepali seasons, and the annual lunar cycles all represented	52
Figure 35. A demonstration of individual item representation. Individual items are shown within a single bubble which is color coded by type of item, whether wild, domesticated, plant, animal, fungi, or unknown. “Grain, Pulse, or Legume” is included as a distinct category	53
Figure 36. A demonstration of how to represent an item’s seasonality (whether that be seasonal or year-round) and utilization	54
Figure 37. An example seasonal round the P.I. used during participant interviews to demonstrate how seasonal rounds could be created. Care was taken to include only plants and animals which could be found in the P.I.’s native New York State.....	55
Figure 38. An example of a Seasonal Round created in collaboration with a study participant	56
Figure 39. A typical scene for conducting one-on-one participant interviews	57
Figure 40. A “concurrent triangulation design” (Creswell and Plano Clark, 2011)	58
Figure 41. Qualitative Content Analysis of both Short Answer Questions and Field Observations. Content was first coded deductively, according to research question, and then inductively, by sub-theme	59
Figure 42. Qualitative Content Analysis of the Short Answer Questions only. Content was coded deductively, with codes determined by categorizing the answers	60
Figure 43. An illustration of a sequence: When during the solar year are individual items coming into season in a certain order and being harvested?	62
Figure 44. An illustration of a synchrony: When during the solar year are groups of items coming into season simultaneously and being harvested?	62
Figure 45. An illustration of two different Densities: when during the solar year are there greater concentrations of species coming into season and being harvested? When are there lesser concentrations of species?.....	63
Figure 46. A simplified representation of the concurrent triangulation design (Creswell & Plano-Clark, 2011) for the mixed methods analysis	64
Figure 47. A more complex representation of the concurrent triangulation design (Creswell & Plano-Clark, 2011) for the mixed methods analysis. Individual analyses are described, cited, and attached to research questions	65
Figure 48. Visualized results from the convergent triangulation analysis. A summary of findings from each of the five comparisons is provided in bolded pink text. Findings tended to agree with each other	

through convergence, although occasional divergences in the data supplied context towards findings in the singular analyses.	66
Figure 49. EID Questionnaire, question 1 responses (histogram)	70
Figure 50. EID Questionnaire, question 2 responses (histogram).....	70
Figure 51. EID Questionnaire, question 3 responses (histogram).....	71
Figure 52. EID Questionnaire, question 4 responses (histogram).....	71
Figure 53. EID Questionnaire, question 5 responses (histogram).....	72
Figure 54. EID Questionnaire, question 6 responses (histogram).....	72
Figure 55. EID Questionnaire, question 7 responses (histogram).....	73
Figure 56. EID Questionnaire, question 8 responses (histogram).....	73
Figure 57. EID Questionnaire, question 9 responses (histogram).....	74
Figure 58. EID Questionnaire, question 10 responses (histogram).....	74
Figure 59. EID Questionnaire, question 11 responses (histogram).....	75
Figure 60. EID Questionnaire, question 12 responses (histogram).....	75
Figure 61. EID Questionnaire, question 13 responses (histogram)	76
Figure 62. EID Questionnaire, question 14 responses (histogram).....	76
Figure 63. EID Questionnaire response densities, with included mean & median line for this research, as well as Clayton et al's (2021) mean (shown in green)	77
Figure 64. participant demographics: age and gender	78
Figure 65. participant demographics: education level attained	78
Figure 66. participant demographics: family size of participant.....	78
Figure 67. participant demographics: livestock ownership.....	78
Figure 68. participant demographics: time spent living within the research site	79
Figure 69. participant demographics: occupation.....	79
Figure 70. participant demographics: have you migrated for work?.....	79
Figure 71. participant demographics: number of years spent migrating for work	79
Figure 72. Deductive & Inductive content analysis of Short Answer Questions & Field Observations.....	82
Figure 73. Deductive content analysis of Short Answer Questions only	83
Figure 74. participant Seasonal Round profile: Typology 1	85
Figure 75. participant Seasonal Round profile: Typology 2	85
Figure 76. participant Seasonal Round profile: Typology 3	86
Figure 77. participant Seasonal Round profile: Typology 4	86
Figure 78. participant Seasonal Round profile: Typology 5	87
Figure 79. participant Seasonal Round profile: Typology 6	87
Figure 80. participant Seasonal Round profile: Typology 7	88
Figure 81. participant Seasonal Round profile: Typology 8.....	88
Figure 82. Total number of items in individual Seasonal Rounds, plotted by number of times that number is attained amongst participants (density).....	97
Figure 83. Total number of animals and plants in individual Seasonal Rounds, plotted by number of times that number is attained amongst participants (density).....	98
Figure 84. Total number of domesticated items and wild items in individual Seasonal Rounds, plotted by number of times that number is attained amongst participants (density).....	98
Figure 85. Total number of domesticated plants and wild plants in individual Seasonal Rounds, plotted by number of times that number is attained amongst participants (density).....	99

Figure 86. Total number of domesticated animals and wild animals in individual Seasonal Rounds, plotted by number of times that number is attained amongst participants (density).....	99
Figure 87. A flat calendar displaying the seasonality of every item named by study participants, color coded by class (domesticated (red) or wild (blue))	100
Figure 88. Number of items in individual Seasonal Rounds, plotted in relation to participants' average EID score..	102
Figure 89. Number of items in individual Seasonal Rounds, plotted in relation to participants' average EID score, and color-coded by age. No significant relationship concluded	102
Figure 90. Number of items in individual Seasonal Rounds, plotted in relation to participants' average EID score, and color-coded by time of residency at the research site. No significant relationship concluded	103
Figure 91. Number of items in individual Seasonal Rounds, plotted in relation to participants' average EID score, and color-coded by education level attained. No significant relationship concluded	103
Figure 92. Number of items in individual Seasonal Rounds, plotted in relation to participants' average EID score, and color-coded by whether participants engaged in labor migration. No significant relationship concluded.....	104
Figure 93. Number of items in individual Seasonal Rounds, plotted in relation to participants' average EID score, and color-coded by gender. No significant relationship concluded.....	104
Figure 94. Figure 94. Number of items in individual Seasonal Rounds, plotted in relation to participants' average EID score, and color-coded by occupation. No significant relationship concluded.....	105
Figure 95. Individual items listed on all 41 Seasonal Rounds by participants, ordered by frequency of mention and color coded by class (Domesticated or Wild)	141
Figure 96. Individual items listed on all 41 Seasonal Rounds by participants, ordered by frequency of mention and color coded by class (Plant, animal or fungi)	142
Figure 97. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P01.....	143
Figure 98. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P02.....	143
Figure 99. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P03.....	144
Figure 100. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P04.....	144
Figure 101. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P05.....	145
Figure 102. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P06.....	145
Figure 103. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P07.....	146
Figure 104. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P08.....	146
Figure 105. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P09.....	147
Figure 106. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P10.....	147

Figure 129. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P33.....	159
Figure 130. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P34.....	159
Figure 131. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P35.....	160
Figure 132. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P36.....	160
Figure 133. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P37.....	161
Figure 134. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P38.....	161
Figure 135. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P39.....	162
Figure 136. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P40.....	162
Figure 137. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P41.....	163
Figure 138. Cumulative Community Seasonal Round comprised of the information from every individual seasonal round.....	164
Figure 139. Photo: a child examines the seasonal rounds template	174
Figure 140. Photo: a child examines the seasonal rounds template	174
Figure 141. An example of a wild Himalayan Fig, or bedu, edible	174
Figure 142. An example of a wild Himalayan Fern, niuro, edible	174
Figure 143. The route to an interview site	175
Figure 144. An example of a typical meal in rural Nepal.....	175

LIST OF TABLES

Table 1. Clayton et al.'s (2021) Environmental Identity Questionnaire, utilized in this study.....	43
Table 2. Singular & Mixed methods analysis - compilation of findings	67
Table 3. Participant Sequences, Synchronies, Densities, and Typologies	89
Table 4. Interview participant demographics & EID scores (continued on next page).....	139

LIST OF ABBREVIATIONS

CFUG - Community Forestry User Group

CNS - Connectedness to Nature Scale

CSV - Comma-Separated Values

DCNS - Disposition to Connect with Nature Scale

EID - Environmental Identity Scale

EIS - Ecological Identity Scale

EGS - Eco-Generativity Scale

EI - Ecological Identity

IRB - Institutional Review Board

MMR - Mixed Methodology Research

NEPS - New Ecological Paradigm Scale

NR-6 - Nature-Relatedness Scale

OED - Oxford English Dictionary

PEB - Pro-Environmental Behavior

PI - Principal Investigator

SES - Social-Ecological Systems

SESR - Social-Ecological Systems Resilience

TEK - Traditional Ecological Knowledge

TPK - Traditional Phenological Knowledge

UN - United Nations

US - United States

I. INTRODUCTION

Worldwide, social-ecological systems (SES) are facing unprecedented challenges stemming from global environmental change (Turner, Lambin, & Reenberg, 2007). The ways in which individuals and communities respond to these changes have wide-reaching implications for the conservation of biological and cultural diversity, as well as for the maintenance and enhancement of these systems' resilience to social and environmental disturbances (Glaser, Krause, Ratter, & Welp, 2008; Turner N. , Ancient Pathways, Ancestral Knowledge , 2014; Dickson, 2016; Fa, et al., 2020; Dawson, et al., 2021). There is intense interest amongst researchers in multiple disciplines in understanding the mechanisms by which communities of practice steward their environments in response to environmental change. In the social sciences, the body of work on Ecological Identity (EI) has grown in response to this interest (Axelrod, 1994). Researchers of EI assert that through understanding of EI, policymakers and institutions have a grasp of the likelihood of individuals and communities to view themselves as an integrated component of their natural environment, engage in environmental stewardship, or associate with others who do the same. Consequently, researchers have produced myriad scales which assess and evaluate various aspects of EI (Fairlamb, 1979; Stern & Dietz, 1994; Thomashow, 1996; Light, 2000; Roszak, 2001; Bonaiuto, Carrus, Martorella, & Bonnes, 2002; Gooch, 2002; Schultz, 2002; Clayton S. , 2003). But despite having been debated and refined within separate fields, these assessment scales have yet to be examined through the SES lens towards the purpose of better understanding human relationships within social-ecological systems. Nor have researchers considered the potential that EI holds as a mechanism by which individuals and communities maintain biocultural diversity and resilience to disturbance within SES.

This research examines the relationships between EI, traditional ecological knowledge (TEK), and social-ecological systems resilience (SESR) through the case of a specific smallholder and resource-proximate indigenous Magar community in the rural mid-hills of Western Nepal. This research first evaluates the established scholarship on EI using a case study of smallholder. Subsequent fieldwork through interviews with individual study participants sought to determine the extent to which individual study participants view themselves as a member of an integrated SES, and the implications for environmental stewardship, the conservation of biocultural diversity, and overall resilience of a SES to disturbances. I utilize a mixed methodology towards answering three main research questions, pertaining to (1) the efficacy of existing EI assessment scales, (2) potential

methods by which researchers might mitigate the shortcomings of existing scales, and (3) towards proposing EI as a mechanism of SESR. This included research evaluating EI using an existing peer-validated scale, and collecting a series of short answer questions, a demographic questionnaire, and field observation notes. I carried with me through this research a predilection towards engaged scholarship which addresses social challenges along with ecological ones. This informed the addition of one last data collection method. Seasonal Rounds (Ruelle, et al., 2021), a participatory method novel to this field, were created in collaboration with each study participant, seeking to mitigate drawbacks to contemporary EI assessment scales and yield info on food and ecological management practices which may contribute towards the maintenance of biocultural diversity and SESR.

My work revealed that the resource-proximate individuals in the case study community score lower than the global average on Clayton et al.'s (2021) EID questionnaire from the established literature on EI, and they express confusion about the structure of the questions, as well as their nature. Concurrently, through the creation of Seasonal Rounds which display their food practices and ecological management practices, and short answer questions addressing the resiliency of those food practices, participants demonstrated that, contrary to their EID scores, they do view themselves as an integrated component of the surrounding SES. This would suggest that, were it not for some fundamental cultural differences in how rural Nepali smallholders view themselves in relation to their natural environment compared to the societies from which assessment scales like the EID were developed, Nepali smallholder study participants would be scoring higher on Clayton's (2021) EID assessment. The outcomes suggest that existing methods for assessing EI are not sufficient for working with resource-proximate individuals and communities.

“Ecological Identity” is a multidimensional, complex construct by which an individual can demonstrate emotional and psychological attachment to the natural environment, a sense of belonging within it, and a willingness to associate with other human individuals and groups who identify similarly (Thomashow, 1996; Clayton S. , 2003; Clayton, et al., 2021). Social scientists have recently become more interested in exploring the tangible applications of this aspect of identity and its empirical measurement (Mayer & Frantz, 2004; Schultz & Tabanico, 2007; Dunlap R. E., 2008; Olivos & Aragonés, 2011; Walton & Jones, 2018; Clayton, et al., 2021). One application of EI evaluation this research concerns itself with is the use of EI evaluation to gauge the likelihood of engagement in environmental stewardship activities (Clayton S. , 2003; Clayton, et al., 2021). Countless methods have emerged which attempt to quantitatively assess EI, with the end goal of determining an

individual's likelihood of engagement in environmentally-friendly activities or active stewardship of their environment. Some of the more popular methods for assessing EI currently include Mayer & Franz's (2004) Connectedness to Nature Scale (CNS), Walton & Jones' (2018) Ecological Identity Scale (EIS) , and Clayton et al.'s (2021) Environmental Identity Scale (EID). Other researchers have tested these scales in different scenarios amongst diverse groups, validating the assessments or making suggestions for improvement as they go. Presently, most academic study of EI has centered around individuals in urban or academic settings, albeit from a range of cultures, places, and professions (Ariccio & Mosca, 2023; Devine-Wright & Clayton, 2010; Nartova-Bochaver, et al., 2022) There is a dearth of studies which examine the ecological identities of rural, indigenous, or smallholder individuals, or of individuals who are dependent upon local natural resources for most of their livelihoods, in Nepal or elsewhere. It's unlikely that this is an intentional lapse in coverage, and more likely that researchers simply have not had access to these individuals or groups (Mehta & Kellert, 1998; Soga & Gaston, 2023). This research seeks to fill that gap.

I hypothesize that one potential application of EI assessment is the framing of EI as a social mechanism of SESR. Linking EI to SESR begins with understanding how humans enhance resilience within systems (Berkes & Folke, 1998; Berkes, Colding, & Folke, 2002; Folke, 2006; Kassam K.-A. , 2010; Tidball & Stedman, 2013; Epstein, DiCarlo, Marsh, Ray, & Maren, 2017) Efforts towards understanding SES resilience have grown in the last few decades, with many researchers particularly interested in the ways by which an SES remains resilient to disturbances and perturbations (Gret-Regamey, Huber, & Huber, 2019; Sterling, Ticktin, Morgan, Cullman, & Alvira, 2017; Kumar Jha, Negi, Alatalo, & Negi, 2021; Palazzo & Bardsley, 2021; Dakos & Kéfi, 2022) Approaches are twofold in the literature. One way in which humans might enhance resilience within a system is through the maintenance of biocultural diversity, defined by Badenoch (2010) as the "interconnected variety of both biological species and human cultures within a given ecosystem." In a social-ecological system, the maintenance of biocultural diversity has been established as crucial to the maintenance and enhancement of that system to disturbance and perturbation (Badenoch, 2010; Gret-Regamey, Huber, & Huber, 2019; Palazzo & Bardsley, 2021). Maintaining and enhancing biodiversity within SES, therefore, is beneficial to the overall resilience of an SES, and understanding how that is done can help us understand how to support or supplement system resilience. EI has been framed by myriad researchers as having a role in promoting pro-environmental behaviors (PEB) (Whitmarsh & O'Neill, 2010; Whitburn, Linklater, & Abrahamse, 2019; Ajibade & Boateng, 2021), sense of place (Gooch,

2002; Devine-Wright & Clayton, 2010), and environmental concern (Stern & Dietz, 1994), all of which contribute to the maintenance of biocultural diversity in SES.

The other way in which humans might enhance SESR, and the primary focus of this research, is by ecological management practices and the social mechanisms which drive them. The foundational literature on this topic remains Berkes & Folke's (1998) work, which frames management practices such as resource rotation, protection and conservation of certain species, and nurturing sources of renewal within systems (Berkes & Folke, 1998). Along with detailing ecological management practices as acts which enhance a system's resilience, Berkes & Folke (ibid.) also describe "social mechanisms" which drive the development and evolution of ecological management practices over time. While resilience as a concept has garnered support amongst researchers and practitioners of SES management, the social mechanisms of said resilience are still being explored in the literature (Berkes, Folke & Colding, 2001; Tidball, 2012). I seek to contribute to that literature by exploring EI as a social mechanism of SESR.

In this research I pose the following research questions, paired with corresponding objectives that guide the pursuit of answers to these questions:

- **Research Question 1:** Using an existing method for assessing EI, to what extent and in what ways do Nepalese smallholders view themselves as members of an integrated social-ecological system?
 - Research Objective 1: Explore possible patterns or correlations between EI and other traits held by study participants.
 - Research Objective 2: Uncover potential drawbacks of existing scholarly methods for assessing and describing EI.
- **Research Question 2:** Could the process of developing seasonal rounds to describe food practices, TEK, and biocultural diversity in a bounded system contribute to existing frameworks for assessing EI?
 - Research Objective 3: Describe the relationships between food practices and time within Nepal's mid-hill social-ecological system, using seasonal rounds, at both the individual and community levels.
 - Research Objective 4: Understand how food practices shape and influence ecological management practices within Nepal's mid-hills social-ecological system.

- Research Objective 5: Understand how food practices shape and influence EI within Nepal's mid-hills social-ecological system.
- **Research Question 3**: Does EI operate as a social mechanism of SESR?
 - Research Objective 6: Postulate, using this study's findings, how EI could be situated in SESR theory as a social mechanism of SESR.
 - Research Objective 7: Postulate, using this study's findings, how EI could be operationalized within Nepal's mid-hill social-ecological system to enhance resilience of smallholder farmers to various disturbances.

If Ecological Identities in the mid-Hills of Nepal, and within the Magar community, are shown to be relatively low, then there may be the potential for several rippling effects within that social-ecological system. The first and most immediate is a lower likelihood of individuals engaging in environmental stewardship practices such as ecological management, the use and conservation of surrounding natural resources including plant and animal species, and protection of the natural environment from extractive influences. In the longer term, one could expect to see a loss of biocultural diversity, homogenization of both culture and environment, and an erosion of SESR to disturbances and perturbations of all kinds. Therefore, if we are aware of the existence of EI and understand that some individuals may be more resilience prone, behaviorally and normatively, than others, then understanding how Ecological Identities are shaped, shifted, and nurtured will have wide-reaching implications for addressing the wicked problems of our time.

II. REVIEW OF LITERATURE

A. ECOLOGICAL IDENTITY

ECOLOGICAL IDENTITY – A BASIC UNDERSTANDING

One of the most fundamental paradigmatic assumptions an individual can make about themselves concerns their relationship to nature - whether they consider themselves a part of nature or separate from it (Schultz & Tabanico, 2007). In recent decades, researchers have turned their attention to studying this paradigmatic frame, bestowing upon it a dizzying number of terms such as Environmental Self-Identity (van der Werff, Steg, & Kees, 2013), Connectedness to Nature (Mayer & Frantz, 2004), Environmental Identity (Clayton S. , 2003; Olivos & Aragones, 2011; Clayton, et al., 2021), Nature Relatedness (Nisbet, Zelenski, & Murphy, 2008), EI (Thomashow, 1996), Inclusion of Nature in Self (Schultz, 2002), and the New Ecological Paradigm (Catton & Dunlap, 1980; Dunlap, Van Liere, Mertig, & Emmet Jones, 2000; Roszak, 2001). These terms all differ slightly in their utility and purpose, but despite the myriad terminology, many of these terms and their corresponding assessment scales have been positively associated with each other in the academic literature (Balundė, Jovarauskaite, & Simas Poškus, 2019; Olivos, Aragones, & Amerigo, 2011; Sierra-Barón, Olivos-Jara, Gómez-Acosta, & Navarro, 2023). Due to the vast number of positively associated terminology for this concept, I have adopted “EI” as an encompassing term for the tendency of an individual to identify as part of nature, rather than existing separately from it. This is one of the older terms in the literature (Thomashow, 1996), and the one which tends to find favor with interdisciplinary researchers (Tidball & Stedman, 2013; Walton & Jones, 2018; Lee & Youn, 2022).

For the purposes of this research, the most pertinent definition of EI comes from Clayton et al. (2021), who defines Environmental (Ecological) Identity as:

“one part of the way in which people form their self-concept: a sense of connection to some part of the nonhuman natural environment, based on history, emotional attachment, and/or similarity, that affects the ways in which we perceive and act toward the world; a belief that the environment is important to us and an important part of who we are. An environmental identity can be like another collective identity (such as a national or ethnic identity) in providing us with a sense of connection, of being part of a larger whole, and with a recognition of similarity between ourselves and others.”

Although EI has been recently adopted by researchers as a topic of study, the concept has been present in the paradigmatic framing of nature for much longer. Researchers in various disciplines have

undertaken study of “EI” , such as in political science (Light, 2000), ecopsychology and ecosophy (Fairlamb, 1979; Roszak, 2001; Thomashow, 1996; Merchant, 2005), ecological anthropology (Bateson, 2000; Tidball K. G., 2012), environmental psychology (Winter, 2003; Clayton, et al., 2021), deep ecology (Bragg, 1996; Zavestoski, 2003), and biology (Wilson E. O., 1984). Presently, EI is researched most extensively in the disciplines of environmental psychology and anthropology (Winter, 2003; Olivos & Aragones, 2011; Balundė, Jovarauskaite, & Simas Poškus, 2019), where researchers are attempting to study environmental attitudes, drawing inspiration from both identity theory – how one perceives oneself, and social identity theory – how one perceives oneself as a member of a group (Stets & Biga, 2003). When examining these theories in an environmental context, identity and social identity become intertwined with perceptions and attitudes towards the natural world and how we see ourselves within it (ibid.).

ECOLOGICAL IDENTITY ASSESSMENT & ENVIRONMENTAL STEWARDSHIP

Like other branches of identity research, the ecological dimension of identity is pertinent towards applications involving tangible human activities. A “strong” EI indicates an individual’s psychological integration within the surrounding natural environment (Clayton S. , 2003), a higher likelihood of aligning with people who identify as environmentalists (Swim, Zawadzki, Cundiff, & Lord, 2014; Cowie, Greaves, Milfont, Houkamau, & Sibley, 2016; Brick & Lai, 2018; Clayton, et al., 2021), or identifying as an environmentalist themselves (Gatersleben, Murtagh, & Abrahamse, 2014; Brick & Lai, 2018; Nartova-Bochaver, et al., 2022), in both a social and political context (Light, 2000). Just as importantly, a strong EI may also indicate the potential for willing participation in environmentally friendly activities and engagement in environmental stewardship, pro-environmental behavior (PEB) , and ecological management practices (Gooch, 2002; Devine-Wright & Clayton, 2010; Whitmarsh & O'Neill, 2010; Ajibade & Boateng, 2021; Lee & Youn, 2022). For practitioners in resource management endeavoring to engage individuals and communities in environmental stewardship initiatives, the use of methods to describe and understand EI amongst individuals and communities can have a tangible impact on their work (Axelrod, 1994; Stern & Dietz, 1994; van der Werff, Steg, & Kees, 2013).

Correspondingly, a weak EI could indicate an individual’s tendency towards psychological separation from their surrounding natural environment (Axelrod, 1994; Ajibade & Boateng, 2021), a reluctance to associate with or identify as an environmentalist (Clayton S. , 2003; Bonaiuto, Carrus,

Martorella, & Bonnes, 2002; Nartova-Bochaver, et al., 2022), and a lower likelihood of engagement in PEBs and stewardship initiatives (Stern & Dietz, 1994; Gooch, 2002; Whitmarsh & O'Neill, 2010; Whitburn, Linklater, & Abrahamse, 2019). Globally, there have been changes in the strength of EI over time and across heterogeneous geographical spaces, as reported by Soga & Gaston (2023), which introduces an element of uncertainty with respect to the future of human environmental stewardship.

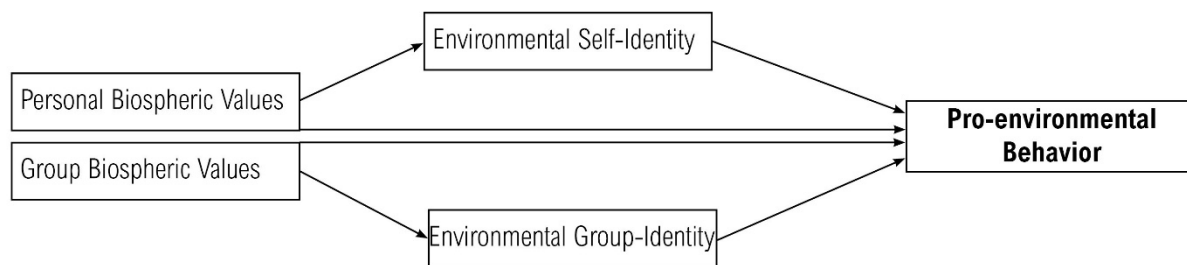


Figure 1. Personal and group pathways to predict pro-environmental behavior (Wang et al., 2021)

EVOLUTION OF THE ECOLOGICAL IDENTITY ASSESSMENT LITERATURE

Researchers have developed many scales pertaining to or addressing ecological identity which suit different needs. Several scales stand out in the available academic literature for their popularity. The New Ecological Paradigm Scale (NEPS) (Dunlap, Van Liere, Mertig, & Emmet Jones, 2000) measures endorsement of a “pro-ecological” worldview, while the Connectedness to Nature Scale (CNS) (Mayer & Frantz, 2004) and the Disposition to Connect with Nature Scale (DCNS) (Brügger, Kaiser, & Roczen, 2011) both assess proximal feelings of nature-connectedness. Similarly, the Nature-Relatedness Scale (NR-6) (Nisbet, Zelenski, & Murphy, 2008) assesses “subjective” connectedness with the natural environment. Both the EIS (Walton & Jones, 2018), and the EID (Clayton, et al., 2021) measure a likelihood to self-identify with nature, and a likelihood of displaying PEBs. These two scales also draw on Stets & Bigas’ (2003) work on commitment to the introduction of Identity Theory into environmental sociology.

Of the scales which have been identified as popular amongst academic researchers, Clayton et al.’s (2021) EID is the only scale which identifies individuals who might self-identify with nature and engage in environmental stewardship, but also those individuals who identify as an environmentalist and associate with other individuals and groups who do the same. Additionally, Clayton et al. (2021) has

reviewed their original EID (Clayton S. , 2003) through a multi-cultural lens, translating and testing the scale in six separate languages and countries to ensure validity. Although the researchers worked primarily with populations in urban areas, this current work is evolving towards multi-cultural use. The revised EID (2021) uses culturally adaptive language that can be theoretically applied to individuals and groups in any setting, including but not limited to the original study groups in academia and urban areas. The ways in which Clayton et al.'s (2021) EID scale are distinguished from other available scales made it a good choice for my research examining the EI's of indigenous, non-western individuals in the context of stewardship and resilience.

Researchers have recently applied Clayton et al.'s (2021) EID Scale in a variety of diverse contexts. Osorno et al. (2022) used the EID scale to measure relationships between different socio-economic positions, gender, and commitment to the environment in Mexico, finding no difference between different socio-economic positions but several variations amongst gender. In the same year, Aricio & Mosca (2023) use a study of Italian pet owners and their relationship to EID to propose an Italian addition to Clayton et al.'s multinational scale. Ghasemi & Kyle (2023) use the EID to highlight hunters' opposition to harmful hunting practices which degrade ecosystems and ecological communities, supporting hunters as bastions of environmental stewardship behaviors. Finally, di Fabio & Svecher (2023) leverage Clayton's EID scale as an aspect of their own four-part Eco-Generativity Scale (EGS), which represents the potential for a population to engage in eco-regenerative activities in the future.

POTENTIAL DRAWBACKS AND CRITIQUES WITHIN THE ECOLOGICAL IDENTITY LITERATURE

Despite recent developments and improvements to contemporary scales for EI assessment, there still exist some potential shortcomings that could be addressed in contemporary research. Initial forays into the creation of EI assessment scales relied largely upon engaging with groups and populations that were easily accessible to researchers. This might have included university students, urban populations, or social groups to which researchers and their collaborators find belonging in and hold ties to. This may have unintentionally led to the development of scale items which cater to EI paradigms held by these groups. Similarly, researchers have relied upon collaboration with Anglophone and industrialized populations who embrace certain mental models of "the environment,"

and what these concepts represent to them. More specifically, these populations tend to view nature as a separate entity from which they can choose to disengage. Very few, if any, studies exist which explore the understanding of EI amongst rural, smallholder, non-Anglophone, or indigenous individuals and groups. These groups may have very different paradigms around nature, their place within nature, and their concepts of environmental stewardship or “environmentalism” as understood by most contemporary researchers. This research aims to close some of these gaps and gain a greater understanding of EI amongst lesser represented peoples.

B. SEASONAL ROUNDS

SEASONAL ROUNDS – A BASIC UNDERSTANDING

“Seasonal rounds” as we refer to them in this research are a versatile, illustrative representation of phenological resource use and management practices of individuals and communities in a bounded geographic area. The practice of optimally timing natural resource usage spans eons and serves as a foundation for the ecological management systems of countless human individuals and societies. Owing to the seasonality of the Earth and its ecological systems, an understanding of the availability and management of food sources, both plant and animal, at different points in the year was and continues to be particularly essential to the survival and growth of resource-dependent communities (Woodward & Marrfurra McTaggart, 2019; Dunlap, Loros, & DeCoursey, 2004; Turner N. , Ancient Pathways, Ancestral Knowledge , 2014).

Anyone familiar with life on a farm will understand the necessity of working with the seasons, and the use of phenological knowledge is seemingly as old as time. However, the practice of diagrammatically visualizing resource use across time is somewhat novel in the academic literature (Ruelle, et al., 2021; Kassam & Bernardo, 2022). For anthropologists and other social and environmental scientists who work with communities of practice, interest in seasonal rounds as we define them began with a desire to understand how human interaction with the natural world is shaped by cyclical change (Steward, 1938; Kroeber, 1939; Boas, 1964). These researchers have used the term “seasonal round” to refer to human patterns of resource use and management, which have developed over millennia in response to seasonal change (Turner N. , 2014). As early as 1939, Evans-Pritchard was studying time as it relates to social and ecological phenomena amongst the Nuer

people of South Sudan, and detailing their method of timekeeping as it relates to ecological processes as well as lunar cycles (see figure 2 below). For the Nuer, a society which bases its wealth on cattle, the ecological almanac which drives the wellbeing of their herds is a more relevant indicator of passing time than the schedules with which industrialized societies plan their productivity (Evans-Pritchard, 1939). Plants and animals which proved beneficial to their cattle were noted, and their phenology remembered and passed down. Evans-Pritchard (1939) was also one of the first researchers to depict phenology in the circular diagrams and format that we adopt in this research (ibid., pp. 196-201).

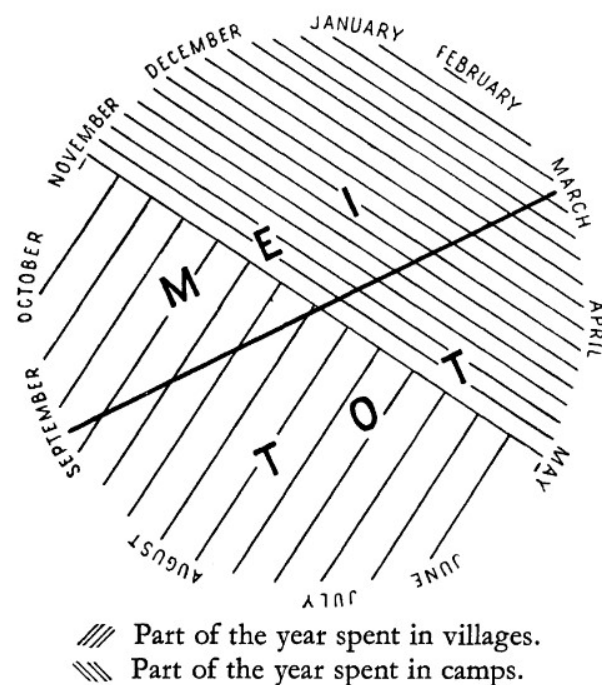


Figure 2. An example of an early seasonal round (Evans-Pritchard, 1939)

Later, researchers began studying seasonal rounds as an indicator of environmental stewardship, and the relationship between culture and habitat. Specifically, many researchers were interested in the rules which govern resource use and determine when individuals carry out certain ecological activities such as cultivation, hunting, and gathering in ways which are beneficial or benign to the organisms of interest (Ljubicic, Okpakok, Robertson, & Mearns, 2018; Lantz & Turner, 2003; Woodward & Marrfurra McTaggart, 2019; Kassam K.-A. , 2010). These rules allow for co-existence not just within SES, but between human communities which embrace different ecological practices (Kassam K.-A. , 2010).

Recently, both researchers and communities of practice have become interested in the ways in which Traditional Ecological Knowledge (TEK) can inform responses to the wicked problems of the 21st century (Alexander, et al., 2011; Petzold, Andrews, Ford, Hedemann, & Postigo, 2020; Green & Raygorodetsky, 2010; Nyong, Adesina, & Osman, 2007). The use of Seasonal Rounds presents themselves as a participatory method by which to engage communities of practice on issues of social-ecological management, the maintenance of biocultural diversity, and fostering adaptive capacity to global environmental change and disturbance. Seasonal rounds are versatile and can be documented in several ways; in charts, graphs, lists, or as in this research, through the creation of circular figures, as can be seen in figures 3 and 4 below (Kassam, Baumflek, Ruelle, & Wilson, 2011). They can be described as “place-based narratives that give insight into the living world and the sequence of festivals and other events that link a people to their habitat” (ibid.). Done well, they are an easily comprehensible snapshot into the environmental stewardship practices of individuals and communities. These practices are intimately tied to their local surroundings and influence their day-to-day lives, identities, and cultures.

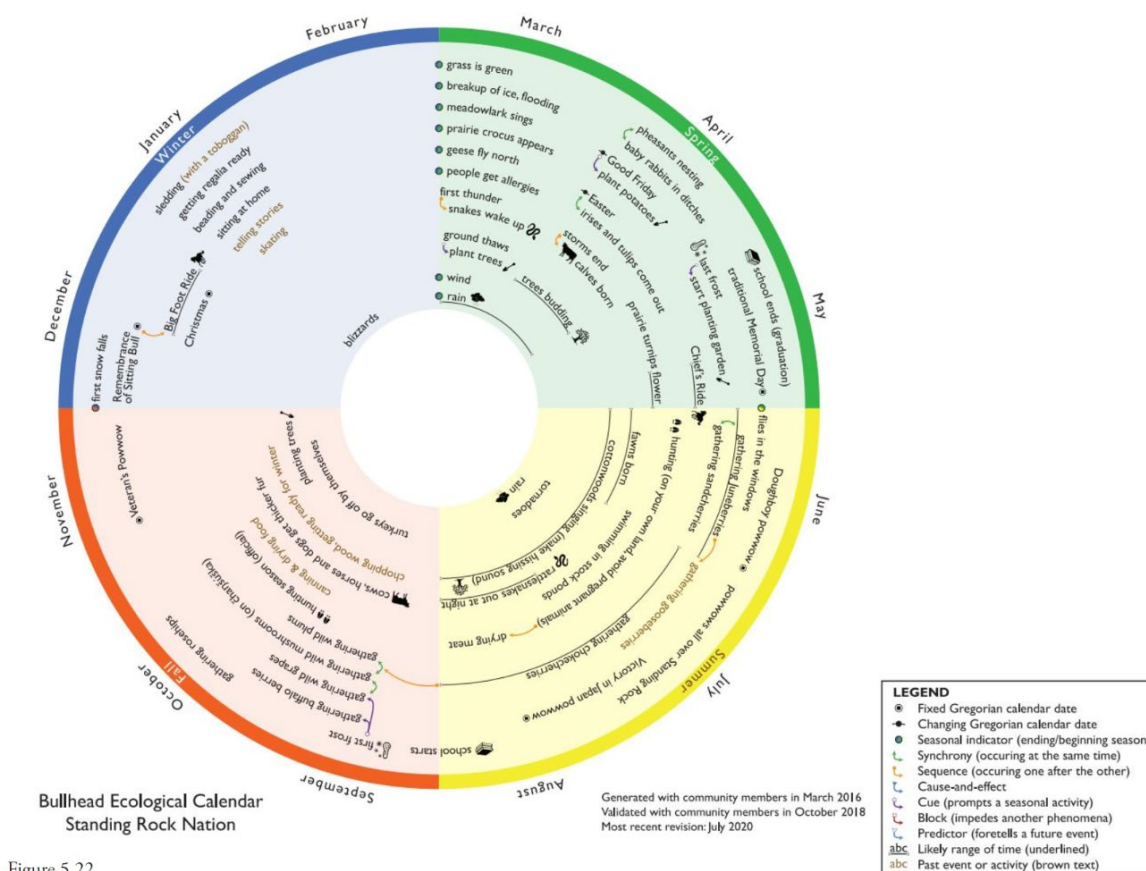


Figure 5.22

Figure 3. Ruelle et al.'s (2022) Seasonal Rounds

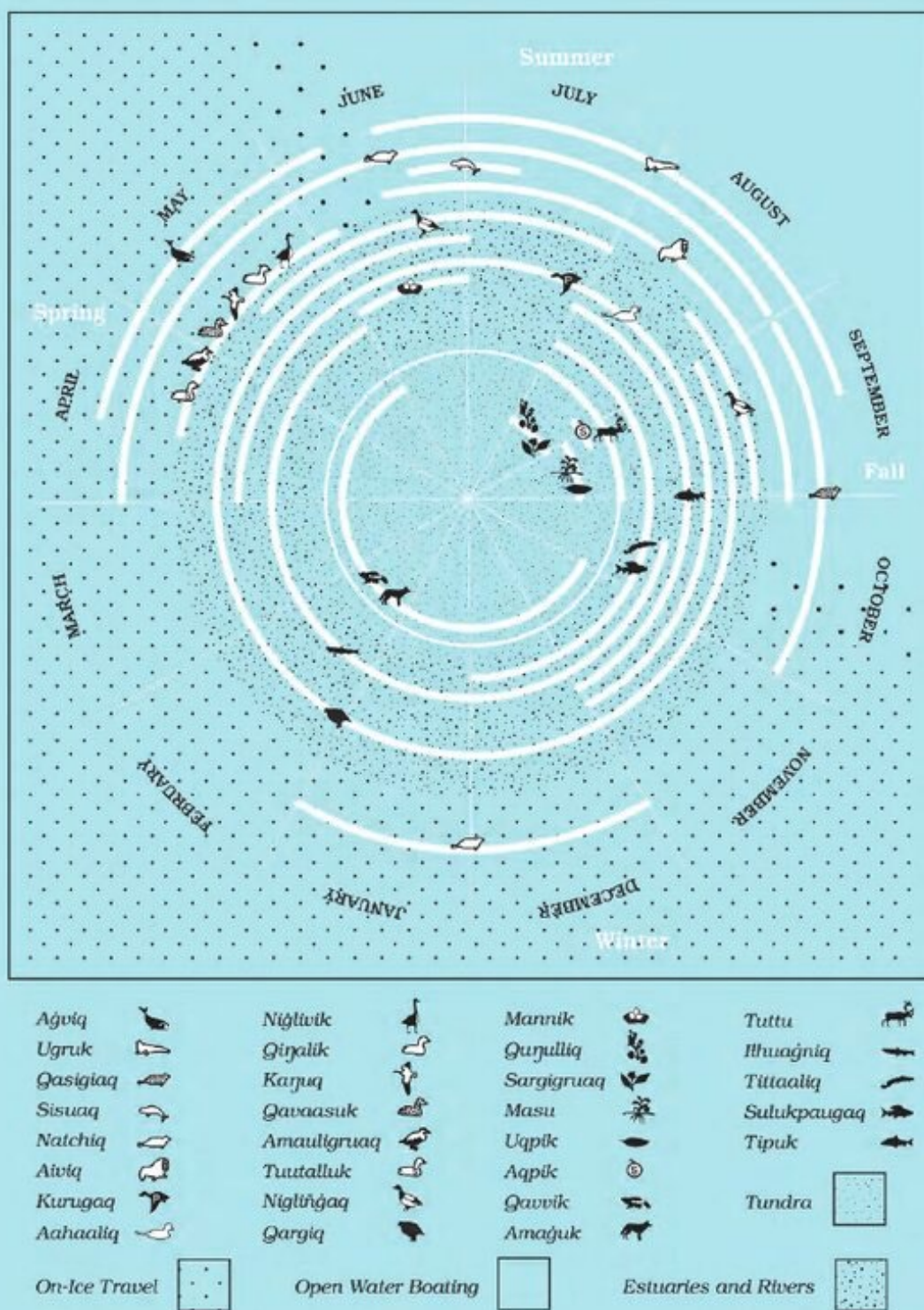


Figure 4. Seasonal profile of subsistence harvesting in Wainwright, Alaska (Kassam, Baumflek, Ruelle, & Wilson, 2011)

Prior research has positioned seasonal rounds as a method of seasonal timekeeping, an indicator of environmental stewardship, and a participatory method for building adaptive capacity and resilience. We accept all of these uses, and proffer the use of seasonal rounds as a method of assessing EI, which is itself a social mechanism of social-ecological systems resilience (SESR).

DOCUMENTING PHENOLOGICAL USE OF NATURAL RESOURCES

Cataloging Traditional Ecological Knowledge for Future Use

Traditional Phenological Knowledge (TPK) has been established as important to the language, cultural beliefs, ecological practices, and conceptions of time of countless indigenous and local communities (Lantz & Turner, 2003). One reason for the importance of documenting the phenological use of natural resources through the creation of seasonal rounds is as a means of recording socio-culturally important knowledge for future generations. Much contemporary research involving Traditional Ecological Knowledge (TEK) and Traditional Phenological Knowledge (TPK) involves a collaboration between researchers and communities of practice and are initiated by knowledgeable community members concerned about the loss of ecological knowledge and the ramifications of that loss for future generations. FiveCrows et al. (2023) have worked with indigenous groups in the Columbia River basin on leveraging TEK towards not only to support fishery recovery in the basin, but to catalogue knowledge for later learning and use by indigenous groups residing in the basin. In Australia's Daly River Region, Indigenous Ngan'gi Australians concerned about the loss of their language, TEK, management practices, and relationship to their biophysical environment collaborated with water management researchers to create traditional rounds and calendars which document TEK as a tool for indigenous communities and local resource managers to collaborate on future stewardship initiatives (Woodward & Marrfurra McTaggart, 2019). Similarly, Chambers et al. (2021) document the use of seasonal rounds amongst meteorological services in the Pacific Ocean region (Samoa, Vanuatu, Palau, the Solomon Islands, and Tonga) to communicate climate variability and forecasting in local island communities. This research accepts all of these implementations, and puts forward the creation of seasonal rounds as a method of determining environmental stewardship activities, and well-fleshed out seasonal rounds as an indicator of strong ecological identities.

Demonstrating Environmental Stewardship

A small but insistent body of research frames Traditional Ecological Knowledge (TEK) and Traditional Phenological Knowledge (TPK) as an indicator of environmental stewardship and as a means of environmental restoration in SES. Here, seasonal rounds are less a scholarly artifact as they are an internalized knowledge mechanism that individuals and communities of practice drawn upon to survive within a social-ecological system. Working with Aboriginal and Torres Strait Islanders in Australia, Green et al. (2010) makes the case for the presence of TEK as a catalyst which enables environmental stewardship and the execution of ecological management activities. In the Brazilian Amazon, the lives of indigenous Tukano communities are structured through sociocultural practices deriving from an ecological management system of the surrounding riverine fisheries and the production of bitter manioc. The knowledge catalyzing this management is brought about using complex seasonal rounds which document the phenology of local plants and animals in detail, to ensure that ecological management practices meet the needs of communities without compromising the wellbeing of the social-ecological system. Environmental stewardship practices are not just a means of survival, but an essential cornerstone of the Tukano's cultural foundation (Cochran, et al., 2016). The communities surrounding the Patos Lagoon, also in Brazil, employ a similar technique of using seasonal rounds to determine the abundance of the different fish species throughout the year, so as not to deplete existing fisheries (Kalikoski, Quevedo Neto, & Almudi, 2010). Similarly, communities in the eastern Himalaya depend upon the incorporation of certain species into their seasonal rounds to determine optimal times for certain ecological management activities. Specifically, the many *Rhododendron* species of the Himalayas signal to many high-altitude indigenous communities that it is time to harvest the wild fruits of spring and begin plowing for corn planting (Hart & Ranjitkar, 2019). For many communities, this is also the time to check in on the progress of other vitally important plants which come into season later in the year and to determine if interventions are needed (ibid.). Chisholm-Hatfield, et al. (2018) supplements these insights with their own observations of indigenous observations and documentation of plant and animal seasonality and corresponding management techniques across the Southwestern United States. Indigenous participants in their study state that TEK in the form of seasonal rounds informs ecological management and overall stewardship decisions across both time and space (ibid.), and the execution of ecological management activities contributes towards the well-being of both human communities and the greater system in which they are nested.

Demonstrating Adaptive Capacity and Social-Ecological Systems Resilience

Other literature addresses seasonal rounds as a tool for building adaptive capacity to a changing climate and enhancing social-ecological systems resilience (SESR) to disturbances. These insights have been split up mostly into two camps: (1) seasonal rounds as a method of discerning changes in climate through perception of changes in environmental management, and (2) seasonal rounds as a method of discerning changes in the social-ecological system and regional climate. As early as 2010, Kalikoski et al. (2010) and Cochran et al. (2016) were documenting the use of seasonal rounds to explore the dynamics of fisheries management over time in central and southern Brazil, finding that local people were changing their resource management practices along with the shifting climate. Similarly, Wilson (2014) corroborated those findings through the creation of seasonal rounds and interviews in the Athabascan village of Ruby, Alaska, in a study focusing on the land use and subsistence adaptations of local individuals in response to a changing climate. Turner & Reid (2022), also in North America, outline some of the ways in which indigenous peoples use seasonal rounds to embrace both predictability and change in their local environments, recognizing and adapting to a changing climate with the tools of knowledge they have accumulated over the centuries. Kassam et al. (2018), Kassam & Bernardo (2022), and Ruelle et al. (2022) term this trait “anticipatory capacity,” and outline the ways in which seasonal rounds contribute to food sovereignty and allow indigenous and rural societies to anticipate changes in climate based on periodic changes to their seasonal rounds. Haag (2021), in their examination of climate change detection in data-poor regions such as the Pamir Mountains of Afghanistan, proffers that the use of seasonal rounds “could also be transferred to the climate sciences to derive more robust information on site-specific weather and climate processes, while simultaneously strengthening effective transdisciplinary research” (p. 175).

THEORETICAL LINKS BETWEEN SEASONAL ROUNDS & ECOLOGICAL IDENTITY

This research explores the linkages between Ecological Identity and Traditional Ecological Knowledge. Kassam, Ruelle et al. (2021) give an overview of the development of seasonal rounds in the literature and their application as tools for cataloguing TEK (Woodward, 2010), demonstrating environmental stewardship, and as a tool for demonstrating and building anticipatory capacity to a changing climate. It follows that if the assessment of EI is a measurement of the likelihood of engaging in environmental stewardship activities such as resource use, acquirement of knowledge, and

conservation of resources and species, then seasonal rounds are a representation of an individual's actions in these categories. In societies which have endured immense societal, cultural, political, and environmental change in the last several centuries (Whyte, 2017), engagement with and use of seasonal rounds may have been a critical link to TEK which aided in enhancing overall resilience within a social-ecological system undergoing intense disturbance and change (Ruelle & Kassam, 2011). There are currently no linkages between EI and Seasonal Rounds in the academic literature, however this research attempts to outline and describe a potential relationship between the measurement of EI (the likelihood of engaging in environmental stewardship) and the demonstration of that stewardship through the creation of seasonal rounds. In doing so, we introduce the use of seasonal rounds as a participatory methodology which grounds EI in the use and care of natural resources in rural and smallholder contexts.

C. SOCIAL MECHANISMS OF SOCIAL-ECOLOGICAL SYSTEMS RESILIENCE

SOCIAL-ECOLOGICAL SYSTEMS RESILIENCE – A BASIC UNDERSTANDING

Social-ecological systems (SES) are complex adaptive units comprising of social (human) actors and their institutions, living members of the ecological community such as plants and animals, and biogeochemical components such as climate (Partelow, 2018). Figure 5 models some of the basic dynamics of a typical SES. SES researchers focus on the interdependent linkages between social and environmental change, how those linkages influence human management and use of natural resources, and how different SES can be managed sustainably for both people and environment (Berkes, Colding, & Folke, 2002; Partelow, 2018). With the end goal of sustainable management of SES and natural resources, researchers have searched for an approach with which to understand the dynamics of SES (Folke, 2006). Increasingly, these researchers are turning to the resilience perspective to achieve that goal (ibid.).

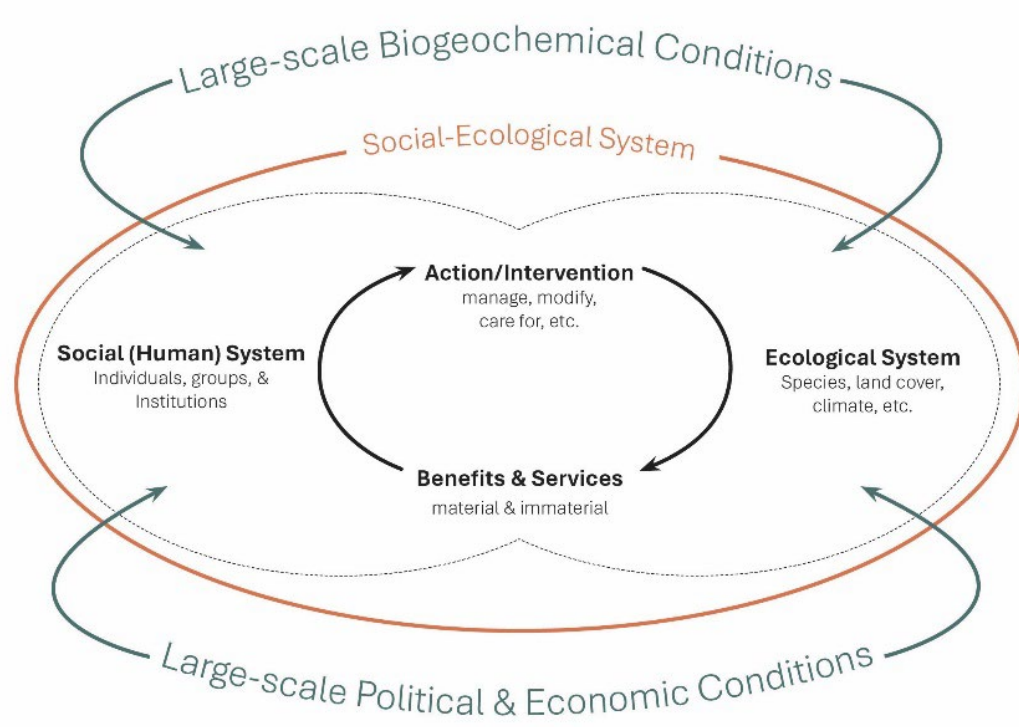


Figure 5. A conceptualization of a social-ecological system, its external influences and internal components (Virapongse, et al., 2016)

Resilience has become a buzzword in multiple disciplines (Walker, 2020). But the term as we understand it today and as it pertains to SES originates in ecology, where two definitions pervade most of the research literature. The first, termed “engineering resilience,” is defined as the ability of an ecological system to return to a single, ideal equilibrium state following a disturbance (Pimm, 1984; Holling, 1996). The second, termed “ecological resilience,” was defined by Holling (1973) as the amount of disturbance that can be absorbed by an ecological system before it changes into another state. Holling’s concept of resilience...

“...determines the persistence of relationships within a system and is a measure of the ability of these systems to absorb change-of-state variables, driving variables, and parameters (disturbances), and persist. In this definition resilience is the property of the system and persistence or probability of extinction is the result” (Holling, 1996, pg. 38).

Ecological resilience thinking implies the possibility of an ecosystem moving between multiple stable states, or “basins of attraction,” over time (ibid.). Often referred to as “Holling’s resilience” (Dakos & Kéfi, 2022), this definition guides most research on SESR.

In the Anthropocene there are virtually no existing ecosystems which are not influenced, intentionally or otherwise, by humans (Vitousek, Mooney, Lubchenco, & Melillo, 1997). Therefore, although the presence of human society is implied in Holling's resilience, a reconceptualization of the term is ongoing, to fully incorporate the "social" of social-ecological systems for the purposes of conducting resilience research involving human individuals, institutions and communities. Folke et al. (Folke, Biggs, Norström, Reyers, & Rockström, 2016) clarifies social-ecological resilience as "the capacity to adapt or transform in the face of change in SES, particularly unexpected change, in ways that continue to support human wellbeing."

SOCIAL-ECOLOGICAL SYSTEMS RESILIENCE & THE ADAPTIVE CYCLE

Ecological resilience theory (Holling C. S., 1973) explicitly acknowledges that SES are complex systems which can exist in different stable states, and as SES experience change, whether gradually or through a sudden disturbance, they have the potential to shift abruptly to an alternative state (Jean Blair, Mabee, & Kobayashi, 2020). Disturbances can manifest in many forms, both anthropogenic and environmental in origin (Schoon & Cox, 2012). As members of a social-ecological community perish or persist within a system experiencing disturbance, the system itself is moving through phases which allow it to either maintain resilience, increase its adaptive capacity internally, or transform over time (Walker, Holling, Carpenter, & Kinzig, 2004). This movement has been coined the "adaptive cycle" (Holling, 2001), and is demarcated into four distinct phases; growth (r), conservation (K), release (Ω), and reorganization (α).

Each phase of the adaptive cycle models different levels of connectedness between members and components, different availability of resources, and of different potential for change and innovation. When a system shifts into a different state as the result of a disturbance, there is a breakdown of connections in the "release" phase. As the system begins to reimagine itself, living members of the system are scrambling to do the same. In the "reorganization" phase, new connections and relationships are being forged, resources are abundant, and the resilience of this new system is increasing. In the "growth" phase, successful elements, connections, and relationships between members of the community become dominant, and there is increasing homogeneity and decreasing innovation. The last phase before a system experiences a disturbance it cannot accommodate is called "conservation." Here, the system is highly connected, there is little room for

innovation or creativity, and resilience is at its lowest. At some point, a system in the conservation phase will experience a disturbance that it cannot absorb, and will collapse, beginning the adaptive cycle all over again. Together, adaptive cycles (modeled in Figure 6 below) operating at different scales within SES form a panarchy, which describes how a system can innovate and change across scales from microscopic to biospheric, sometimes over thousands of years (Holling, 2001).

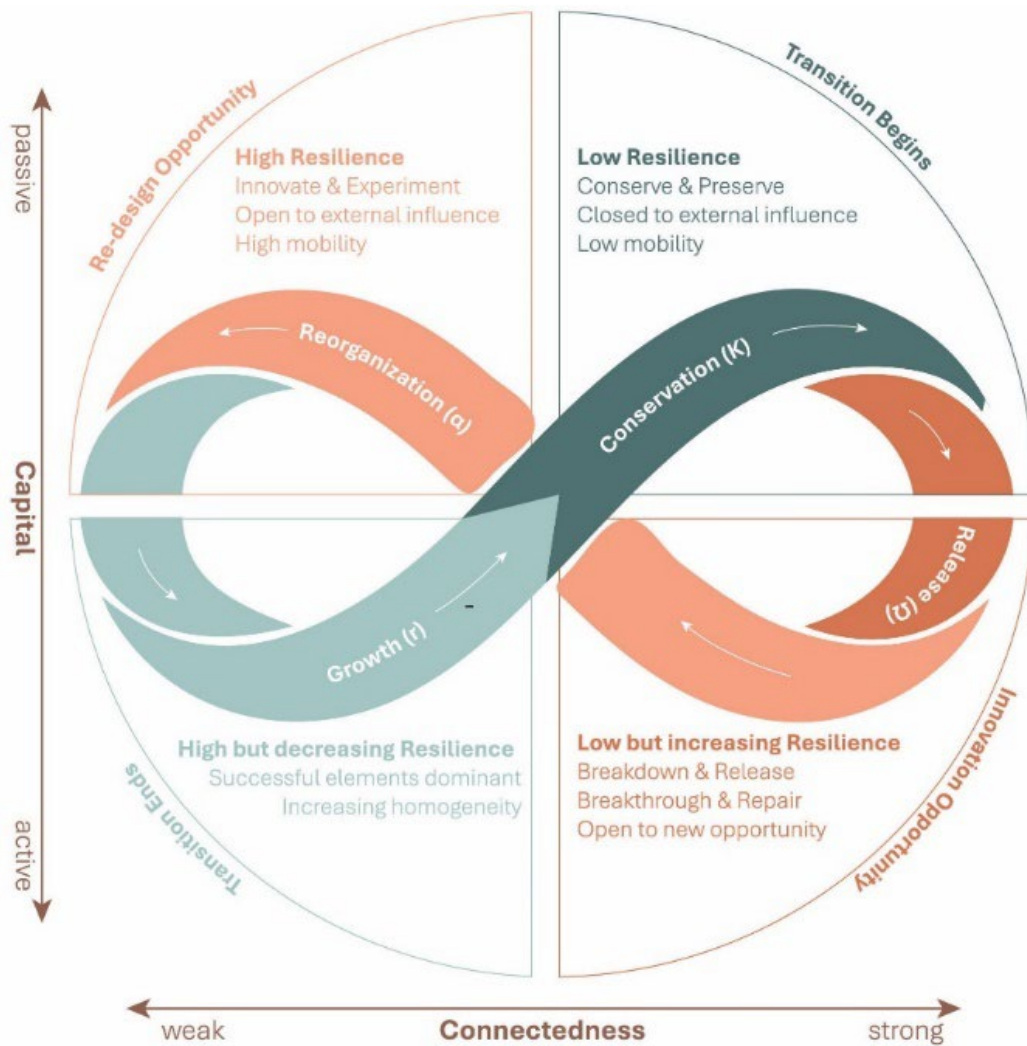


Figure 6. The adaptive cycle demonstrating its four phases of growth, conservation, release, and reorganization (adapted from (Wahl, 2020))

Actors within an SES, including human beings, influence the overall direction of the system's adaptive cycle, whether unintentionally through subsistence on the system's resources, or intentionally through direct management, control, exploitation, etc., of those same resources (Berkes,

Colding, & Folke, 2002; Glaser, Krause, Ratter, & Welp, 2008). From within an SES, the presence and actions of human individuals, communities, and institutions can have tangible impacts on a system and influence the direction and speed at which it moves through the adaptive cycle, whether it remains within the same state, or shifts into a novel one (Virapongse, et al., 2016). The project detailed here concerns itself with the processes that enable human beings to impact and influence a system and its resilience to disturbance. These processes, or “mechanisms,” are grounded in our social world, and termed “social mechanisms” of SESR (Berkes & Folke, 1998; Tidball K. G., 2012).

SOCIAL MECHANISMS OF SESR

The Oxford English Dictionary (OED) defines a mechanism as “a natural or established process by which something takes place or is brought about” (OED, 2023). When applied to the concept of SESR, a mechanism augments the intended outcome of increased social-ecological systems resilience (SESR), or by its absence, detracts from that same outcome. Berkes & Folke (1998) initially introduced idea of resilience mechanisms to the literature by asserting that systems which exhibit resilience in the wake of disturbances are functioning on a feedback of sorts, “by which information from the environment (including human society) can be received, processed, and interpreted.” Social institutions and individuals (and the mechanisms by which they operate) influence the development of ecological management practices that increase resilience in the wake of a disturbance or perturbation in the SES. Social mechanisms ensure that lessons are learned during the recovery from a disturbance, and that learned knowledge is incorporated into modified practices. These mechanisms, catalyzed by members of the SES which include humans, contribute not just towards the adaptation of human society in the wake of disturbances, but to the SES as a whole. Berkes & Folke (1998) split resilience mechanisms into *ecological practices*, which directly affect the functioning of an SES, and *social mechanisms* (modelled in Figures 7 and 8 below), which govern the cultural values, ethics, and norms of a society within an SES, and determine that society’s behavior and influence on the overall system. By this logic, maintaining social-ecological resilience is strongly dependent on social mechanisms.

Social Mechanisms

- Traditional Ecological Knowledge
- Structure and dynamics of institutions
- Mechanisms for cultural internalization
- Worldview & cultural values
- Urgent Biophilia
- Restorative Topophilia
- Memorialization
- Social-ecological Symbols and rituals
- Discourses of defiance
- **Ecological Identity**

(Berkes & Folke, 1996; Tidbell, 2012)

Ecological Management Practices

- Monitoring change in ecosystems & resource abundance
- Total protection of certain species
- Protection of vulnerable life stages
- Protection of specific habitats
- Temporal restrictions of harvest
- Multiple species integrated management
- Resource rotation
- Management of succession
- Watershed management
- Managing processes at multiple scales
- Responding to/managing pulses and surprises
- Nurturing sources of renewal

(Berkes & Folke, 1996)

Figure 7. A listing of the current social mechanisms and ecological management practices contributing to resilience, as they are established in the literature.

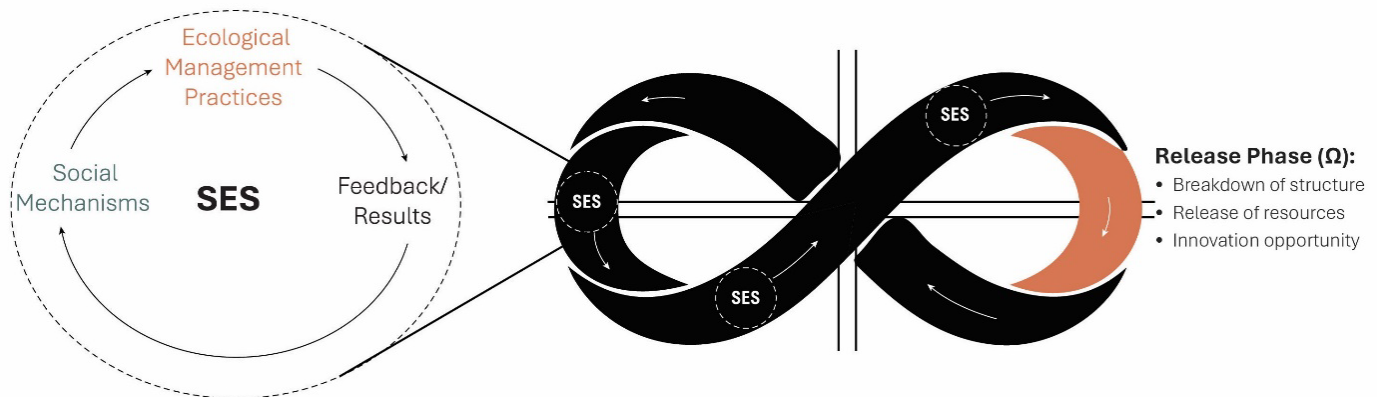


Figure 8. A visualization of how social mechanisms and ecological management practices of SESR contribute to the iterative process of maintaining and enhancing resilience within SES, as SES move through the adaptive cycle in an infinite process of adjustment, evolution, and maintenance of resilience

Berkes & Folke (ibid.) initially put forward several social mechanisms of SESR which have been explored and validated in subsequent academic literature. These include (1) the generation, accumulation, and the transmission of Traditional Ecological Knowledge (TEK) and Traditional Phenological Knowledge (TPK), (2) the structure and dynamics of institutions, (3) the mechanisms for cultural internalization, and (4) worldview and cultural values. These social mechanisms are somewhat ambiguous by design, and have invited exploration, modification, and addition, which later researchers have endeavored to do. Following the establishment of these initial mechanisms, Tidball (2012) proffered direct additions to the list of social mechanisms, using post-disaster contexts and case studies to highlight (1) urgent biophilia, (2) restorative topophilia, (3) memorialization mechanisms, (4) social-ecological symbols and rituals, and (5) discourses of defiance. These additional five social mechanisms, like the ones put forward by Berkes & Folke (1998), describe ways in which human individuals and society operate within SES to adapt to and build resilience in the wake

of one disturbance after another in subsequent waves of improvement, what Tidball & Stedman (2013) might refer to as a “virtuous cycle.”

D. RESEARCH SETTING

THE MID-HILLS OF WESTERN NEPAL – A BIOCULTURALLY DIVERSE SOCIAL-ECOLOGICAL SYSTEM

Nepal is a landlocked country of about 30 million people in South Asia, bordering India to the south and Tibet to the north. In terms of area, the country can be compared to the US state of Pennsylvania. For its small geographic area, Nepal boasts major biodiversity. The country hosts 6 distinct biomes, 35 different forest types, and 113 ecosystem types (Lillesø, Shrestha, Dhakal, Nayaju, & Shrestha, 2005; UN Convention on Biological Diversity, 2023). Nepal’s three major ecological zones, the Terai flatlands, the Middle Hills, and the High Himal, are cumulatively home to over 22,000 species known to science (shown in Figure 9 below) (ibid., 2024).

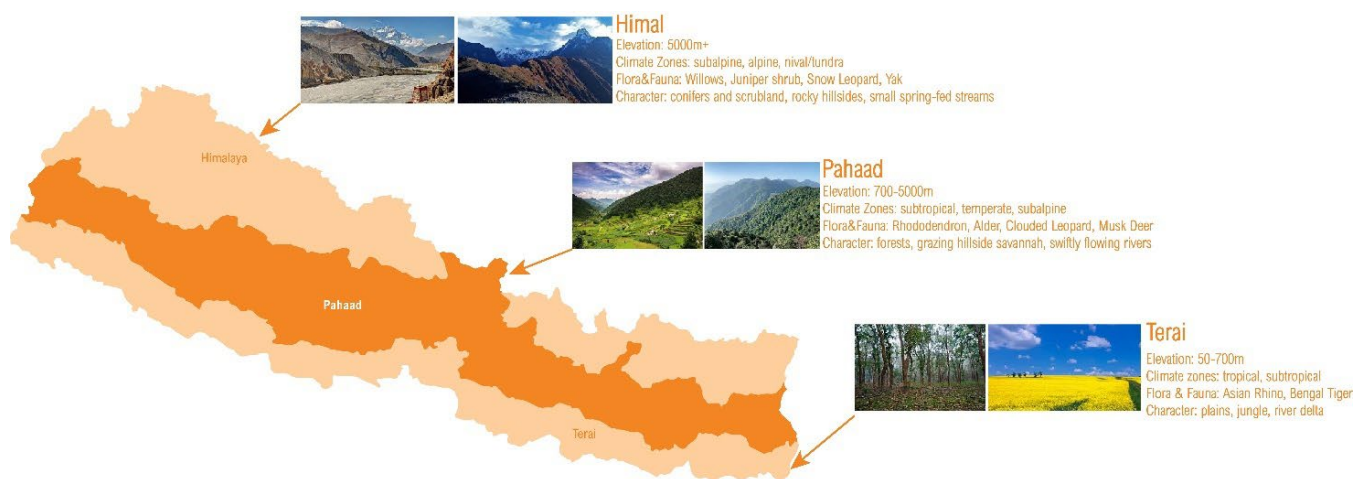


Figure 9. The three main ecological regions of Nepal

The Middle Hills (or Pahaad) constitute 68% of Nepal’s total area and host most of the country’s biodiversity (Shrestha, 1992). Straddling the completely flat Terai and the Himalayas, the Pahaad ranges in elevation from 700 to 3500m above sea level. This region is considered the heartland of Nepal (ibid.) and is comprised of what would be considered anywhere else to be rugged mountain topography, cut through with rivers which originate on the Tibetan Plateau and eventually make their way onto the Gangetic Plains in India. The climate of the Pahaad is complex. Owing to the extreme changes in altitude and topography, the climate can vary from sub-tropical to cold temperate over

relatively short distances (ibid.). In the deepest river valleys, summertime temperatures may reach 100 degrees Fahrenheit, while wintertime temperatures on the higher ridges easily fall below freezing and heavy snow is common (Gopirajan, Kumar, & Joshi, 2022). Additionally, Nepal experiences an intense monsoon season, in which roughly 80% of the annual precipitation occurs between June and September (Lillesø, Shrestha, Dhakal, Nayaju, & Shrestha, 2005). The Monsoon is followed by a long drier season which is punctuated by a brief, rainy period in winter, and spring hailstorms, which often herald the arrival of the monsoon (Shrestha, 1992; Upadhyay, 1970).

Amongst the substantial geological, climactic, and biological diversity of the Pahaad, the region is suffused with considerable cultural and ethnic diversity. This heterogeneity reflects the country's long history of migration, invasion, conquest, and commerce between the civilizations of the Indian subcontinent and the Tibetan Plateau (Shrestha, 1992). In the modern day, the Pahaad is home to over 100 distinct ethnic groups which practice a range of occupations, religions, and social-ecological practices (Hays, 2022). "Pahaadis," or hill-dwellers as they are known in Nepal, have developed intensive agrarian and ecological management systems over millennia which work within some of the most varied and difficult environments on Earth to create livelihoods in the region. These sophisticated agroecosystems are the result of numerous interactions between Pahaadi crops, livestock, and the surrounding ecosystems (Shrestha, 1992), and, until recently, allowed Pahaadi communities to build and enhance resilience to change and disturbance. Social and ecological practices traditionally informed each other in multiple feedbacks, building adaptive capacity in communities which rely on these feedbacks.

The Magar community is one indigenous ethnic group amongst roughly 125 others (ibid.) which have carved a vibrant, living community out of the challenging terrain of the Pahaad, settling primarily in the mid-Western hills, skirting the Annapurna and Dhaulagiri Mountain ranges in what is now Gandaki Province (de Sales, 2011). Over the course of thousands of years of social-ecological feedback and interaction, the Magar community has carved out a unique social-ecological system in the shadow of the Himalayas - one in which the ecological management practices of the people themselves contribute to the rich biocultural diversity of the region.

This research frames the mid-hills of Nepal and the Magar indigenous ethnic community as a unique, bioculturally diverse social-ecological system for the purpose of exploring Ecological Identity (EI) and social-ecological systems resilience (SESR) within this system and community. Here, we

review the available literature which similarly frames the mid-hills Magar community as a distinct SES, any existing anthropological or cultural ecological research working within this system, research examining SESR in this geographic area, and the existing literature on EI, environmental attitudes, and propensities towards environmental stewardship amongst Nepali smallholder farmers in the mid-hills. This research will not only provide a foundation for the diverse topics in this thesis, but it will also serve to give an overview of the bounded social-ecological system being examined, as well as a characterization of the communities within this social-ecological system.

EXISTING RESEARCH IN THE MID-HILLS OF WESTERN NEPAL

The Magar Indigenous Ethnic Group – Existing Anthropological & Cultural Ecological Work

There is a small body of research focusing on the Magar indigenous ethnic group and community, their origins and history in Nepal, settlement patterns and community structure, occupations, religious and spiritual practices, relations with surrounding groups and as citizens of Nepal, as well as their relationship with the surrounding Pahaad landscape and subsequent ecological practices.

The Magars are one of the largest indigenous ethnic groups in Nepal, constituting roughly 6.9% of the national population (Government of Nepal, 2021). The specific origin of the Magar people is lost to time, but current scholarship believes they migrated into Nepal from Central and Eastern Asia, and that they are primarily Tibeto-Burman in origin (Hitchcock, 1966; Bista, 1967; de Sales, 2011). A small Magar community exists in the Eastern Hills of Nepal, but within the last several thousand years, most of the Magar community settled in the foothills of the Annapurna and Dhaulagiri ranges in the west of the country (Cemjong, 2003; Bista, 1967). This region constitutes a substantial geographic portion of present-day Nepal, and for much of its history was known as the *Bara and Athara Magarat*, which translates to “the 12 and 18 Magar Kingdoms.” This corresponds to the split in Magarat between Northern and Southern Magars, with the 12 kingdoms in the south inhabited by southern Magars and the 18 in the north inhabited primarily by *Kham* or northern Magars, although there were diplomatic ties, interaction, and trade between the two regions. Figure 10 illustrates the traditional location of the Bara and Athara Magarat within the borders of modern-day Nepal. Many modern-day boundary lines for Nepal’s districts and provinces are derived from the historic boundaries of these kingdoms (Hitchcock, 1966; Mikesell S. L., 2002). During the Shah Conquest of Nepal, Magarat was rolled into

the Hindu kingdom and the caste system under the classification of *adivasi janajati*, indigenous peoples who have converted to Hinduism but are not included in the traditional caste system followed by the Indo-Aryan Khas peoples of Nepal (Toffin, 2009). The exception to this event were the Khaikhe Magar community in present day Dolpa district, which resisted conquest and conversion and continue to practice Buddhism and animism as they did historically (de Sales, 2011).

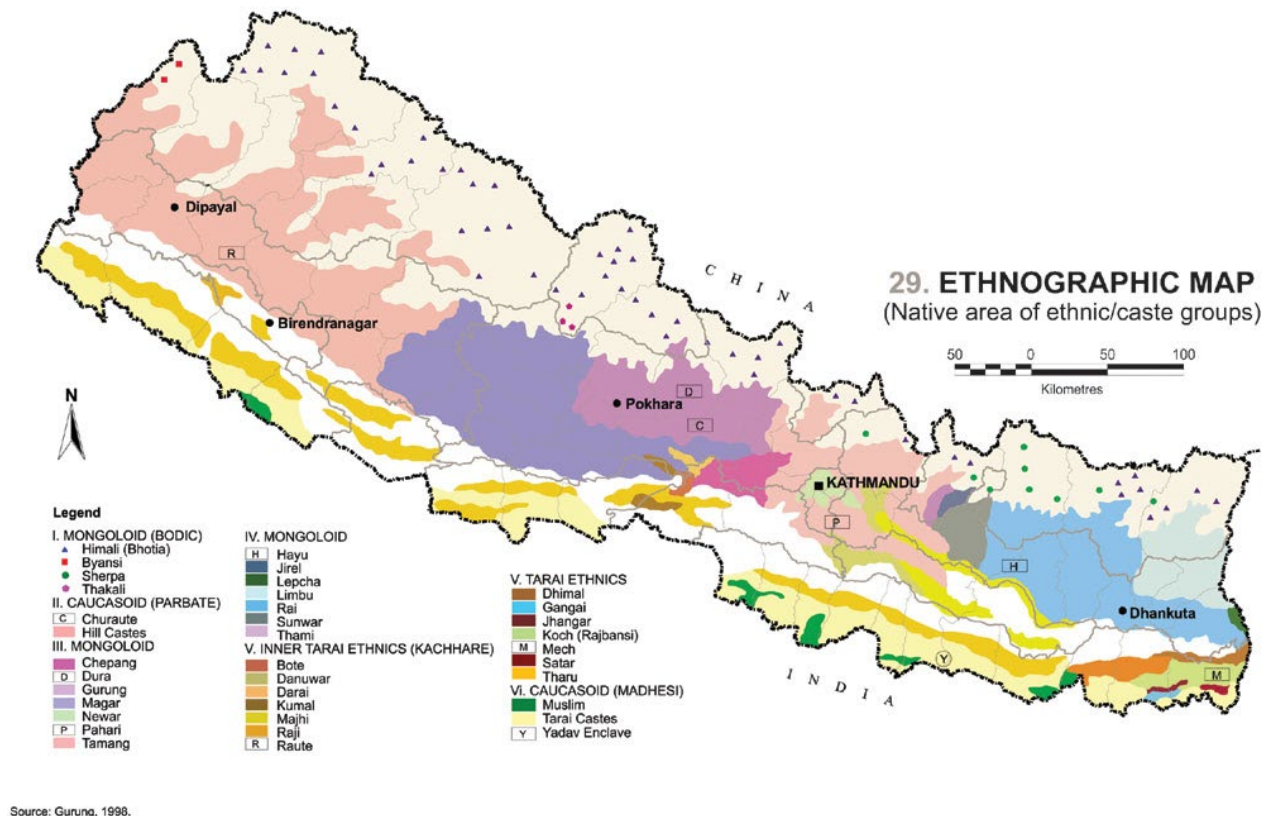


Figure 10. An ethnographic map of Nepal with the Magar community shown in purple (Gurung, 1998)

Today, the Magar community, all their diverse factions and clans, can be found in much the same area as the historic Magarat. They constitute a large portion of the population in Gandaki and Lumbini provinces, specifically in the districts of Dolpa, Myagdi, Rukum (west and east), Rolpa, Baglung, Parbat, Kaski, Palpa, Gulmi, Arghakanchi, Pyuthan, Syangja, and Tanahun (Ahearn, 2002; Government of Nepal, 2021). They practice a variety of livelihoods, such as smallholder farming, pastoralism, craftsmanship (masonry, woodworking, etc.), and work as day laborers (de Sales, 2011). Notably, many Magar Nepalis have gained worldwide renown as members of the Gurkha regiments which constitute the elite forces of the Nepali, Indian, and British Armies. Serving in these regiments is

both a traditional and contemporary point of pride for Magar individuals, their families, and communities (Vansittart, 1895; Hitchcock, 1966; Thapa Magar, 2019). Figures 11-13 display snapshots of Magar life within the case study village. Recently, households in Magar communities have also begun engaging in international labor migration, establishing a large remittance economy in the region through employment in countries such as India, Malaysia, and the Gulf Coast Countries (Hitchcock, 1961; Thapa Magar, 2019).



Figure 11. A group of Magar women walk through hillside rice terraces



Figure 12. A formal dancing group of Magar women partake in the celebrations for Saun Sakranti, a major holiday that occurs in the middle of monsoon season

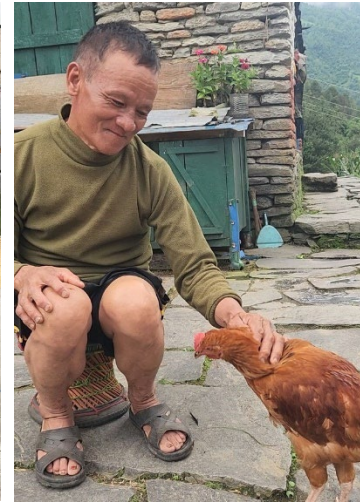


Figure 13. A Magar man plays with his chicken

Most Magar people and researchers on Magar society will state that “Magars have no legends of origins from another place,” (Hitchcock, 1966; Khattri, 2003; Sapkota, 2008). Thapa Magar writes of Magars:

“[They] think that they have occupied and used their land for centuries; have changed the very shape of the mountain upon which they live with their terraces; have worn footpaths connecting farmsteads deep into the soil and those stone resting platforms for wayfarers under the great roots of the banyan trees planted long ago to provide shade enclose. They feel they belong where they are, —and indeed they do, for the people fit the land and the land fits them. And not only do the people live on their land as they feel they always have, but their many ‘godlings’ that control life and the resources upon which life is based are at home there also and must be treated with regular sacrifices of food” (pg. 3).

These beliefs foster a deep psychological and spiritual attachment to the land on which they live, which is reflected in their religious, spiritual, and ecological practices. Most Magars practice a

combination of Hinduism and Shamanism, reflected in the fact that they work with Hindu priests and brahmins for weddings, funerals, and major holidays, but continue to celebrate Magar-specific festivals and holidays and rely on the use of local medicinal healers (Hitchcock, 1966; Sapkota, 2008; Thapa Magar, 2019). Exemplifying these practices is the annual celebration of the Bhume Puja festival. The name translates to “Earth worship,” and is a celebration of the Magar earth goddess and of gratitude towards the earth and its bounty. Bhumi is a neglected god amongst the “higher castes” of Nepal yet is central to the Magar community and its connectedness to the land (Lecomte-Tilouine, 1996). This connectedness is also demonstrated through the knowledge, use, and management of hundreds of species, both plant and animal, for consumption, medicinal, ritual, and spiritual purposes (Khatti, 2003; Sapkota, 2008; Budha-Magar, 2020; Kutal, et al., 2021). Figures 14-18 below display some scenes of Magar spiritual life within the case study village.



Figure 14. The Magar community celebrating Bhume Puja, a major Magar holiday, at the research site



Figure 15. A young girl assisting in the festivities for Bhume Puja, a major Magar holiday



Figure 16. A young girl assisting in the festivities for Bhume Puja, a major Magar holiday, at the research site



Figure 17. Community members at the research site line up next to the community temple with offerings of chickens for the Bhume Puja festivities, a major Magar holiday



Figure 18. Men perform the Maruni Naach during Bhume Puja, a major Magar holiday

Existing SES (SES) resilience research in Nepal's mid-hills

The Pahaad region of Nepal and its residents have been identified as especially vulnerable to the effects of a changing climate (Pandey & Bardsley, 2015; Gopirajan, Kumar, & Joshi, 2022; Agrawal, et al., 2021). As a result, there is significant contemporary interest in the region amongst researchers who study climate and environmental change (Kumar Jha, Negi, Alatalo, & Negi, 2021), social-ecological vulnerability (Wyss, et al., 2022), and what individuals and communities in this region are doing to enhance resilience within their SES (Gupta, Nishi, & Gasparatos, 2021). Within the Pahaad, much of this research is concentrated in the Annapurna and Dhaulagiri regions, where Magar communities constitute a majority of the population.

As a country, Nepal has undergone significant social change since becoming a member of the global community in 1955 (Croes, 2007). These changes have been especially evident in the Pahaad region. The federal government, working together with foreign aid and development agencies, have reached further and further into the Pahaad, which was almost untraversable by vehicle until the 1990s, constructing roads and other infrastructure, bringing social services, and seeking to connect this region, its resources, and its people to the wider world (Beazley & Lassoie, 2017; Aryal, Cockfield, & Maraseni, 2018). Tourism has become a major force in the Pahaad, with the region's beauty and proximity to the high Himalayas, drawing thousands of foreign and domestic sightseers annually (ibid.). This has spurred a cottage industry of teahouses and homestays, especially along the major trekking routes such as the Annapurna Circuit and the Everest Base Camp trek. Connecting mountain labor to the global economy has led to a huge increase in circular labor migration, which has become a major source of income and livelihood for a large percentage of Pahaadi households. Roughly 50% of all households reporting having at least one person sending remittances home from abroad (Government of Nepal, 2021). This change has affected the economies of small Pahaadi communities, leading some households to concentrate their efforts on trekking hospitality, and others to send members abroad to earn extra income, leading to the neglect of traditional pursuits such as animal husbandry and smallholder agriculture (Croes, 2007; Dhakal, et al., 2022).

Researchers have identified Nepal, and the Pahaad region in particular, as vulnerable to ecological change. Several vulnerability indices identify Nepal as one of the most vulnerable countries to climate change (Eckstein, Kunzel, Schafer, & Winges, 2020; Chen, et al., 2023). Average annual temperatures nationwide have been rising by ~0.06°C/year since 1975, and temperatures are

projected to increase another 1.3-3.8 degrees by 2060 (Nepal MoPE, 2016). The country has also seen a significant decrease in precipitation, with an anticipated total decrease of 10-20% by 2060, owing to later arrivals of the annual monsoon (ibid.). Most of these changes are predicted to affect the population-dense mid-hills Pahaad region with significant impact (Government of Nepal, 2019). Rural smallholders in the Pahaad, which constitute most of the population (Government of Nepal, 2021) are perceiving changes which threaten their livelihoods, both traditional and modern. In the Annapurna and Dhaulagiri regions specifically, where the majority of Magar communities are located, community members are perceiving increases in temperature (Dangi, et al., 2018; Devkota, et al., 2017; Karki, Burton, Mackey, & Adam, 2020; Roxburgh, et al., 2021), unpredictable rainfall or a decrease in overall precipitation (Dangi, et al., 2018; Sujahku, et al., 2016), an introduction of mosquitoes and new mosquito-borne illnesses (ibid.), an increase in pathogens both plant and animal in origin (Rabbani, Shafeeqa, & Sharm, 2016; Paudel, Tiwari, Raut, Sitaula, & Poudel, 2019), and an overall change in seasonal weather patterns (Gautam, 2017; Karki, Burton, Mackey, & Adam, 2020). These changes introduce disturbances that may make it difficult for Magar communities to enhance resilience within their social-ecological system.

Households in the Magar community and elsewhere in the Pahaad are responding to changes and disturbances in a variety of ways. Karki (2020) finds that smallholder farmers in the Pahaad are dealing with new challenges primarily by adapting their agricultural practices and through the diversification of income sources to create redundancy in the face of unexpected change. The introduction of crafts, an increase in labor migration, and diversification of crops were notable in their uptake. Epstein et al. (2017) finds a similar outcome in their examination of Pahaadi farming communities in the wake of 2015 earthquake; the adoption of cash crops and economic connectivity to larger urban markets have been a fail-safe solution for smallholders affected by natural disaster. With a steady increase in labor migration in the last few decades (Government of Nepal, 2021), many researchers have noticed a corresponding trend of forest succession in the mid-Hills. McGunnigle et al. (2023) noted that many communities in the mid-Hills are leveraging the availability of abandoned land to cultivate forest products such as fruits, specialty woods, and medicinal herbs. This process diversifies communities economically, creates sustainable livelihood outcomes, and ultimately enhances resilience in Pahaad SES.

In the Annapurna-Dhaulagiri transect specifically, Magar communities and others are adopting similar practices. Transhumant practices have been identified as having the potential to enhance

resilience to disturbances in Magar communities, as pastoralism is a livelihood option which has the potential to increase biodiversity within SES (Aryal, 2015). However, these practices are especially threatened by socio-economic and climatic changes (ibid.). Communities in this area are shifting away from traditional agropastoral practices towards a blend of traditional practices, tourism, and the production of cash crops such as fruits, medicinal plants, and vegetables bound for markets in Nepal's rapidly urbanizing valley landscapes (Konchar, et al., 2015; Pandey, 2019). Beazley (2017) comments that economic connectivity contributes towards socioeconomic wellbeing and poverty alleviation in the Annapurna-Dhaulagiri region but points out that the environmental impacts of such connectivity may pose long-term negative effects for indigenous Pahaadi communities such as the Magar.

Environmental Attitudes and EI Amongst the Nepalese

Research on environmental attitudes in general and EI in particular is concentrated mostly in western and urban settings. Hardly any literature exists on this topic that addresses Nepal specifically, and that which exists lies principally in examining environmental attitudes, a singular component of a holistic EI. None of the existing literature examining EI in Nepal focuses on the differences between different ethnicities, however Ohnishi et al. (2013) carried out a comparative study between university students in both Nepal and Costa Rica, using cognitive surveys which summed both values and knowledge around environmental issues, attitudes towards environmental degradation, and societal responsibility towards addressing these issues both now and in the future. They found Costa Rican students to have clear, unified opinions indicating societal responsibility towards addressing environmental issues, and environmental values tended to line up with this sentiment. Nepalese respondents were more disjointed in their attitudes regarding the environment and found to hold more moderate opinions about societal responsibility towards nature. A similar study amongst Nepalese adolescents (Yadav, 2018) found that many youths recognize their own role in addressing environmental problems and that they engage in environmentally responsible behaviors as much as they are able. This study also found that environmental attitudes and behavior would appear to be influenced by socio-demographic variables such as income and monetary capacity for engagement. This barrier may also explain the disparity between Nepalese and Costa Rican study participants (Ohnishi et al., 2013). Perhaps the most detailed and recent examination of ecological attitudes and identity comes from Regmi, Johnson, & Dahal (2020), with their evaluation of the 2-MEV (Model of Ecological Values) amongst Nepalese children. They state that the 2-MEV has been validated in

industrialized Western societies, but the reliability of a scale like this in a non-industrialized country like Nepal remains unknown. They find that the 2-MEV scale can be validated amongst Nepalese children, with some key differences in certain categories which might indicate cultural differences around concepts like environmental stewardship. Regmi, Johnson, & Dahal (2020) also noted a difference in 2-MEV scores in urban and rural contexts.

There is additional literature which examines environmental attitudes as they translate directly to environmental stewardship activities, bereft of the use of a measurement scale for said attitudes. Mehta & Kellert (1998) examine community-based conservation in Nepal's Makalu-Barun National Park and Conservation, finding that conservation which also works to address the needs of local peoples strongly influences environmental attitudes and community support for biodiversity conservation goals. Later, Mehta & Heinen (2001) found that conservation efforts that involve local communities, engage them in conservation issues, and encourage them to pursue sustainable natural resource-based livelihoods lead directly to improved environmental attitudes on the part of local people in both the Annapurna and Makalu-Barun Conservation Areas. Lastly, Stapp et al. (2016) found that household attitudes regarding conservation-related behaviors varied greatly between two rural Nepalese communities, depending on whether they had experienced significant forest loss or gain, and whether or not they participated in community forestry initiatives.

III. METHODS & ANALYSIS

A. INTRODUCTION & RESEARCH DESIGN

OVERVIEW

The last several decades have seen the development of research interest in the identification of drivers of environmental stewardship and Pro-Environmental Behaviors (PEB). Researchers have proposed Ecological Identity (EI) as one of these drivers, and fostered lines of inquiry around EI, and the development of myriad scales for assessing EI in individuals and communities, to better understand how EI may influence people's actions in and towards their natural environment. Most existing work on EI focuses on urban communities and students of various ages, and most existing measurement scales have been developed with these populations in mind. Prior to this study and to the knowledge of the author, there exists little, if any, academic literature examining EI and subsequent environmental behaviors amongst rural, indigenous, or smallholder communities and individuals, or whether existing assessment scales translate well into use among these individuals and communities. Indigenous communities constitute a small portion of the overall global population but are responsible for the management of more than 25% of the world's land surface (Fa, et al., 2020). Rural, non-indigenous communities also bear a significant portion of the land management burden. Therefore, if ecological identities amongst resource-dependent smallholders, indigenous and rural, are shown to be suffering and declining, then there is the potential for a lower likelihood of individuals engaging in environmental stewardship practices and ecological management, loss of biocultural diversity, and an erosion of SESR to disturbance and perturbation. This research addresses the above issues through exploration of three research questions, which are re-stated below, along with some associated objectives:

- **Research Question 1:** Using an existing method for assessing EI, to what extent and in what ways do Nepalese smallholders view themselves as members of an integrated social-ecological system?
 - Research Objective 1: Explore possible patterns or correlations between EI and other traits held by study participants
 - Research Objective 2: Uncover potential drawbacks of existing scholarly methods for assessing and describing EI.

- **Research Question 2:** How could the use of seasonal rounds to describe food practices, Traditional Ecological Knowledge (TEK), and biocultural diversity in a bounded system contribute to existing frameworks for assessing EI?
 - Research Objective 3: Describe the relationships between food practices and time within Nepal's mid-hill social-ecological system, at both the individual and community levels.
 - Research Objective 4: Understand how food practices shape and influence ecological management practices within Nepal's mid-hills social-ecological system.
 - Research Objective 5: Understand how food practices shape and influence EI within Nepal's mid-hills social-ecological system.
- **Research Question 3:** Does EI operate as a social mechanism of social-ecological systems resilience (SESR)?
 - Research Objective 6: Postulate, using this study's findings, how EI could be situated in SESR theory as a social mechanism of SESR
 - Research Objective 7: Postulate, using this study's findings, how EI could be operationalized within Nepal's mid-hill social-ecological system to enhance resilience of smallholder farmers to various disturbances

RESEARCH SITE

Due to the sensitivity of species conservation initiatives worldwide, it is accepted practice in research encompassing the human dimensions of natural resources to refrain from disclosing identifying information pertaining to specific individuals, communities, or sites of research. Additionally, several practices embraced by participants in this study exist within a grey area of social acceptability, whether due to caste/class restrictions within Nepalese society, or perceptions of suitability, whether medicinal, spiritual, hygienic, etc. Some ecological practices, though ecologically neutral, may be perceived by other members of human society as unacceptable for various reasons, and perpetuate stereotypes and narratives relating to caste or class. Thus, the practice of non-disclosure protects the participants of this study from undue societal harm.

Although the name and specific location of the research site will remain undisclosed, many traits of this site are akin to myriad locations in the region and can be shared. The Government of Nepal organizes its community units from smallest to largest, by *tol* (small village), *ward* (township),

gaunpalika (rural municipality), district, and province. The ward in which this research was conducted is composed of several *tols*, with a total population between 1000-1600. The ward is located within the large and bioculturally diverse Gandaki Province. It skirts the Annapurna and Dhaulagiri massifs and boasts views of both mountain ranges. The base of the hill on which the village is located is around 900m above sea level in altitude with a tropical climate, while the summit reaches 3100m and is characterized by temperate conditions (see figures 19&20). Due to the drastic changes in altitude, human residents on this hillside are exposed to diverse weather and climate and adjust their agricultural and ecological management practices according to average temperatures, weather conditions, and availability of sunlight (see figures 19-24 below). The range of conditions has fostered a rich display of biodiversity, and residents have displayed their knowledge, use, and management of this biodiversity in their interviews with me.



Figure 19. A small village at the research site



Figure 20. A study participant's home, providing a typical demonstration of traditional Nepali agroforestry



Figure 21. A farmer has transplanted wild "khole saag" (water cress) into a spare area in his fields



Figure 22. Agricultural terraces at the research site during winter. In the monsoon



Figure 23. An example of a hilltop grazing area for goats, sheep, cows and water buffalo.

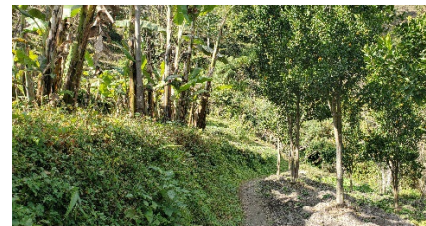


Figure 24. Traditional and modern agroforestry plots, side by side

The ward and villages, like many in the area, are composed primarily of the Magar indigenous ethnic community, and a few families who identify as members of various Shudra castes (Dalit) or Bahun castes (Hill Brahmin). There is very little social conflict stemming from caste or class origins. The religious composition of the village is primarily Hindu, with a small Christian population. The ward depends upon several social institutions, including a ward government of elected officials, tol governments of elected officials, mothers' groups which oversee activities for community women, a Community Forestry User Group (CFUG), a Government of Nepal health post, an agriculture extension office, four schools, and various special committees which address issues as they arise, such as water infrastructure, festival organization, the distribution of aid and trainings, etc. Like many households in Nepal, those in the study area are commonly multigenerational, and married women move into the household of their husband's family after marriage. An average of 2-9 individuals lives in each household, which can include children, parents, grandparents, and unmarried adults both man and woman. Livelihoods and occupations in this area include smallholder agriculture (both subsistence and cash crop), transhumant pastoralism, employment with the government, health post, or school, or engaging in circular labor migration to bring additional income into the household. Residents rely on both smallholder agriculture, hunting, and foraging in the surrounding area to meet their subsistence, cultural, and religious needs.

ONTOLOGY, EPISTEMOLOGY, METHODOLOGY, & PERSONAL VALUES

The frameworks by which we gauge reality and knowledge are unique to each individual researcher, and heavily influence our methodological proclivities. Here, I give a brief overview of the ontological and epistemological frames which I have developed over time as a result of my education and lived experience and describe the subsequent values and methodologies which drive this research.

Ontology

My ontology, the ways in which I conceive of reality and in which I believe that reality shapes my research, are heavily influenced by realism, the notion that reality exists independent from human minds, perceptions, and theories (Niiniluoto, 2002; Jenkins, 2010). In the field of natural resources, it is important to acknowledge that the natural world, independent of human activity, forms the foundation and structure for human society and the ways in which we exist within SES (Tidball, 2012).

If a tree is killed by emerald ash bore and a researcher is not around to record its death, the event stands. Human society cannot exist independently of natural structures and phenomena; this tenet serves as a foundation for my research on the relationships between humans and their environment.

Epistemology

Following the establishment of a foundation for what constitutes reality, a researcher must develop a system by which they know how, when, or if they know something to be real, an epistemic frame. As a researcher, I assess the reality or truthfulness of the phenomenon of interest through two lenses, that of the dialectic stance (or dialectical critical realism) (Bhaskar & Norrie, 1998; Bhaskar, 2008; Cronenberg, 2020) and the use of systems theory (Bausch, 2001). Dialecticism is a paradigmatic stance which allows researchers to employ and consider differing perspectives in pursuit of answers to their research questions. Dialectics has been explored by many philosophers disillusioned with dualistic thinking, and specifically by Bhaskar (2008) who coined Dialectical Critical Realism as a method to address complexity in social phenomena and natural structures. My own fascination with this conceptual stance stems from an interest in comparison of difference to find the best answer(s) to a question or investigation, something I heavily employ in this project with the use of a mixed methodology in both data collection and analysis.

I also embrace the use of systems theory (Bausch, 2001) in my work, by which I focus less on the ways in which things exist in our world, and more on how they work together in an infinite series of processes and mechanisms at multiple scales. As a researcher focusing on how certain social mechanisms might operate within SES to enhance resilience of that system to disturbance, embracing systems theory is practically predetermined.

Commitment to Personal Values

As a scholar, I am committed to certain values which I have carried with me in this research. I strive to practice engaged scholarship which addresses social challenges along with ecological ones. While the empirical applications of this work are important to the fields of human dimensions of natural resources and SES, the theoretical contributions implied for resilience research at large are also very exciting to me. The largest challenge with this research has been attempting to do justice to both the theoretical and empirical aspects of this work. Thus, these values have influenced my methods, as described below.

Methodology

The questions for this research encompass interdisciplinary concepts and embrace participatory methods which engage residents in questions which interest them and have implications for their future livelihoods and way of life. We hope to uncover findings which interest not just our participants and study community, but the research community at large, and contribute to the larger body of work in the field of natural resources. In pursuit of answers to our research questions, we utilize quantitative and qualitative survey data, ethnographic observation, questionnaires, and participatory methods. These data will yield both positivist and interpretivist answers to our questions, and we can examine our data jointly to discover new relationships and insights that might not have been apparent with just one method. All these qualities certify this research as a mixed method and necessitate the use of mixed methodologies in data collection and analysis.

I chose to utilize Mixed Methodology in both the data collection and analysis phases of this research. Mixed Methodology Research (MMR) involves the collection and analysis of both qualitative and quantitative data within one research study (Greene, Caracelli, & Graham, 1989; Creamer, 2018). When addressing interdisciplinary research questions, or research which involves many stakeholders interested in different aspects of a problem (Mathison, 1988; Howe & Eisenhart, 1990), utilizing a mixed methodology presents several advantages. Reichardt & Cook (1979) and Maxwell (2015) voice that MMR can be leveraged to uncover findings that might not have been apparent with the use of a singular method, while Johnson & Onwuegbuzie (2004) and Greene (2007) state that one of the purposes of mixing methods is to amplify the positive traits of both qualitative and quantitative methods while minimizing their undesirable traits in a research pursuit that focuses on holistically addressing an inquiry.

IRB EXEMPTION STATEMENT

A Notice of Exemption was provided by the Institutional Review Board for Human Participant Research (IRB) at Cornell University for this study (Protocol ID #2110010665). The protocol and methodology for this study were determined not to harm the human participants physically or psychologically. Many of the study participants are those with whom I have prior acquaintance with, due to the nature of my work and visits within the ward. I took care to select participants who would provide honest answers and refrain from revealing identifying information. Due to the sensitive nature

of information disclosed to me, extra care was taken in protecting the names, locations, and physical descriptions of study participants. Names and identifying characteristics are not used in this study, nor were they important for the purpose of the study. I determined that my study protocol and methodology would keep all participants safe and anonymous.

B. DATA COLLECTION & ANALYSIS

SAMPLING PLAN

In order to gauge interest in this study's research topics, the first step in my sampling plan was to communicate my intention with community leaders. I have an ongoing working relationship with the communities in this area and used these lines of communication to reach out to the ward *adakhya* (leader/mayor), and several tol leaders to explain my research idea and request permission to visit and conduct interviews with willing participants. I obtained consent to conduct interviews and arrived at the research site two months after obtaining this consent, as well as a Notice of Exemption from the IRB Office of Cornell University. I spent my first few days meeting with community officials in the ward office and health post, explaining my research ideas in further detail, and conducting two pilot interviews which informed how I eventually conducted interviews with my study participants (n = 41). I also spent this time meeting with acquaintances and past collaborators on other projects, several of whom agreed to be interviewed for this study.

This research employed a data collection plan that consisted partially of convenience sampling (Emerson, 2021), and criterion sampling (Palinkas, Horwitz, & Hoagwood, 2015). The majority of the population in this ward are smallholder farmers and labor migrants, and the time they had available to meet with me was limited by the ongoing planting of crops and completion of other manual labor tasks which characterizes the stretch of time I was able to spend in the field during this trip. I conducted interviews at the convenience of my participants. This often meant working in the early mornings and late evenings. Additionally, and despite these limitations, I wanted to ensure I was collecting data from a diverse, yet representative range of community members. My criteria included a representative mix based on gender, age, occupation, education level, number of years living in the community, engagement or participation in community leadership and citizenship, and size of family unit. This combination of meeting with those participants who a) had available time to meet during a

busy season of cultivation, and b) met my criteria, enabled me to conduct between 2 and 4 interviews per day for the remainder of my time at the research site.

This sampling plan yielded interview data from 41 total participants over the course of my fieldwork. Prior to beginning each interview, written consent was obtained before the interview in accordance with IRB protocol and best practices. For this study I was also able to draw on datasets I have collected at this site previously, primarily in the areas of ethnographic observation and demographic surveying. I have expanded on every type of data collected in further detail in the sections below.

DATA COLLECTION

I employed mixed methods data collection throughout my fieldwork, splitting the data into three categories: 1) Qualitative, 2) Quantitative, and 3) Data transformable (initial qualitative data collection, with the intention of transforming the data into a quantitative form for further analysis). Data were collected during participant interviews in the following order:

1. Environmental Identity Questionnaire (Clayton et al., 2021)
2. Creation of Seasonal Rounds
3. Short Answer Questions
4. Demographics Survey
5. Field Observation

This data are explained in further detail below.

Environmental Identity Questionnaire (Clayton et al., 2021)

I chose to utilize Clayton et al.'s (2021) Environmental Identity questionnaire for several reasons. First, the updated scale purports to account for cultural differences and sensitivities and is meant for use in multicultural contexts. Second, it has been validated in six countries, each with their own distinct culture and language. This introduces it is potential for translatability into the Nepali language. Third, the researchers specifically state that the scale is meant to determine not only individual connectedness to nature as an aspect of self, but also an individual's likelihood to engage in

concrete environmental stewardship or natural resource management activities. These qualities distinguished the EID scale (ibid.) to me as the scale most likely to accurately assess the ecological identities of indigenous Nepali smallholders in rural Nepal.

The EID is a 14-question survey which uses Likert scale questions ranging from 1-7, with 1 being “not at all true of me” and 7 being “completely true of me.” Questions assess an individual’s felt relationship to the natural world (cognitive and emotional), likelihood of engaging in environmentally friendly activities or environmental stewardship, and likelihood to associate with others who do the same. The answers to these 14 questions are averaged upon completion of the survey, which provides an individual score out of a total possible 7 points.

Table 1. Clayton et al.'s (2021) Environmental Identity Questionnaire, utilized in this study.

Appendix A

Revised Environmental Identity Scale (EID-R), compared to the original

Please indicate the extent to which each of the following statements describes you by using the appropriate number from the scale below.

1	2	3	4	5	6	7
Not at all true of me			neither true nor untrue			completely true of me

_____ 1. I like to spend time outdoors in natural settings (such as woods, mountains, rivers, fields, local parks, lake or beach, or a leafy yard or garden)

Original: I spend a lot of time in natural settings (woods, mountains, desert, lakes, ocean). Not all people have equal ability to do this, so we changed the item to measure preference rather than behavior.

_____ 2. I think of myself as a part of nature, not separate from it. *Unchanged*

_____ 3. If I had enough resources such as time or money, I would spend some of them to protect the natural environment.

Original: If I had enough time or money, I would certainly devote some of it to working to protect the environment.

_____ 4. When I am upset or stressed, I can feel better by spending some time outdoors surrounded by nature.

Original: When I am upset or stressed, I can feel better by spending some time outdoors "communing with nature".

_____ 5. I feel that I have a lot in common with wild animals.

Original: I feel that I have a lot in common with other species.

_____ 6. Behaving responsibly toward nature – living a sustainable lifestyle – is important to who I am.

Original: Behaving responsibly toward the earth – living a sustainable lifestyle – is part of my moral code.

_____ 7. Learning about the natural world should be part of everyone's upbringing.

Original: Learning about the natural world should be an important part of every child's upbringing.

_____ 8. If I could choose, I would prefer to live where I can have a view of the natural environment, such as trees or fields.

Original: I would rather live in a small room or house with a nice view than a bigger room or house with a view of other buildings.

_____ 9. An important part of my life would be missing if I was not able to get outside and enjoy nature from time to time.

Original: I would feel that an important part of my life was missing if I was not able to get out and enjoy nature from time to time.

_____ 10. I think elements of the natural world are more beautiful than any work of art.

Original: I have never seen a work of art that is as beautiful as a work of nature, like a sunset or a mountain range.

_____ 11. I feel refreshed when I spend time in nature.

Original: I feel that I receive spiritual sustenance from experiences with nature.

_____ 12. I consider myself a steward of our natural resources. *New*

_____ 13. I feel comfortable out in nature. *New*

_____ 14. I enjoy encountering elements of nature, like trees or grass, even when I am in a city setting. *New*

Note: those interested in using the scale in one of the other languages should contact the relevant author.

Demographics Survey

The demographics survey took the form of a brief questionnaire which included questions eliciting the following data:

- Age
- Gender
- Occupation
- Education Level
- Time spent living in Ward
- Frequency of temple/church visitation
- Number of people in family
- Whether or not they have a kitchen garden
- Types of livestock/other animals owned
- Whether or not they have engaged in labor migration, and if so, for how many years
- Whether or not a family member (or multiple members) has engaged in labor migration, and if so, for how many years

For this research I drew on and updated demographic information from previous work, along with adding new demographic information as needed.

Field Observation: 2018-2023

I undertook field observation of this area, as well as of many of the current study's participants, from 2018-2023. Baker (2006) alludes to "the need to study and understand people within their natural environment" as a prime motivation for engagement in ethnographic and field observation. This study concurs with Baker's statement, in that in this research we draw motivation and inspiration from field observation as a method by which to observe people's relationship with and within the natural environment, and a desire to understand how it may be changing over time. Nurani (2008) criticizes ethnography as a method which draws primarily on potentially fallible or biased observations. However, done correctly, ethnographic observation serves as a holistic method by which we can gain an insider's understanding of the research problem from an outsider's perspective. This is

the goal of implementing observation in this research (Baker, 2006; O'Reilly, 2011). As one of several types of qualitative data collected in this research, ethnographic observation holds value as a way by which we can step more completely into the lives of our research participants and understand the motives, successes, and failures which drive their decision-making and ways of being within this social-ecological system, more so than by simply looking through their demographic information.

Short Answer Questions: Adaptability of Food Practices

I initially began this study with the intention of carrying out long-form, semi-structured interviews with my participants. My two pilot surveys illuminated the ambition of this plan, and I reconsidered how I might gather much needed qualitative data while not placing too high a demand on my participants' available free time. Asking a series of short answer questions proved a way to expedite the process of inquiry and eliminated the need for a longform interview which included questions that were non-essential to the research questions or redundant. The short answer questions address the adaptability of personal and community food practices, and how they might be changing over time or affecting the overall SESR and ecological identities of the study participants. The short answer questions were asked following the creation of the social-ecological rounds, and are listed below:

- Q1A: Are there any items in this calendar that are important to you? Why are they important?
- Q1B: What are some foods that you eat throughout the year?
- Q1C: Are there foods that you do not eat? For what reason?
- Q1D: Are there foods that others should not eat? For what reason?
- Q2A: Would you say you eat the same things as your parents or grandparents ate?
- Q2B: Are there any rules about what should be foraged in the surrounding area? Who makes these rules?
- Q2C: Have foraging rules changed over time?
- Q3: What can I (the PI) do to improve this calendar?

Seasonal Rounds

Nepal has a unique and intricate system of date-and-timekeeping which aligns with solar, lunar, and ecological phenomena. It determines the timing of everything from the workday to marriages and major festivals to harvest and planting times. The *Bikram Sambat*, as it is known in South Asia, is a lunisolar calendar which draws heavily on the influence of the ancient Hindu calendar. Similar to the Gregorian calendar, the Nepali *Bikram Sambat* (बिक्रम संवत्) is split into twelve months. Unlike the Gregorian calendar, the *Bikram Sambat* bases time on both the phases of the moon and the time it takes for the Earth to revolve around the Sun. The *Bikram Sambat* also records six seasons, as opposed to the Gregorian four seasons, based on the position of the Sun. This more accurately reflects weather and climate conditions in Nepal and the surrounding region. The final difference is in the year; Nepal is in the year 2080, while the Gregorian world is in the year 2024.

The smallest unit in the calendar is a *Tithi*, or day. A *Tithi* begins at sunrise and records the time it takes for the moon to complete 1/30th of its revolution around the Earth (see Figure 25 below). Each *Tithi* has a specific name corresponding to the phases of the moon. One fortnight is comprised of 14 *Tithis* plus a full or new moon day and is called a *Paksha* (See Figures 26-28 below). There are two *Pakshas* in a month, corresponding to the waxing and waning of the moon; *Shukla Paksha* (waxing) and *Krishna Paksha* (waning). Every *Tithi* in the month is repeated once, apart from the Full Moon *Tithi* (Purnima) and the New Moon *Tithi* (Aunshi).

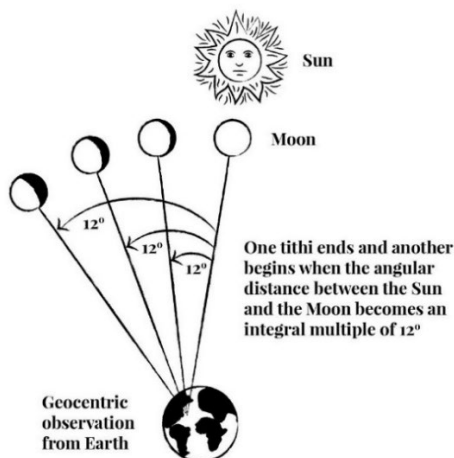


Figure 25. An illustration of the Nepali *Tithi*, the amount of time it takes for the moon to travel 1/30th of its revolution around the Earth

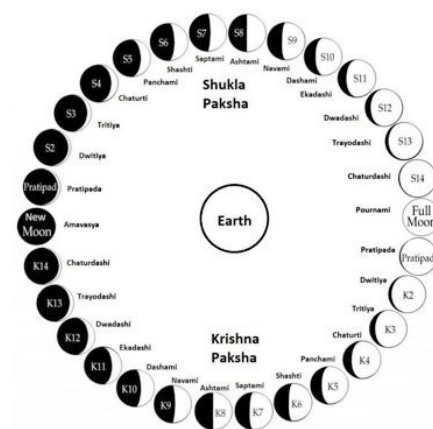


Figure 26. An illustration of the two *Pakshas* of the Nepali month, with all 30 *tithis* displayed.

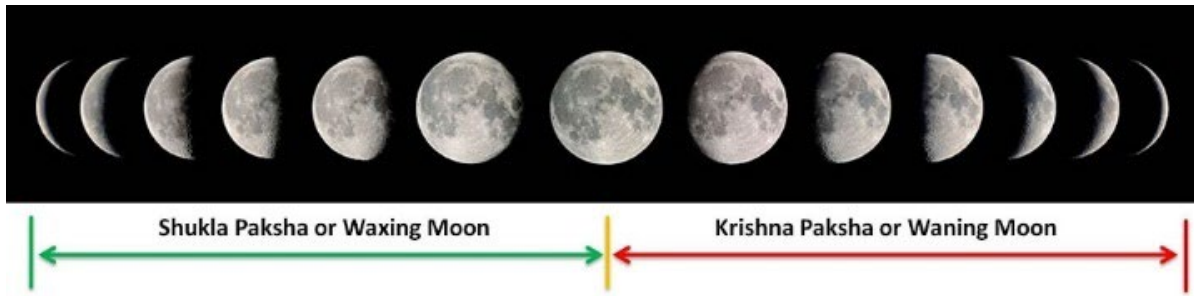


Figure 27. A further demonstration of the two pakshas shown as distinct phases of the moon



Figure 28. The tithis and pakshas superimposed onto a contemporary calendar month for the purpose of modern timekeeping and translation into Gregorian time

Each cycle of the month, all the way down to the Tithi, is associated with different activities. For example, it is considered best practice to harvest a crop in the second half of the month, during Krishna Paksha, as the moon is waning. In this way and many others, the Bikram Sambat heavily influences the food practices of many Nepalis. The Bikram Sambat New Year begins with the month of Baishakh (वैशाख), which corresponds roughly to the second half of April and the first part of May in the

Gregorian calendar. Figures 29 and 30 display a typical Nepali month, and a diagrammatic representation of how the months, seasons, and major holidays correspond.

Falgun 2080					Feb/Mar 2024	
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
		1 Chaturthi Jana Yudda Divas, Mangal Chaudh	2 Panchami Basant Panchami, Saraswati Puja Holiday for	3 Sasthi	4 Saptami	5 Aastami Gorakhi Puja
6 Newami	7 Dashami Rastriya Prajatantra Divas, Nirvachan Divas	8 Ekadashi Bhima (Jaya) Ekadashi	9 Dwadashi	10 Trayodashi	11 Chaturdashi	12 Purnima Shree Swasthani Birat Samapti, Magh Sankranti
13 Pratipada	14 Ditiya	15 Tritiya Maha Samudayako Jati Puja	16 Chaturthi	17 Panchami	18 Sasthi	19 Saptami
20 Aastami Gorakhi Puja	21 Navami	22 Dashami	23 Ekadashi Bijaya Ekadashi	24 Dwadashi	25 Trayodashi Maha Shiva Ratri, Nepali Sena Divas	26 Chaturdashi
27 Aunshi	28 Pratipada Gyalpo Lhosar	29 Ditiya	30 Tritiya			
← Magh 2080					Chaitra 2080 →	

Figure 29. An example of the typical modern representation of the Nepali month

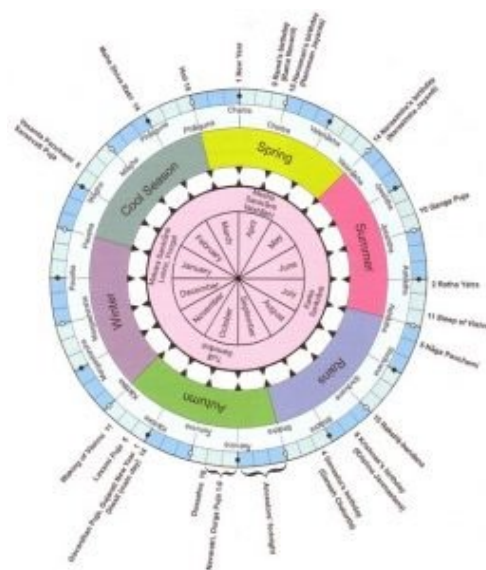


Figure 30. A representation of the ancient Bikram Sambat calendar, shown with the six Nepali seasons and with a key for the Gregorian calendar in the center and major holidays indicated

The calendar then continues through the remaining 11 months and six seasons, which are detailed below:

1. Baishakh (वैशाख): mid-April - mid-May
2. Jeth (जेठ): mid-May - mid-June
3. Asaad (आषाढ): mid-June - mid-July
4. Saaun (साउन): mid-July - mid-August
5. Badhau (भदौ): mid-August - mid-September
6. Asoj (असोज): mid-September - mid-October
7. Kartik (कार्तिक): mid-October - mid-November
8. Mangsir (मंसिर): mid-Nov. - mid-December
9. Poush (पौष): mid-December - mid-January
10. Maagh (माघ): mid-January - mid-February
11. Fagun (फागुन): mid-February - mid-March
12. Chait (चैत): mid-March - mid-April

The six seasons, or “ritu” (ऋतु), of the Bikram Sambat accurately describe Nepal’s annual climate patterns:

1. Basanta Ritu (बसन्त ऋतु): Chait + Baishakh: spring-type weather. Plants come back to life
2. Grishma Ritu (ग्रीष्म ऋतु): Jeth + Asaad: hot season. Wild trees bear fruit
3. Barshaa Ritu (वर्षा ऋतु): Saaun + Badhau: rainy season. Monsoon
4. Sharad Ritu (शरद ऋतु): Asoj + Kartik: end of monsoon. Harvest of grains and main crops
5. Hemanta Ritu (हेमन्त ऋतु): Mangsir + Poush: early winter. Harvest of vegetables. Mildly chilly
6. Shishir Ritu (शिशिर ऋतु): Maagh + Fagun: deep winter. Nothing really growing. Coldest weather

For this research I needed to devise an easily legible way of viewing the ecological and food practices of interview participants as they relate to this very intricate system. I decided to make a list of elements we need in these calendars, explore different ways to depict these elements, and then try different combinations of these depictions to come up with a system that is simple/straightforward, culturally sensitive/appropriate, beautiful/engaging, and easily legible by both anglophone and Nepali audiences. In order to achieve this, I needed to design a seasonal round template with the ability to depict the following characteristics:

- Time: in months, seasons, and the full solar year
- Lunar cycles: Many Nepalis base their consumption habits on this element of their calendar, with the cycles of the moon dictating times of harvest, forage, hunting, sacrifice, celebration, etc.
- Individual items: Their species, genus, class, scientific name, and common names both Nepali and English
- Item seasonality: The times of year in which individual items are available
- Item utilization: The number of people in my study set who are utilizing a specific item.

Drawing on these requirements for the research and on the details of the Bikram Sambat calendar, a template was created which incorporates all of these elements into a circular format. These individual elements are depicted in Figures 31-33 below:



Figure 31. Months are displayed in a circular manner and meant to be read clockwise. The months of both the Bikram Sambat and the Gregorian calendar are included for legibility

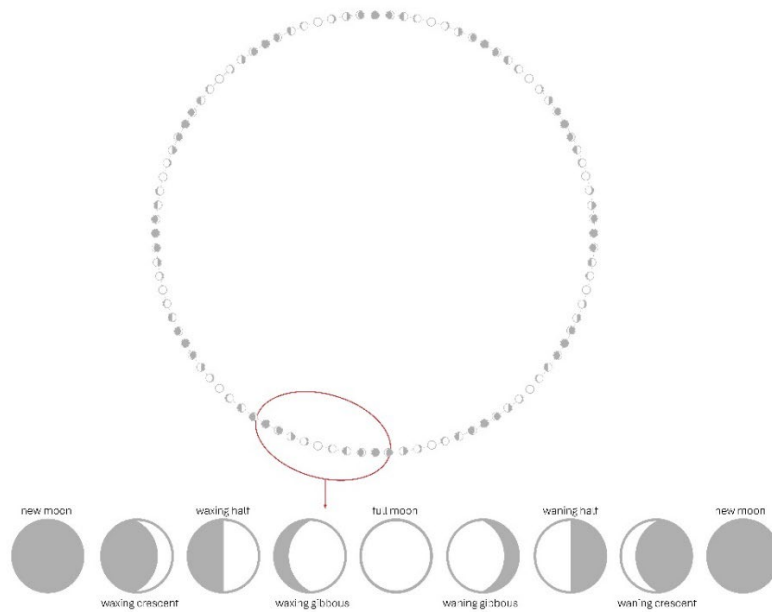


Figure 32. Ideally, the beginning of the Bikram Sambat month falls on the new moon, with the full moon occurring roughly halfway through the month. At the same time, the Nepali year is measured by the time it takes to complete one revolution around the sun, represented in our calendar by a circle. Because many Nepalis base their gathering and consumption practices on the phases of the sun and moon, these are shown on the calendar.

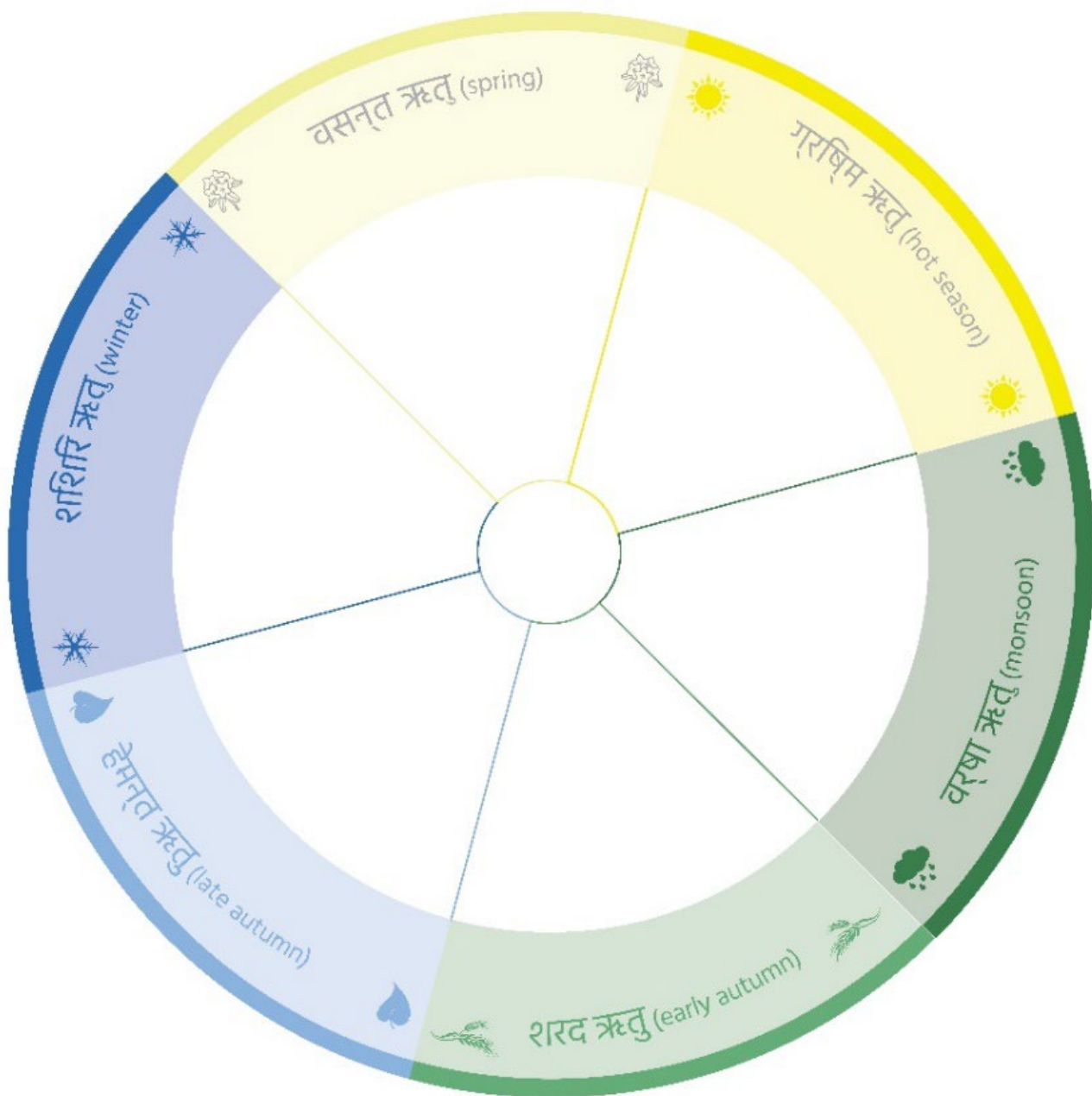


Figure 33. The six seasons of the Bikram Sambat (spring, hot, monsoon, early autumn, late autumn, and winter) are shown on the calendar to make it easier for the reader to interpret the seasonality and ideal weather conditions for various items on the calendar such as wild fruits, hunting seasons, or planting times

Combined and read in a clockwise fashion, the Nepali Seasonal Round (absent of items on it) looks like this (Figure 34 below):

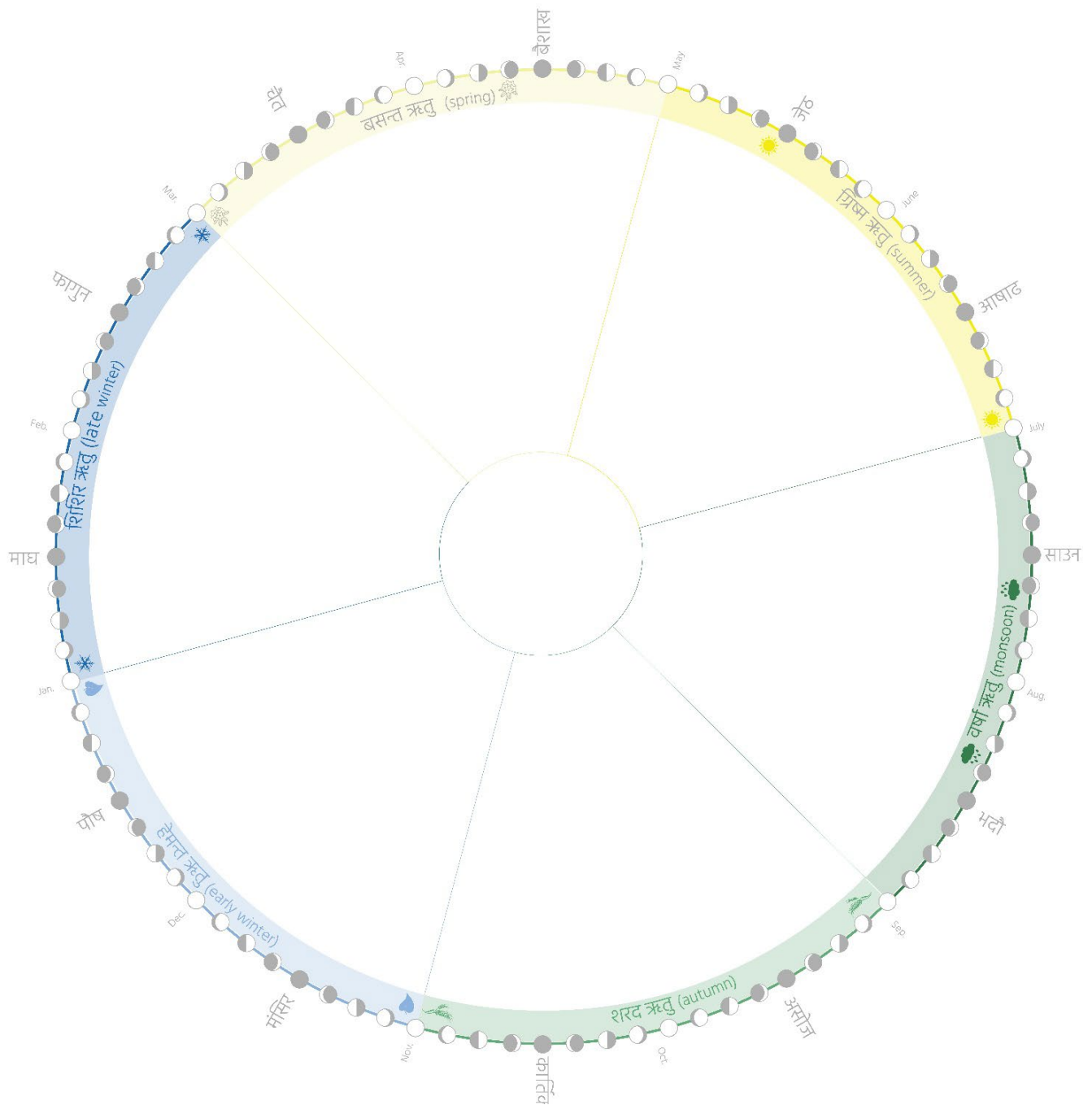


Figure 34. The completed Nepali Seasonal Round, with the months of the Bikram Sambat, the six Nepali seasons, and the annual lunar cycles all represented

With the template complete, I also needed a simple method of portraying items and their seasonality upon the Nepali Seasonal Round. This was accomplished through creating a color-coded system to delineate different categories of item, such as “domesticated plant” or “wild animal.” Seasonality can be shown with a simple line, showing where the season of harvest begins and ends for that species. Year-round items are placed in the center of the calendar, and the utility of each item can be shown by increasing or decreasing the size of the item on the calendar itself. These elements are visualized in Figures 35 and 36 below:



Item: Kaalij Pheasant (कालजि)
Category: Wild Animal



Figure 35. A demonstration of individual item representation. Individual items are shown within a single bubble which is color coded by type of item, whether wild, domesticated, plant, animal, fungi, or unknown. “Grain, Pulse, or Legume” is included as a distinct category

Calendar Item Variability

Seasonality

Items which are consumed seasonally are shown in a range which spreads across the calendar, beginning where the item's image is placed and ending when the range sweeps out. Range sweeps are shown in the same color as the item's category to help the reader determine larger patterns and trends over the course of a calendar participant's ecological year.



Year-Round Items

Items which are consumed year-round are clustered together in the center of the calendar, both to show the 12-month use of the items and to symbolize their significance as cornerstones of a participant's diet.



Popularity of Consumption

Items on the calendar are sized according to the number of people who consume them. The largest number of people who indicated consuming one single item was 40/41 people interviewed, and the smallest was just 1. The key determining popularity based on item size is below:

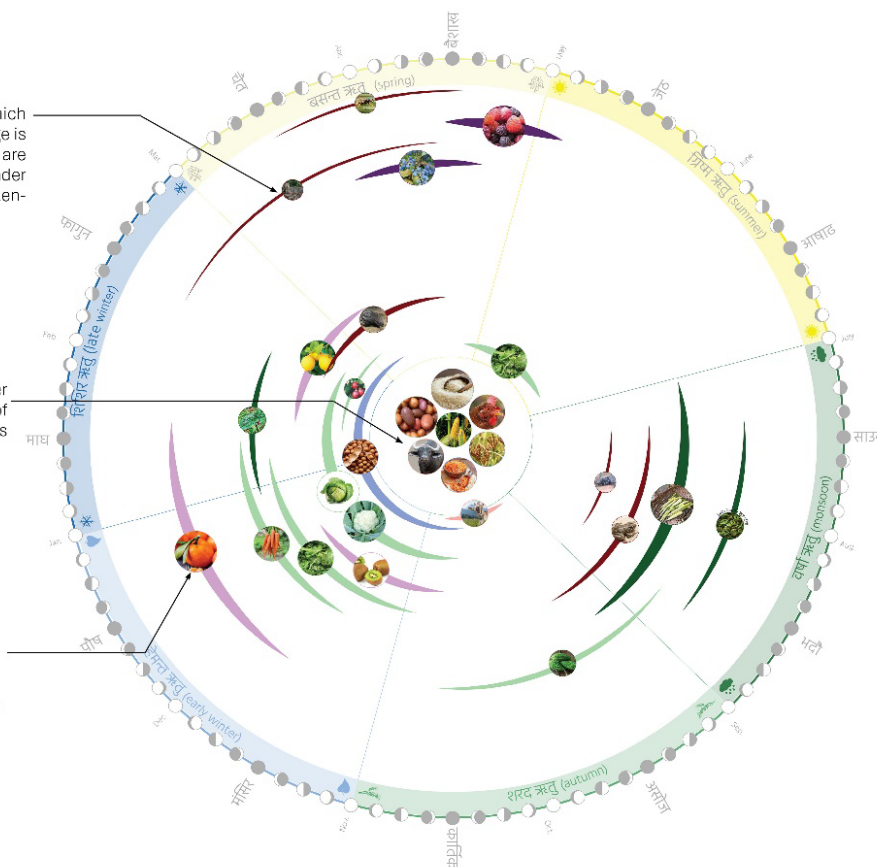
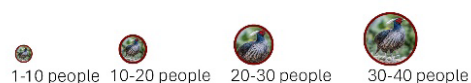


Figure 36. A demonstration of how to represent an item's seasonality (whether that be seasonal or year-round) and utilization

Co-creation of Individual Seasonal Rounds with Nepali Participants

With a workable seasonal round template completed, I moved into data collection with my Nepali survey participants. The creation of individual seasonal rounds was conducted in one-on-one interviews, sometimes with children or other family members present. Participants were given a template, described above, which included the elements of the Nepali calendar in the Devanagari script, with markers to delineate time, in a circular format. I explained in Nepali how to fill out the round, and why we were doing this together. To assist in inspiring participants, I provided them with my own calendar illustrating my annual food practices in New York State, shown in Figure 37 below. The plants and animals on my calendar were intentionally different from those found in Nepal, so participants would not feel pressured to imitate my example.

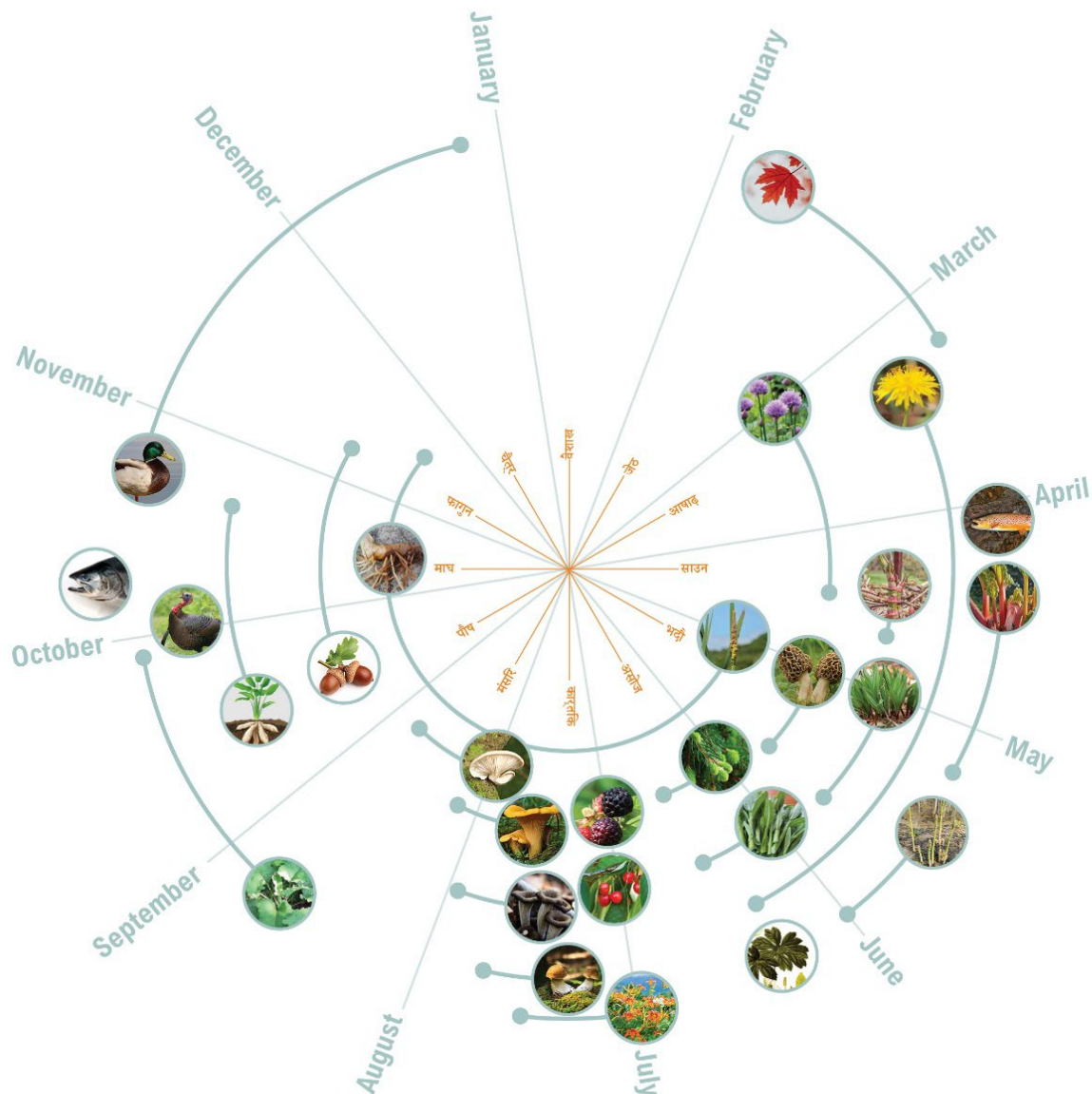


Figure 37. An example seasonal round the P.I. used during participant interviews to demonstrate how seasonal rounds could be created. Care was taken to include only plants and animals which could be found in the P.I.'s native New York State

Beginning at the Nepali New Year in the month of Baishakh (around mid-April for the Gregorian Calendar), most participants worked their way around the template month by month, narrating the foods that they utilized in each season while I wrote them down and confirmed with participants that I had written everything correctly. The goal of this portion of the study was to search for foods which participants find important enough to remember and discuss, what those foods are, and why they are

important to that participant. This methodology did not require an exhaustive list of items; most of interest were the foods, medicines, and useful consumables which participants found important enough to remember and recount. For example, during the monsoon season there is a dearth of fresh domestic vegetables, grain stores are running low, and most of the dried food exempting ferments is becoming moldy due to the constant rain and moisture. Many smallholders depend upon wild vegetables in this season, and the extent of their knowledge on the availability and sustainable management of these key species could be an indicator of their resilience, as well as evidence of their active integration within the surrounding social-ecological system. Figures 38 and 39 below illustrate the process of creating seasonal rounds with study participants.

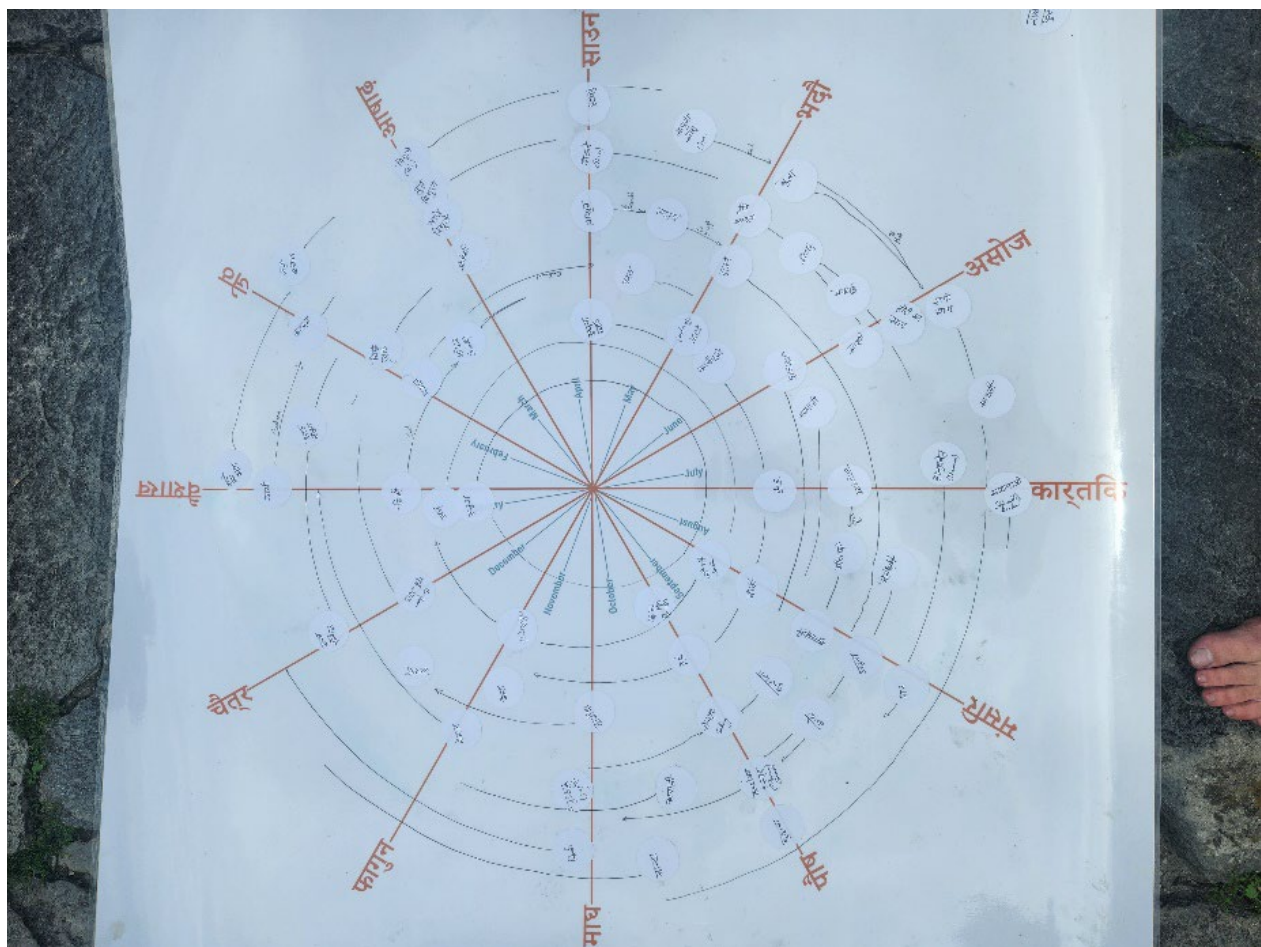


Figure 38. An example of a Seasonal Round created in collaboration with a study participant



Figure 39. A typical scene for conducting one-on-one participant interviews

DATA ANALYSIS

I employed a mixed method triangulation design (Teddle & Tashakkori, 2006; Teddle & Tashakkori, 2009) to “obtain different but complementary data on the same topic” (Morse, 1991, p. 122) that align with my research objectives and aid in addressing the research questions. Triangulation is a one-phase research design by which I implemented qualitative and quantitative data collection at the same time, with the same study participants, giving equal weight to each mode of data collection and subsequent analysis. This design could be called a “concurrent triangulation design” (Creswell & Plano Clark, 2011), and is often referred to as a “three-legged stool” in which each leg bears an equal weight of importance with the other two and complement each other to reveal meaningful findings that might not have been uncovered using qualitative or quantitative data collection alone (Teddle & Tashakkori, 2009). A “concurrent triangulation design” of data collection and analysis implies three phases of data collection, and five phases of data analysis: (1) Singular Quantitative, (2) Singular

Qualitative, (3) Singular Data Transformable (qualitative and quantitative), and (4) a multimethod mixed analysis. If done correctly, the singular phases should yield unique insights on our research questions, and the fifth phase will determine whether these insights diverge or converge (agree or disagree) on significant findings which conclusively answer, or strongly suggest answers to, our research questions.

Figure 40 below illustrates this scheme:

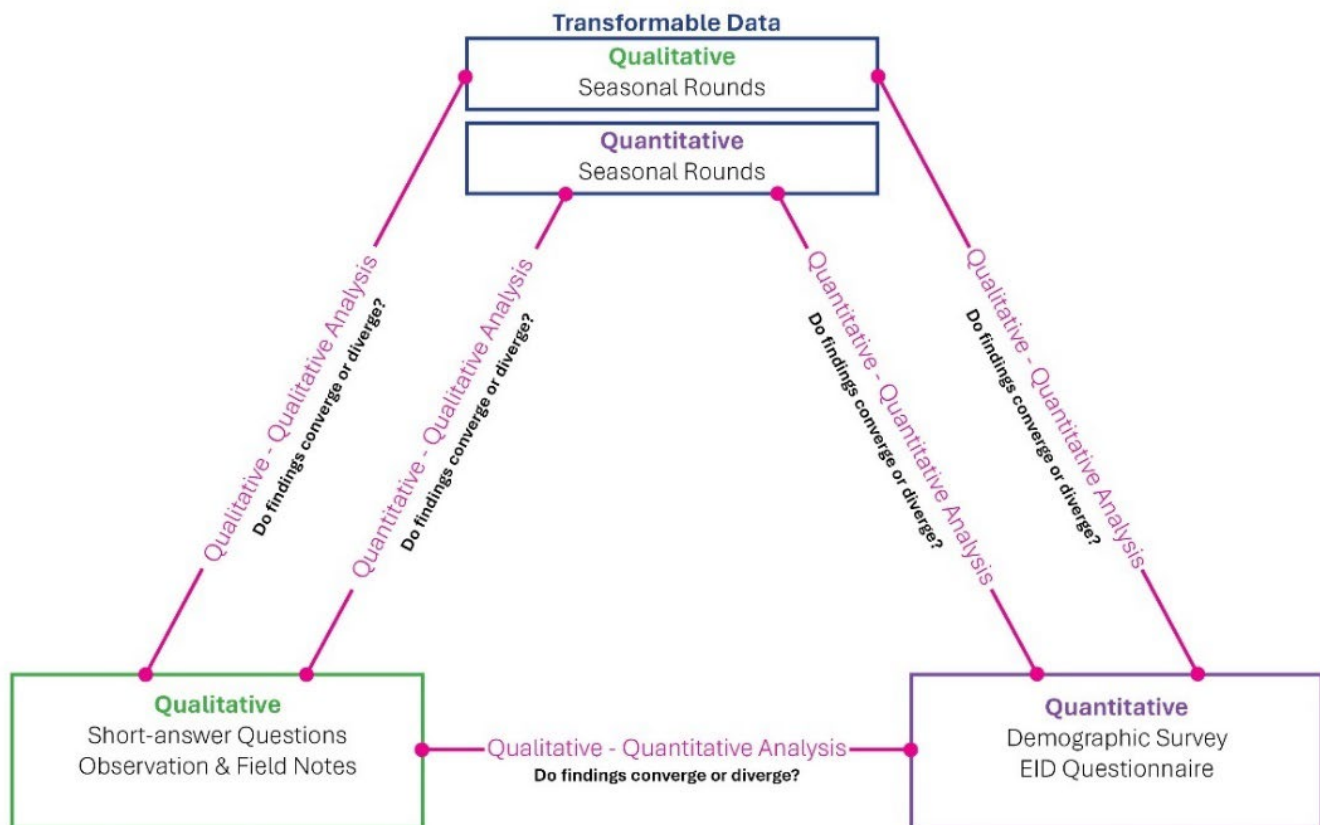


Figure 40. A “concurrent triangulation design” (Creswell and Plano Clark, 2011)

Qualitative Data Analysis

Qualitative Data Analysis centered on the Short Answer Questions and Field Observation and addressed the following research objectives:

- Research Objective 2: Uncover potential drawbacks of existing scholarly methods for assessing and describing EI.
- Research Objective 3: Describe the relationships between food practices and time within Nepal’s mid-hill social-ecological system, at both the individual and community levels

- Research Objective 5: Understand how food practices shape and influence EI within Nepal's mid-hills social-ecological system.

Both datasets, the Short Answer Questions and the Field Observations, were qualitatively analyzed through content analysis and the creation of a hierarchical code frame (Miles, Huberman, & Saldana, 2018). Datasets were coded using both deductive and inductive content analysis (Schreier, 2014). Deductive Content Analysis involved coding the data for association with the research questions and a simple categorization of answers given to each question. Inductive Content Analysis involved the creation of sub codes which were assigned to each of the main research question codes. This process yielded two hierarchical code frames, and is illustrated in Figures 41 and 42 below:

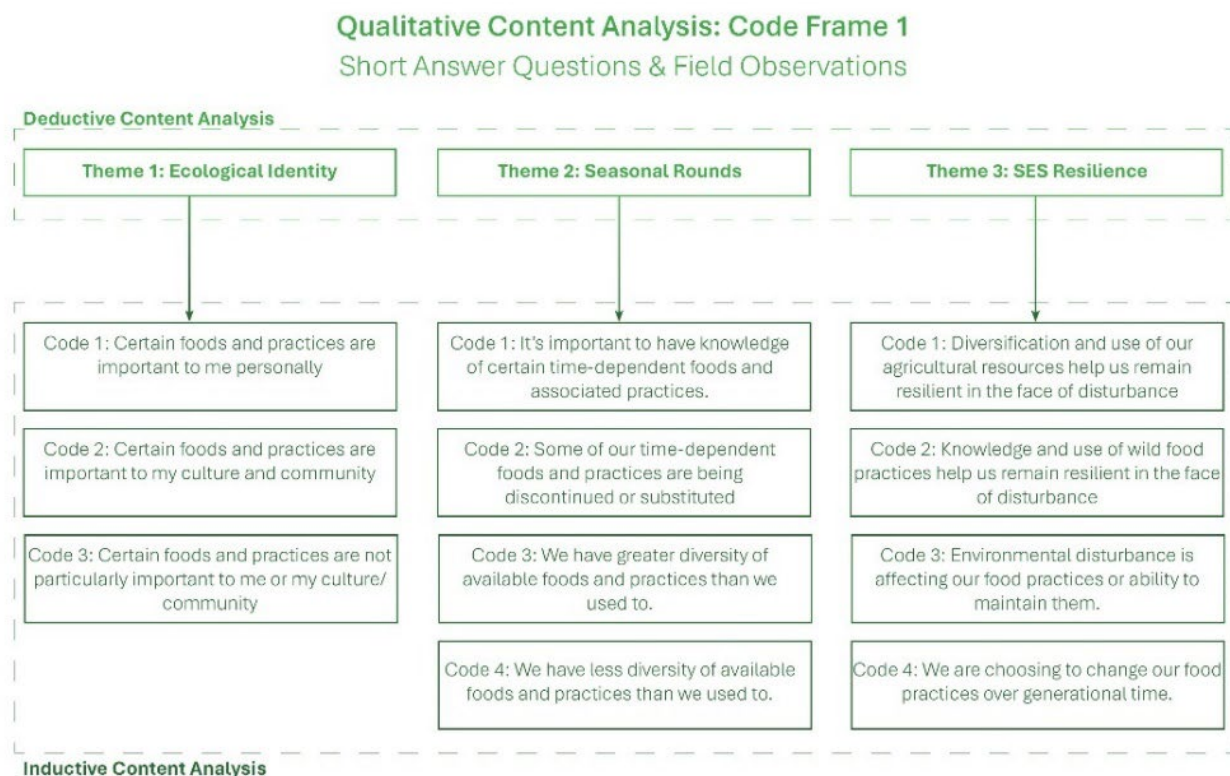


Figure 41. Qualitative Content Analysis of both Short Answer Questions and Field Observations. Content was first coded deductively, according to research question, and then inductively, by sub-theme

Qualitative Content Analysis: Code Frame 2

Short Answer Questions only

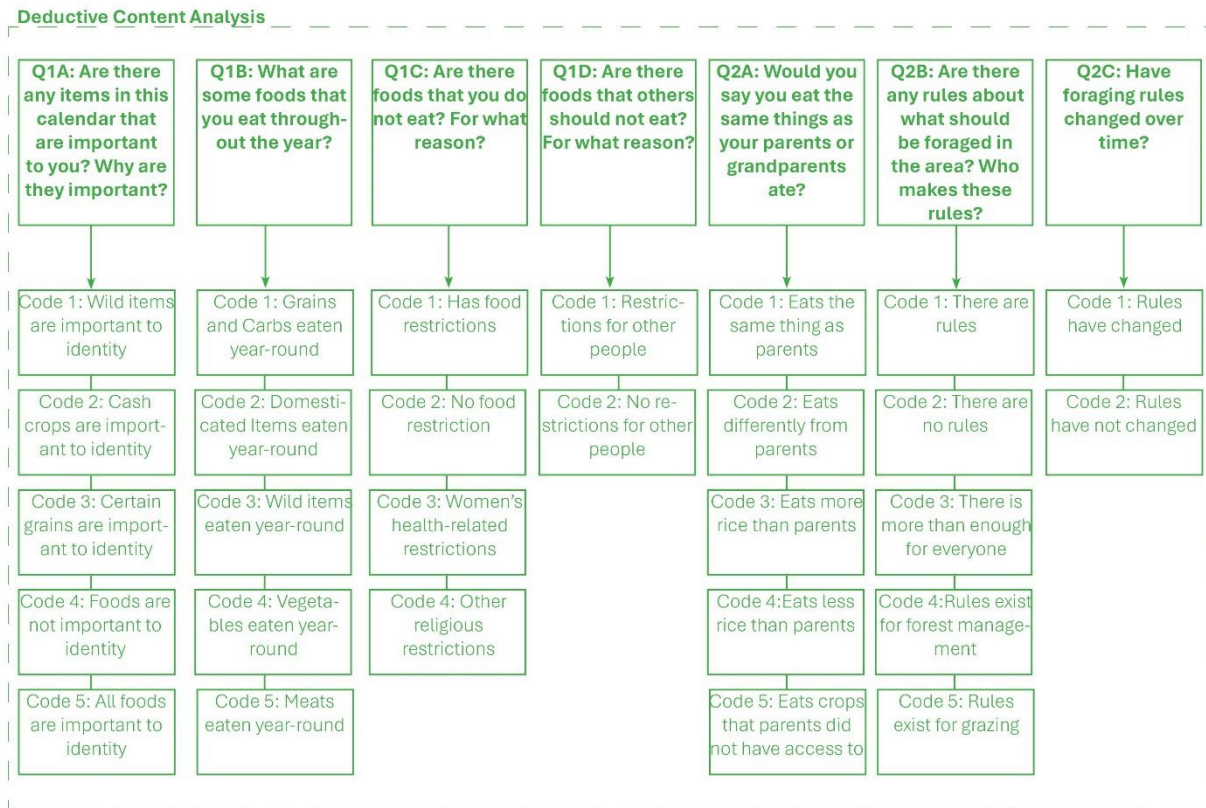


Figure 42. Qualitative Content Analysis of the Short Answer Questions only. Content was coded deductively, with codes determined by categorizing the answers

Upon completing Qualitative Content Analysis, results were numerated and analyzed in R (Chandra & Shang, 2019; Cooksey, 2020) to examine for any patterns or correlations within the datasets. Results were compiled into a comma-separated values file (CSV) file for further analyses.

Quantitative Data Analysis

Quantitative Data Analysis centered on the EID Questionnaire (Clayton et al., 2021) and the Demographics Survey, and addressed the following research objectives:

- Research Objective 1: Explore possible patterns or correlations between EI and other traits held by study participants

- Research Objective 2: Uncover potential drawbacks of existing scholarly methods for assessing and describing EI
- Research Objective 5: Understand how food practices shape and influence EI within Nepal's mid-hills social-ecological system.
- Research Objective 7: Postulate, using this study's findings, how EI could be operationalized within Nepal's mid-hill social-ecological system to enhance resilience of smallholder farmers to various disturbances.

Both datasets were numerated and imported into RStudio (Wetcher-Hendrick, 2011) to create descriptive statistics to summarize data for examination and comparison (Cooksey, 2020). All data was plotted using RStudio's visualization packages and examined to identify any patterns, commonalities, or areas of interest that might relate to the research questions and their objectives (Albers, 2017). Results were compiled into a CSV file for further analyses.

Transformable Data Analysis

Transformable Data Analysis centered on the Seasonal Rounds dataset, and addressed the following research objectives:

- Research Objective 3: Describe the relationships between food practices and time within Nepal's mid-hill social-ecological system, at both the individual and community levels.
- Research Objective 4: Understand how food practices shape and influence ecological management practices within Nepal's mid-hills social-ecological system.
- Research Objective 5: Understand how food practices shape and influence EI within Nepal's mid-hills social-ecological system.
- Research Objective 6: Postulate, using this study's findings, how EI could be situated in SESR theory as a social mechanism of SESR

The participatory methods used for this project, specifically the creation of seasonal rounds, have the potential to be analyzed both qualitatively and quantitatively. This is a process known as data transformation (Fetters, Curry, & Creswell, 2013), during which one type of data, qualitative or quantitative, is converted into another. In the case of the seasonal rounds, each individual round was first qualitatively interpreted, after which its elements were numerated, organized in a data frame, and quantitatively analyzed using RStudio and Microsoft Excel.

Transformable Qualitative Analysis

During Transformable Qualitative Analysis, the goal was to interpret the relationships between items listed on the seasonal rounds, and time. As explored in the literature review, the use of seasonal rounds to explore time-related natural resource practices is academically novel. Methods of qualitatively interpreting seasonal rounds are somewhat sparse. Ruelle et al. (2022) demonstrates how seasonal rounds may be interpreted, by identifying the following:

1. Individual items and time: When during the solar year are individual items in season?
2. Synchronies and time: When during the solar year are groups of items coming into season simultaneously and being harvested?
3. Sequences and time: When during the solar year are individual items coming into season in a certain order and being harvested?

Identifying individuals, synchronies, and sequences within each seasonal round allows the researcher an idea of the practices that individuals within a social-ecological system maintain in order to subsist within that system. Figures 43 and 44 below illustrate examples of sequences and synchronies within the seasonal rounds.

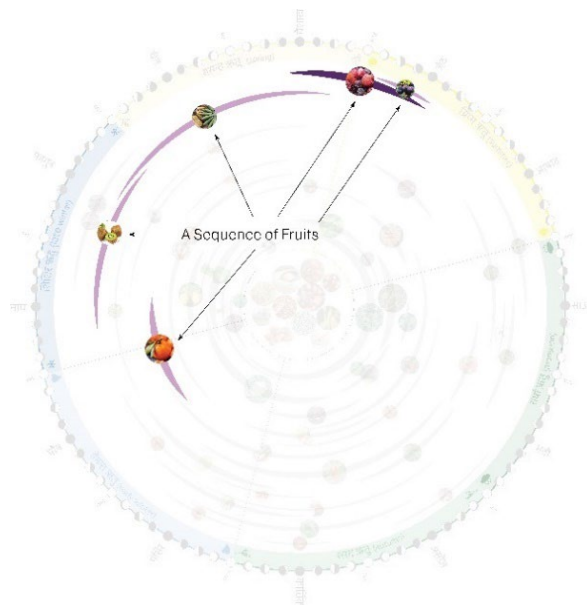


Figure 43. An illustration of a sequence: When during the solar year are individual items coming into season in a certain order and being harvested?



Figure 44. An illustration of a synchrony: When during the solar year are groups of items coming into season simultaneously and being harvested?

By layering knowledge and interpretation of seasonal climate patterns atop the individual items of a seasonal round, the researcher gains further insight into how these practices allow an individual the ability to maintain or enhance their resilience within their social-ecological system. To further illuminate the resilience aspect of the seasonal rounds, I chose to analyze and interpret the *density* of the seasonal rounds as well. When during the solar year are there greater concentrations of species coming into season and being harvested? When are there lesser concentrations of species? Seasonal Round density is exemplified in Figure 45 below.

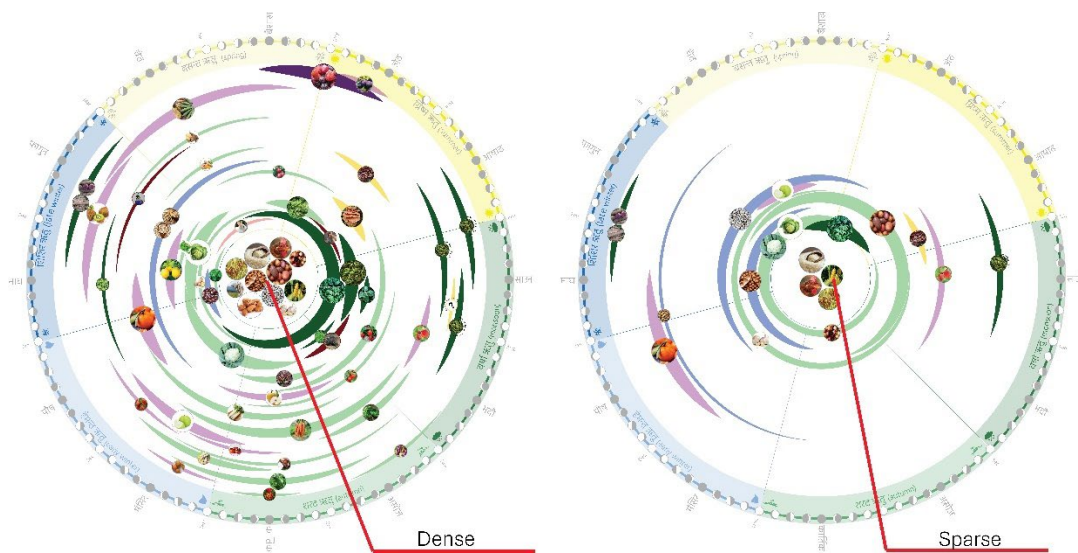


Figure 45. An illustration of two different Densities: when during the solar year are there greater concentrations of species coming into season and being harvested? When are there lesser concentrations of species?

Following interpretation of individuals, synchronies, sequences, densities, and utilizations, this information was imported into a Microsoft Excel file and examined for any patterns or possible groupings. 8 “typologies” emerged, each expressing a certain intensity of the above five characteristics. Examples of seasonal rounds which typify these 8 typologies were selected from the data set and are displayed in Results.

Transformable Quantitative Analysis

During Transformable Quantitative Analysis, the main goal was to numerate the qualitative characteristics of each item, such as their class, seasonality, genus, etc., and import that information into RStudio for the creation of descriptive, summary, and inferential statistics. All data was plotted using RStudio’s visualization packages and examined to identify any patterns, commonalities, or areas

of interest that might relate to the research questions and their objectives (Albers, 2017). Results were compiled into a CSV file for further analyses.

Mixed Methodology Analysis

With the prior four individual qualitative and quantitative analyses complete, the mixed methodology analysis involves the analysis and comparison of each dataset with the other, in order to determine whether findings from each dataset support and reinforce one another or contradict and confuse. The use of data transformation in this research requires me to modify the simple concurrent triangulation design (Teddle & Tashakkori, 2009) I began with, and incorporate elements of the data-transformation design (Creswell & Plano Clark, 2011) into the analysis. Where the concurrent triangulation design would have limited my analysis to a maximum of three different datasets, by using data transformation I can elongate the analysis and fully utilize the five unique sets of data and five points of comparison between datasets I have collected during my fieldwork (Figures 47 and 48 below).

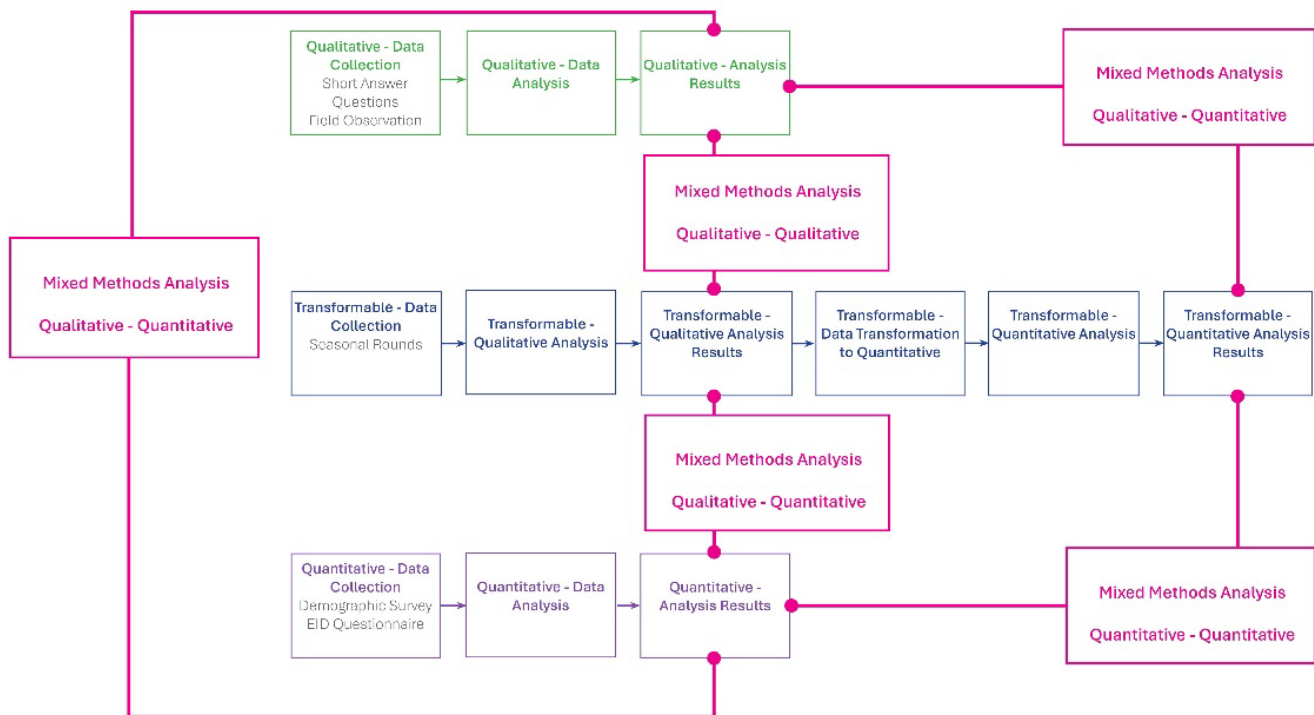


Figure 46. A simplified representation of the concurrent triangulation design (Creswell & Plano-Clark, 2011) for the mixed methods analysis

- R1: Nepalese Ecological Identity
- R2: Ecological Identity & Seasonal Rounds
- R3: Ecological Identity & Resilience

Mixed Method Design: Convergent Triangulation
Timing of Data Collection: Concurrent
Timing of Data Analysis: Concurrent
Priority: Equal

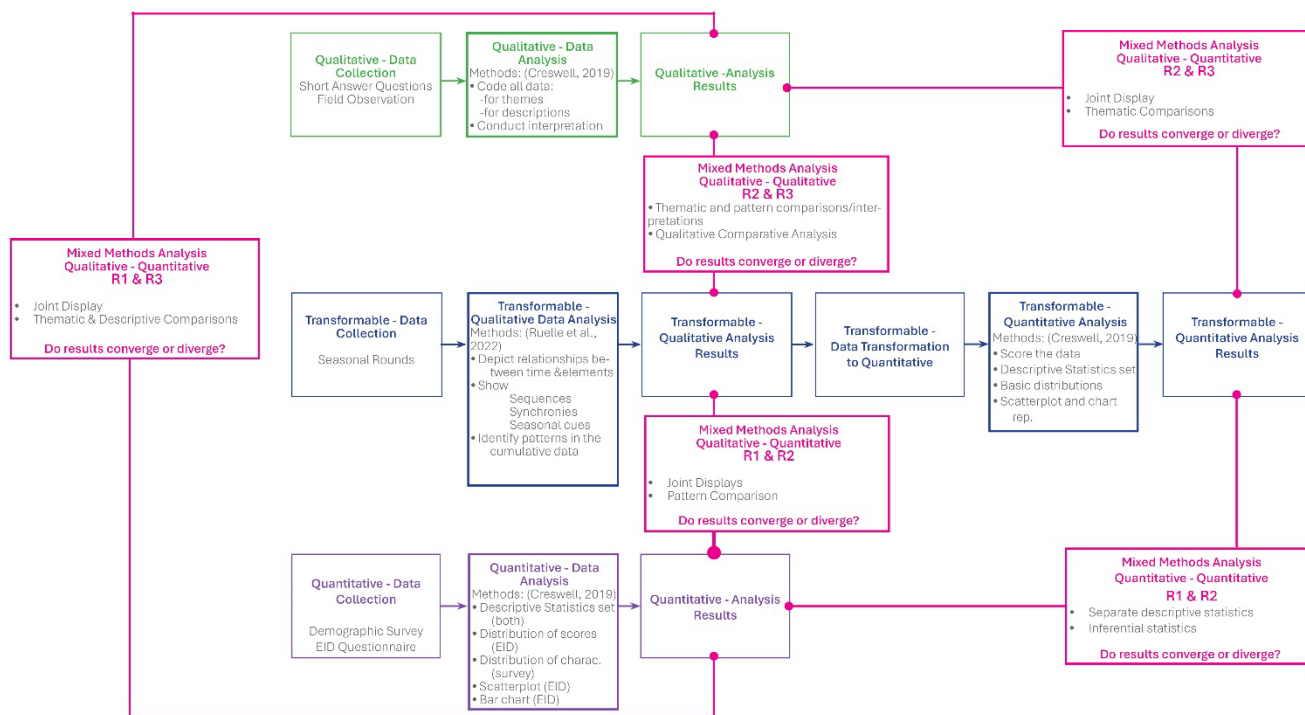


Figure 47. A more complex representation of the concurrent triangulation design (Creswell & Plano-Clark, 2011) for the mixed methods analysis. Individual analyses are described, cited, and attached to research questions

During the five mixed methodology comparisons, I sought to answer one question: do results from the previous analyses converge or diverge? That is, do they agree or disagree with each other? The way in which I determined this depended on the data being compared. With comparisons between the purely quantitative datasets, this was done using descriptive and inferential statistics to identify where data converges and diverges on certain answers, findings, and observations. With comparisons between two qualitative datasets, or a qualitative and a quantitative dataset, this was achieved using joint displays (Creamer, 2018; Fetters & Tajima, 2022) to understand whether the data converge or diverge on certain answers, findings, and observations. Once convergence and divergence findings were identified, they were tallied and assigned to the research questions and objectives they most similarly resembled and addressed. Once complete, this tally was examined to determine whether I could assign definite answers or results to our research questions and objectives.

IV. RESULTS

A. SUMMARY OF MIXED METHODS FINDINGS

A summary of whether findings typically converged or diverged between each of the five specific comparisons is detailed in the diagram below. Overall, divergences in findings between the four singular analyses were present, but did not constitute a large portion of the total findings, and did not constitute a majority of the findings in any of the five comparisons. In short, when compared with findings from other singular method analyses, findings tended to converge (agree) with each other more often than not (see Figure 49 below).

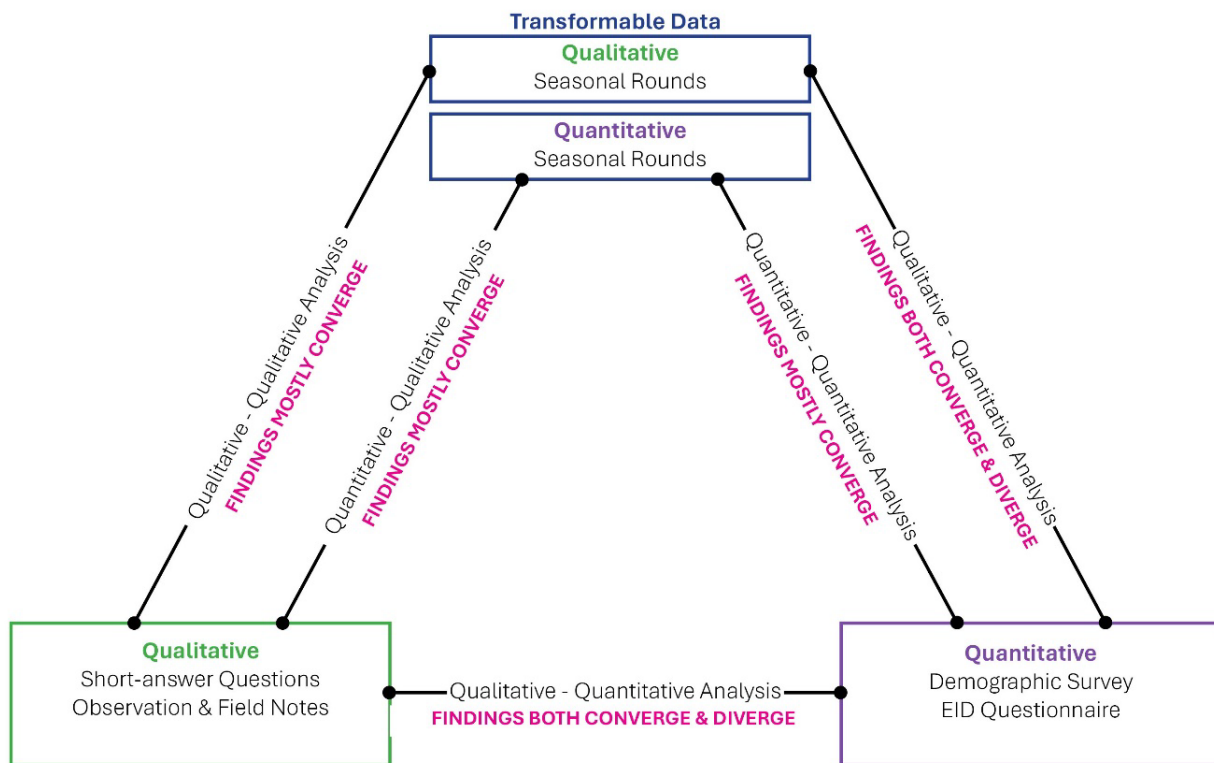


Figure 48. Visualized results from the convergent triangulation analysis. A summary of findings from each of the five comparisons is provided in bolded pink text. Findings tended to agree with each other through convergence, although occasional divergences in the data supplied context towards findings in the singular analyses.

Findings resulting from the five mixed method comparisons, which are listed above in detail, were compiled and organized according to the objective they most strongly addressed. These are displayed below, organized by research objective and finding. Singular findings may be duplicated under

different research objectives if they strongly address more than one research objective at once. The following pages discuss the research findings in detail, organized by research objectives 1 through 7.

Table 2. Singular & Mixed methods analysis - compilation of findings

Research Question & Objective	Finding
Research Question 1: Objective 1: Explore possible patterns or correlations between EI and demographic identifiers such as age location occupation etc. in Nepal's mid-hill social-ecological system.	Divergence Finding: No correlation between EID scores, number of items in seasonal rounds, and demographics
	Divergence Finding: No correlation between seasonal round typologies and demographics
	Singular Finding: No correlation between EID scores and demographics
Research Question 1: Objective 2: Uncover potential shortcomings of existing scholarly methods for assessing and describing EI.	Convergence Finding: Noticeable patterns and correlations between EID scores and seasonal round typologies
	Convergence Finding: Certain foods and practices are both culturally important and important to individual identity
	Divergence Finding: Participants are maintaining a lesser diversity of food habits and practices compared to their ancestors, but are not concerned about degradation of resilience
	Singular Finding: Participants expressed confusion about particular questions in the EID Questionnaire, particularly questions pertaining to nature or the idea of nature, as there are many different meanings of "nature" in Nepali culture
	Singular Finding Participants score particularly low on questions dealing with psychological distance from Nature. These questions likened humans to animals, and this comparison was poorly received.
	Singular Finding: Participants express confusion about the Likert type question format, and greatly benefited from a diagram explaining the representation of each number on the scale as an answer
Research Question 2: Objective 3: Examine the relationships between food practices within Nepal's mid-hill social-ecological system and time at both the individual and community levels.	Convergence Finding: Participants are intentionally and gradually changing their food habits over time
	Divergence Finding: No correlation between food habits/practices and demographics
	Divergence Finding: Diets are becoming less diverse vs. diets are becoming more diverse

	Singular Finding: Participants are eating a less diverse diet than they used to despite having access to more kinds of foods but are still eating the same number of wild foods.
Research Question 2: Objective 4: Understand how food practices shape and influence ecological management practices within Nepal's mid-hills social-ecological system.	Convergence Finding: A diversity of food habits and practices contributes towards maintaining biocultural diversity and SESR
	Convergence Finding: Use of wild food items contributes toward maintaining SESR
	Convergence Finding: Participants believe their practices enhance the resilience of their system
	Divergence Finding: No association between food habits/practices and demographics
	Divergence Finding: No correlation between seasonal round typologies and demographics
	Singular Finding: Participants are eating a less diverse diet than they used to despite having access to more kinds of foods, but are still eating the same number of wild foods.
	Singular Finding: Participants are maintaining a lesser diversity of food habits and practices compared to their ancestors, but are not concerned about degradation of resilience
Research Question 2: Objective 5: Understand how food practices shape and influence EI within Nepal's mid-hills social-ecological system.	Convergence Finding: Noticeable patterns and correlations between EID scores and number of items in seasonal rounds Convergence Finding: Noticeable patterns and correlations between EID scores and number of wild items in seasonal rounds
	Convergence Finding: Noticeable patterns and correlations between EID scores and seasonal round typologies
	Convergence Finding: Participants worry that losing some of their food practices/habits may contribute to a loss of identity
	Singular Finding: Certain foods and practices are both culturally important and important to individual identity
	Singular Finding: No correlation between EID scores, number of items in seasonal rounds, and demographics
Research Question 3: Objective 6: Understand how EI could be situated in SESR theory as a social mechanism of SESR	Convergence Finding: Noticeable patterns and correlations between EID scores and number of items in seasonal rounds
	Convergence Finding: Use of wild food items contributes toward maintaining SESR

	Singular Finding: Participants are intentionally and gradually changing their food habits over time
	Singular Finding: Participants worry that losing some of their food practices/habits may contribute to a loss of identity
	Singular Finding: Certain foods and practices are both culturally important and important to individual identity
Research Question 3: Objective 7: Postulate, using this study's findings, how EI could be operationalized within Nepal's mid-hill social-ecological system to enhance resilience of smallholder farmers to various disturbances.	Convergence Finding: Noticeable patterns and correlations between EID scores and number of wild items in seasonal rounds
	Convergence Finding: Noticeable patterns and correlations between EID scores and number of items in seasonal rounds
	Singular Finding: A diversity of food habits and practices contributes towards maintaining biocultural diversity and SESR
	Divergence Finding: No correlation between EID scores, number of items in seasonal rounds, and demographics

B. RESEARCH OBJECTIVE 1: PATTERNS & CORRELATIONS BETWEEN EI & OTHER TRAITS HELD BY STUDY PARTICIPANTS

Within the EID questionnaire results there was a range of answers as diverse as the respondents. The mean score was 4.92 out of a possible score of 7.00, roughly 0.8 points lower than the average in Clayton et al.'s (2021) study (5.7). The minimum score was 3/7 and the maximum was 6.21/7. Scores varied widely across the 14 individual questions, with some questions garnering lower responses than others. For example, participants chose to rate the statements in questions 2 & 5, which deal with psychological distance between humans and animals, rather poorly. However, questions which deal with the emotional aspects of nature, such as questions 9, 12, and 14, garnered much higher scores. Each of these questions along with their answer distributions can be viewed in the histograms (Figures 49-63) below:

Q1: I like to spend time outdoors in natural settings (such as woods, mountains, rivers, fields, local parks, lake or beach, or a leafy yard or garden).

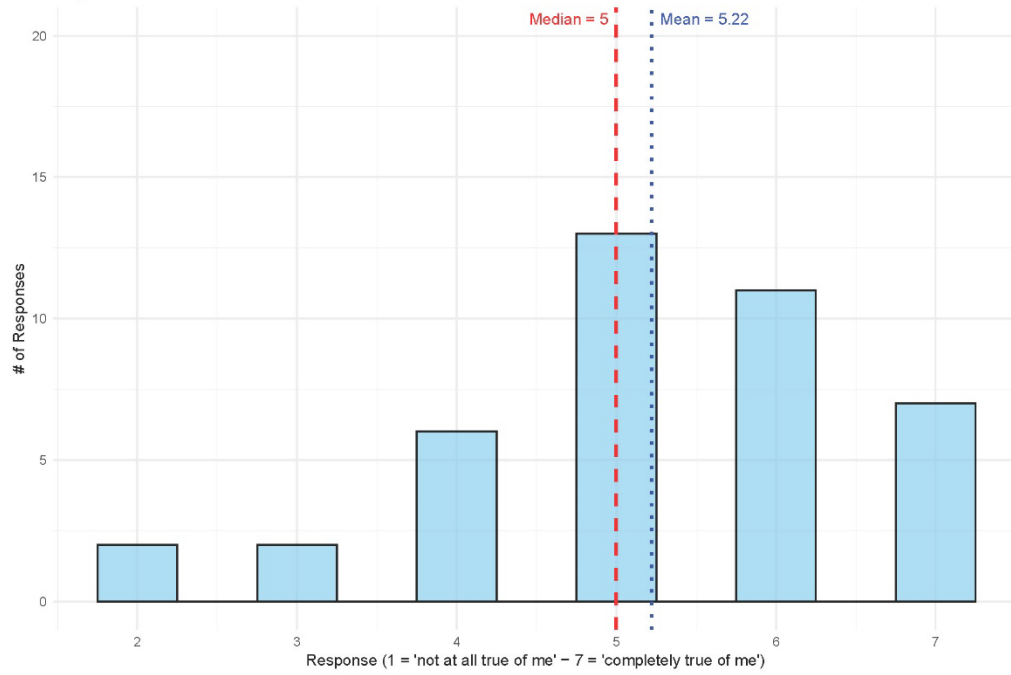


Figure 49. EID Questionnaire, question 1 responses (histogram)

Q2: I think of myself as a part of nature, not separate from it.

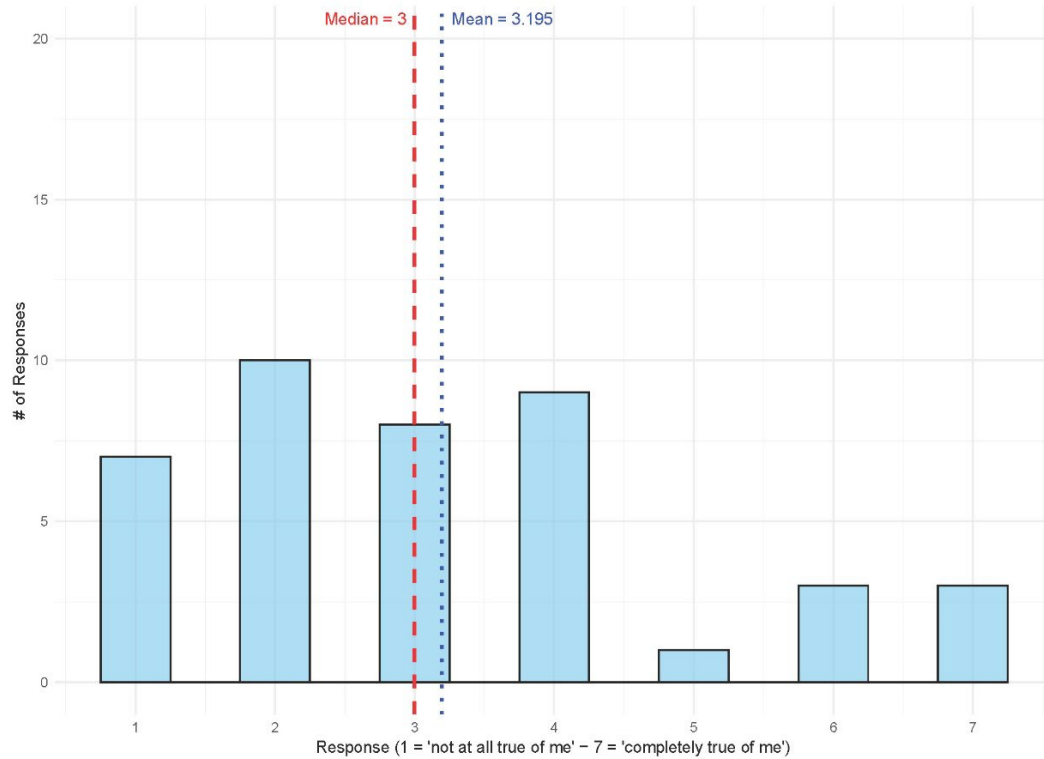


Figure 50. EID Questionnaire, question 2 responses (histogram)

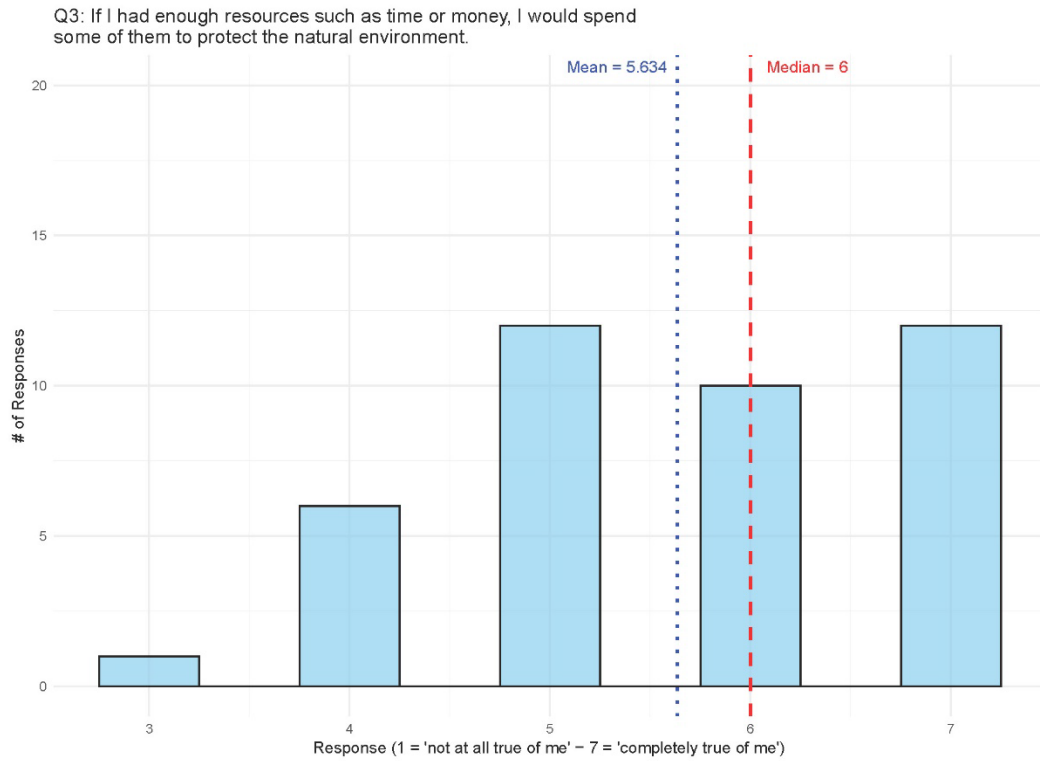


Figure 51. EID Questionnaire, question 3 responses (histogram)

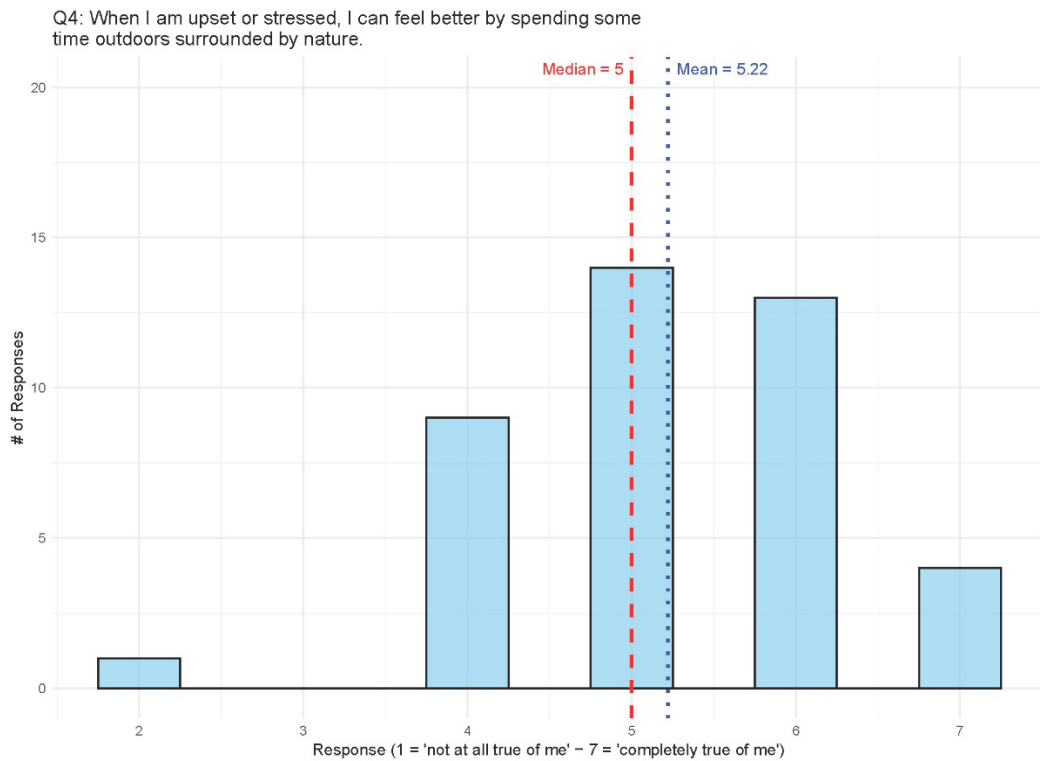


Figure 52. EID Questionnaire, question 4 responses (histogram)

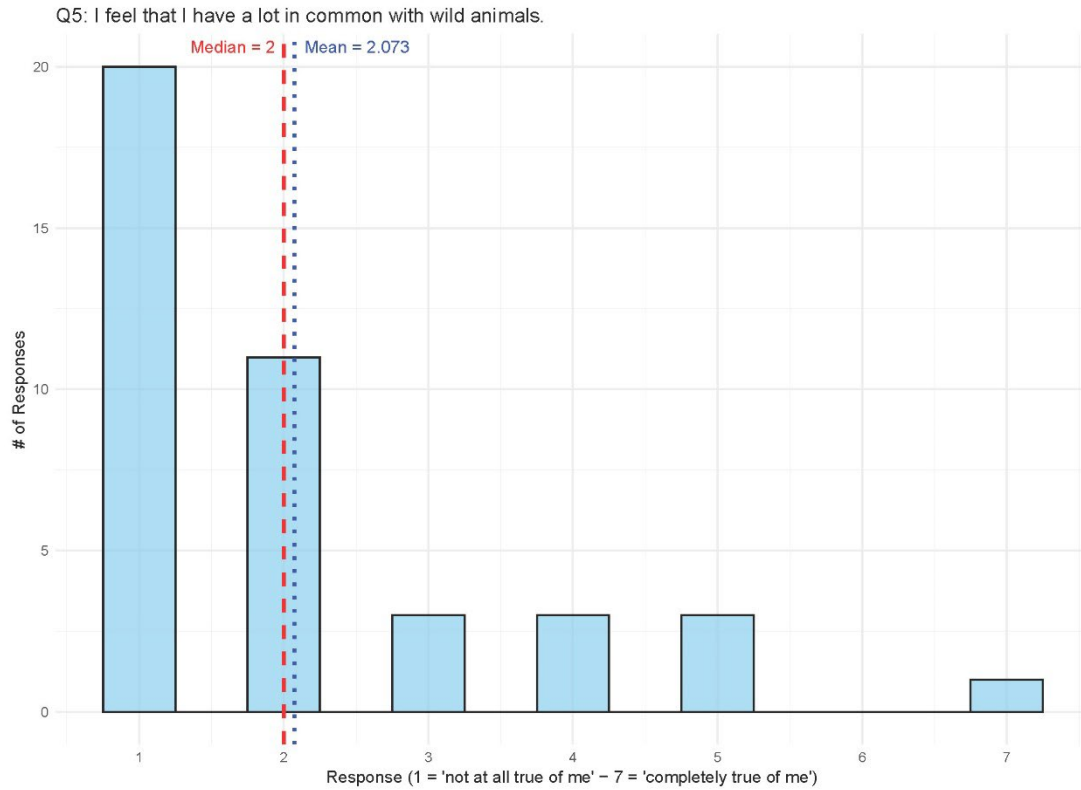


Figure 53. EID Questionnaire, question 5 responses (histogram)

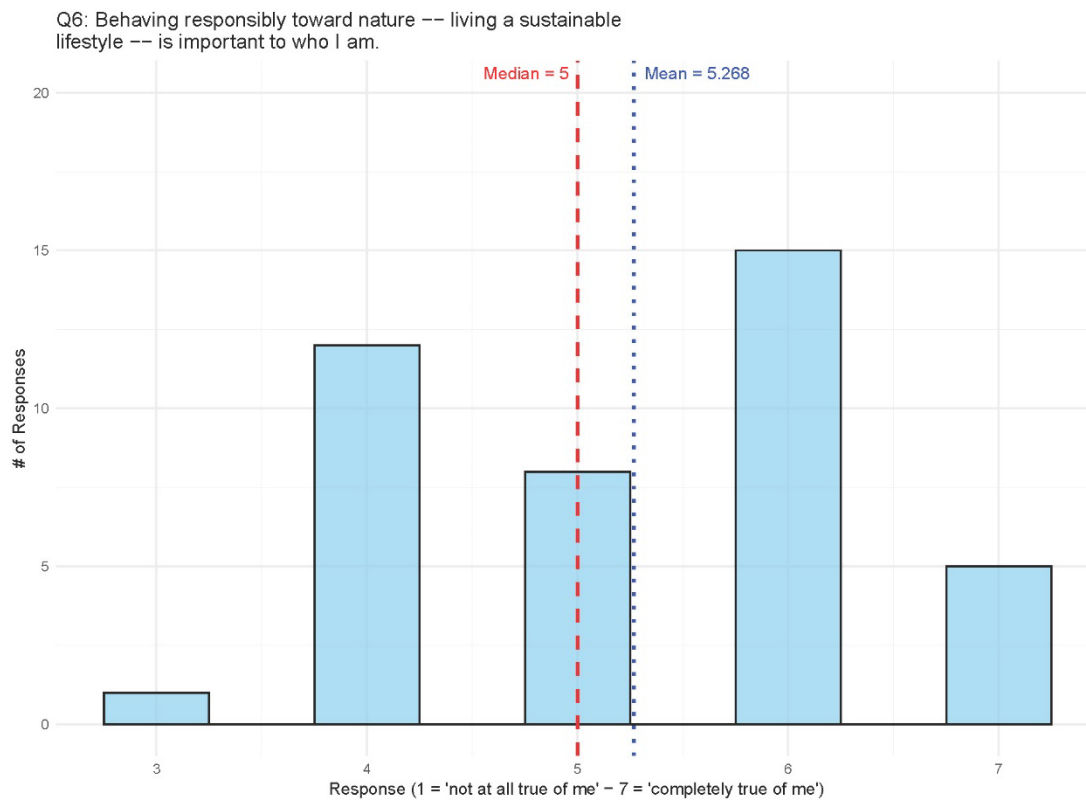


Figure 54. EID Questionnaire, question 6 responses (histogram)

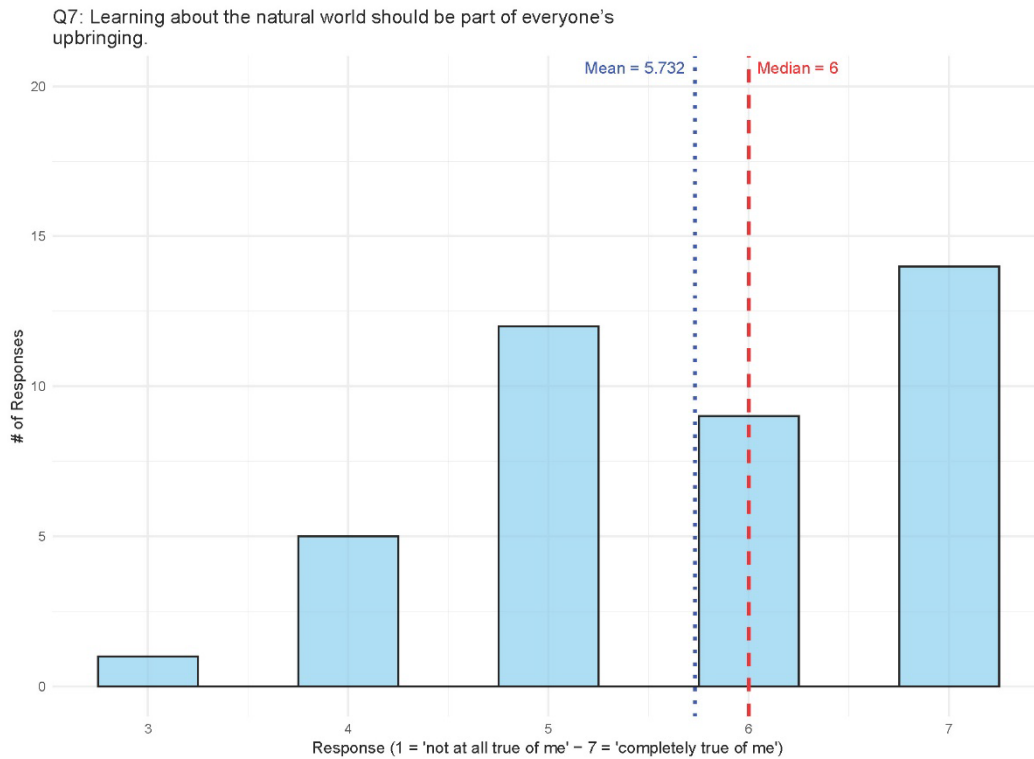


Figure 55. EID Questionnaire, question 7 responses (histogram)

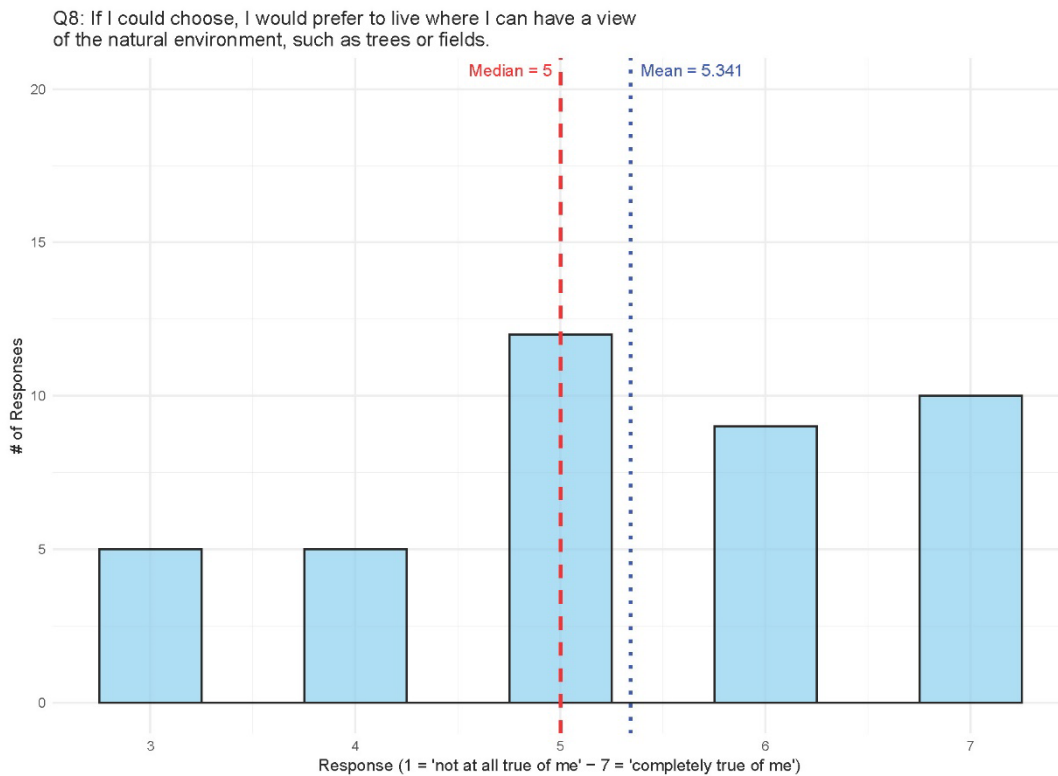


Figure 56. EID Questionnaire, question 8 responses (histogram)

Q9: An important part of my life would be missing if I was not able to get outside and enjoy nature from time to time.

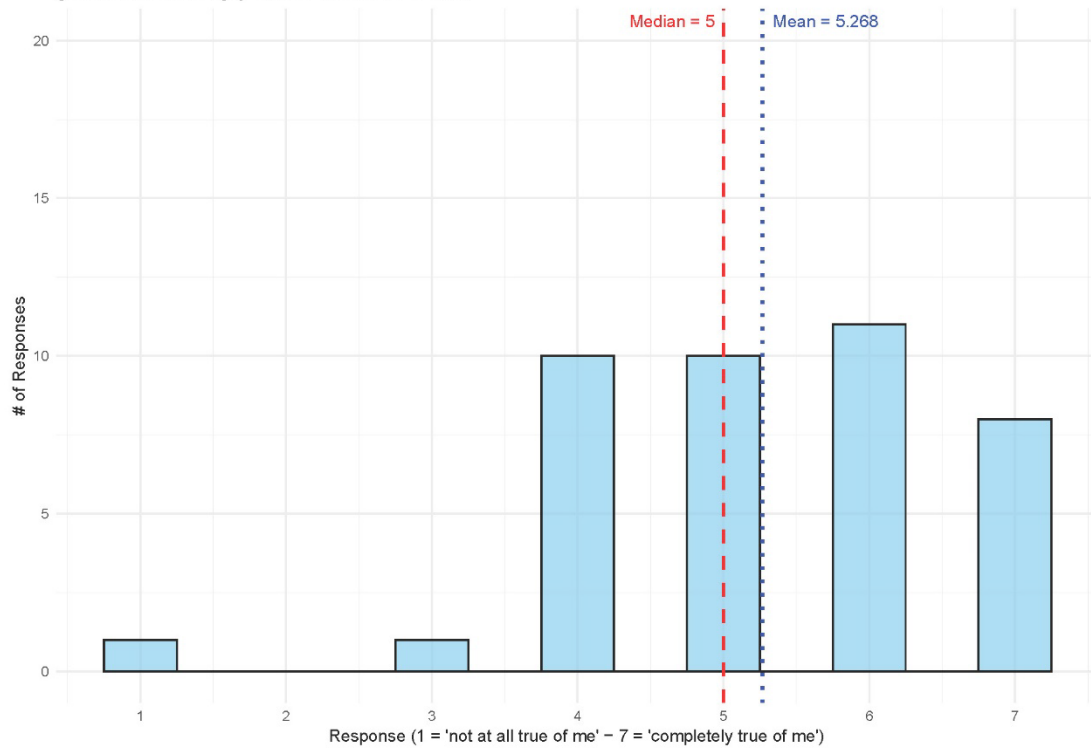


Figure 57. EID Questionnaire, question 9 responses (histogram)

Q10: I think elements of the natural world are more beautiful than any work of art.

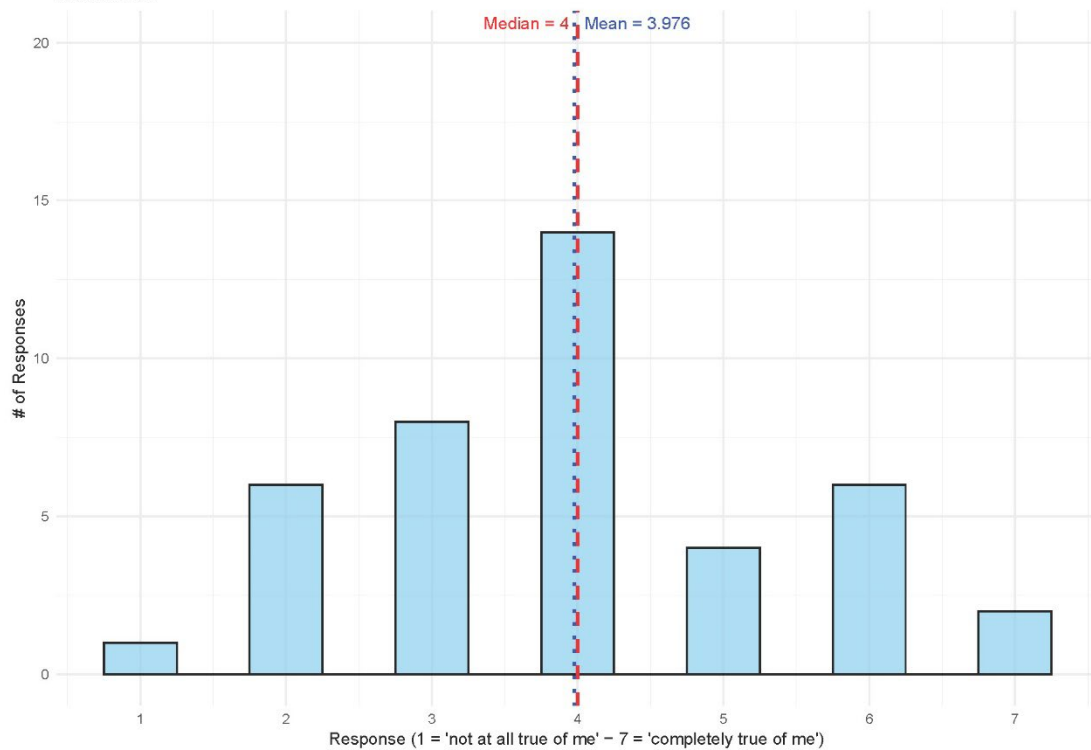


Figure 58. EID Questionnaire, question 10 responses (histogram)

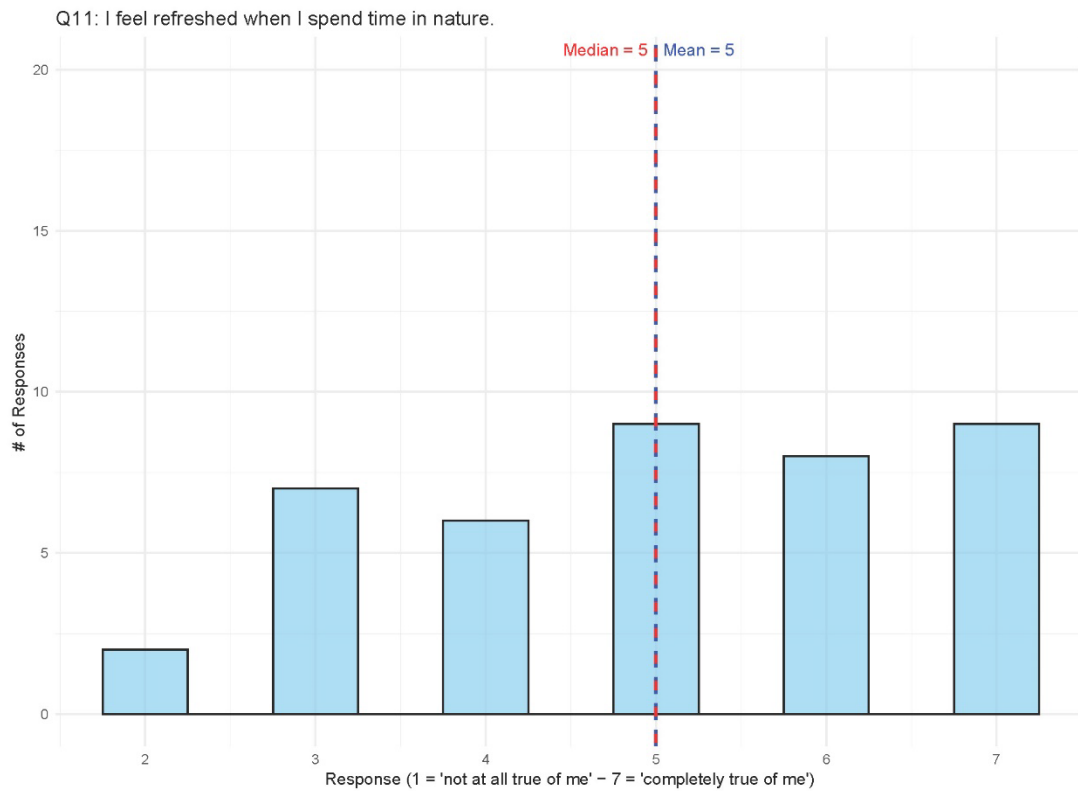


Figure 59. EID Questionnaire, question 11 responses (histogram)

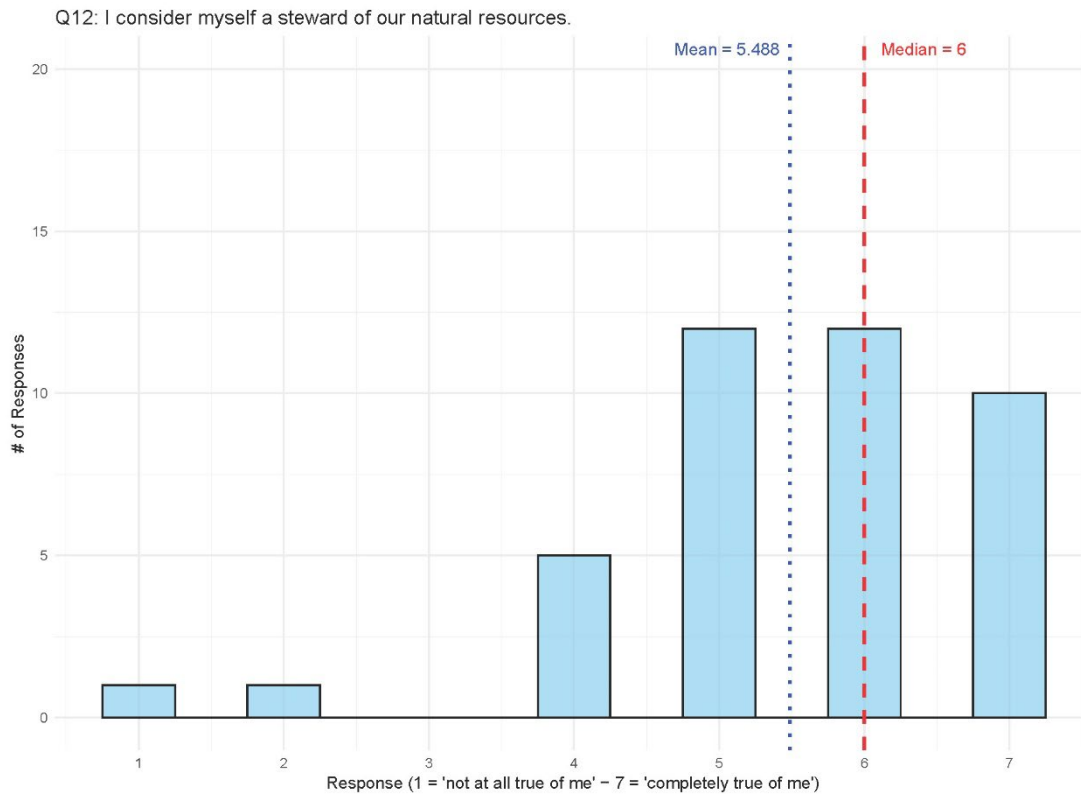


Figure 60. EID Questionnaire, question 12 responses (histogram)

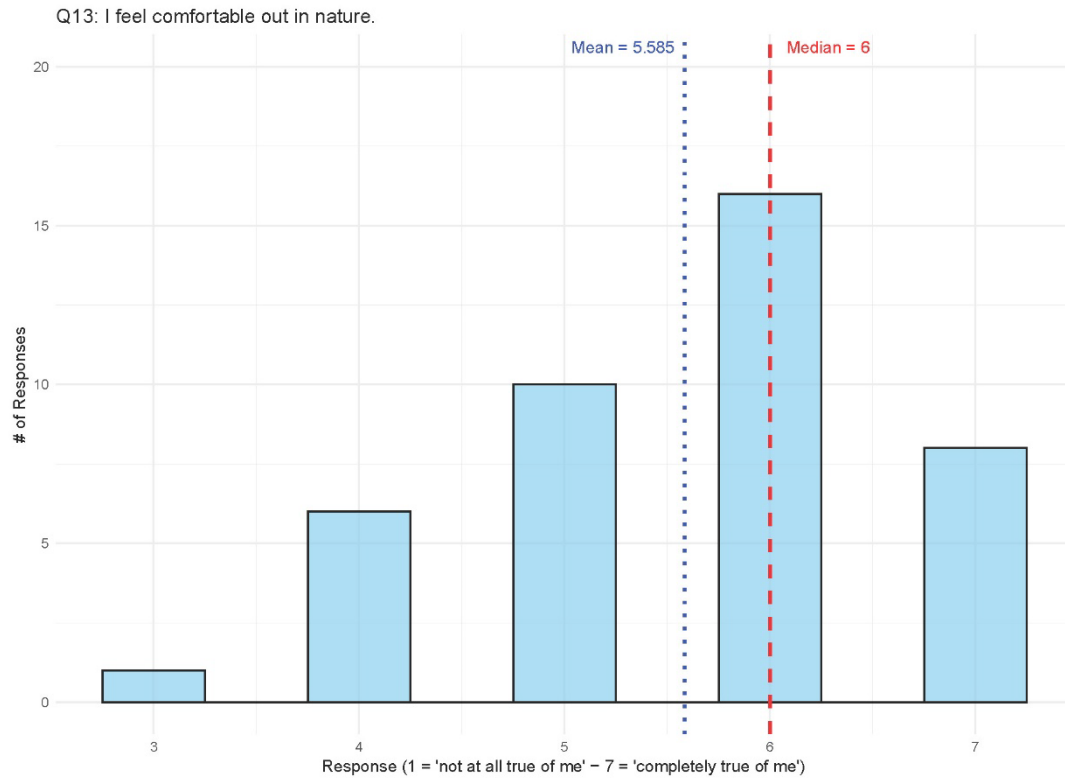


Figure 61. EID Questionnaire, question 13 responses (histogram)

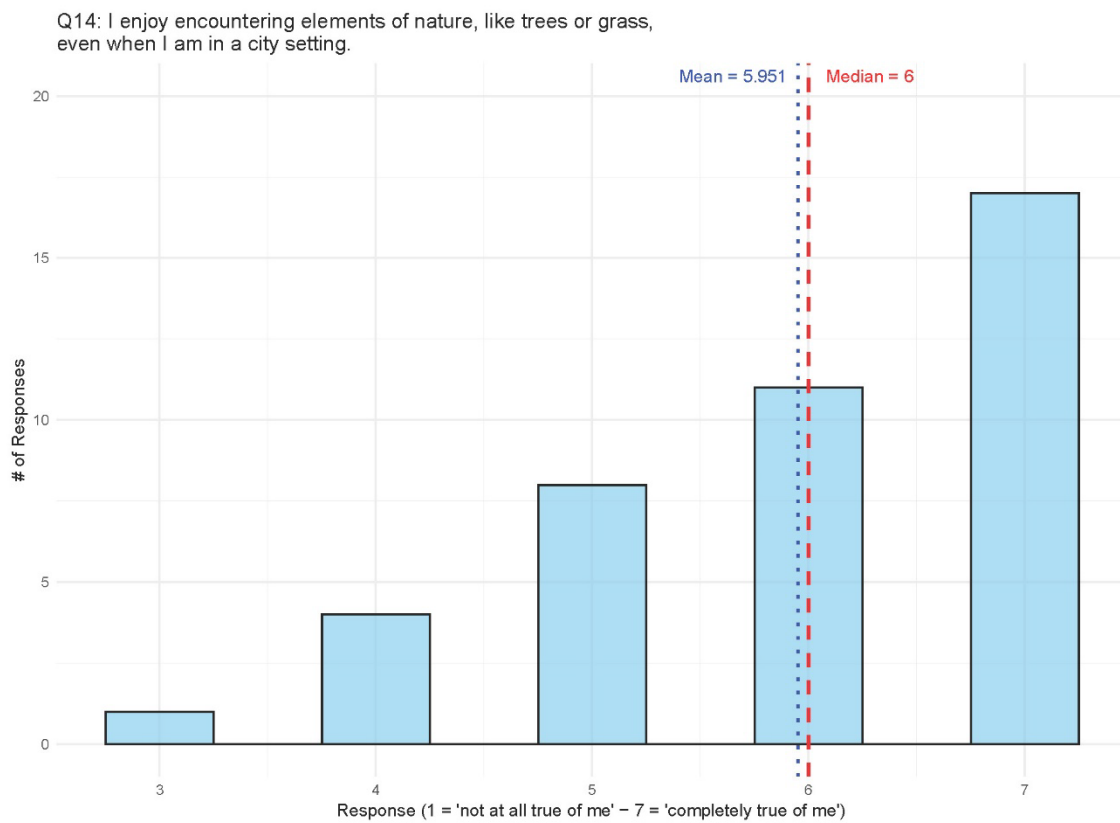


Figure 62. EID Questionnaire, question 14 responses (histogram)

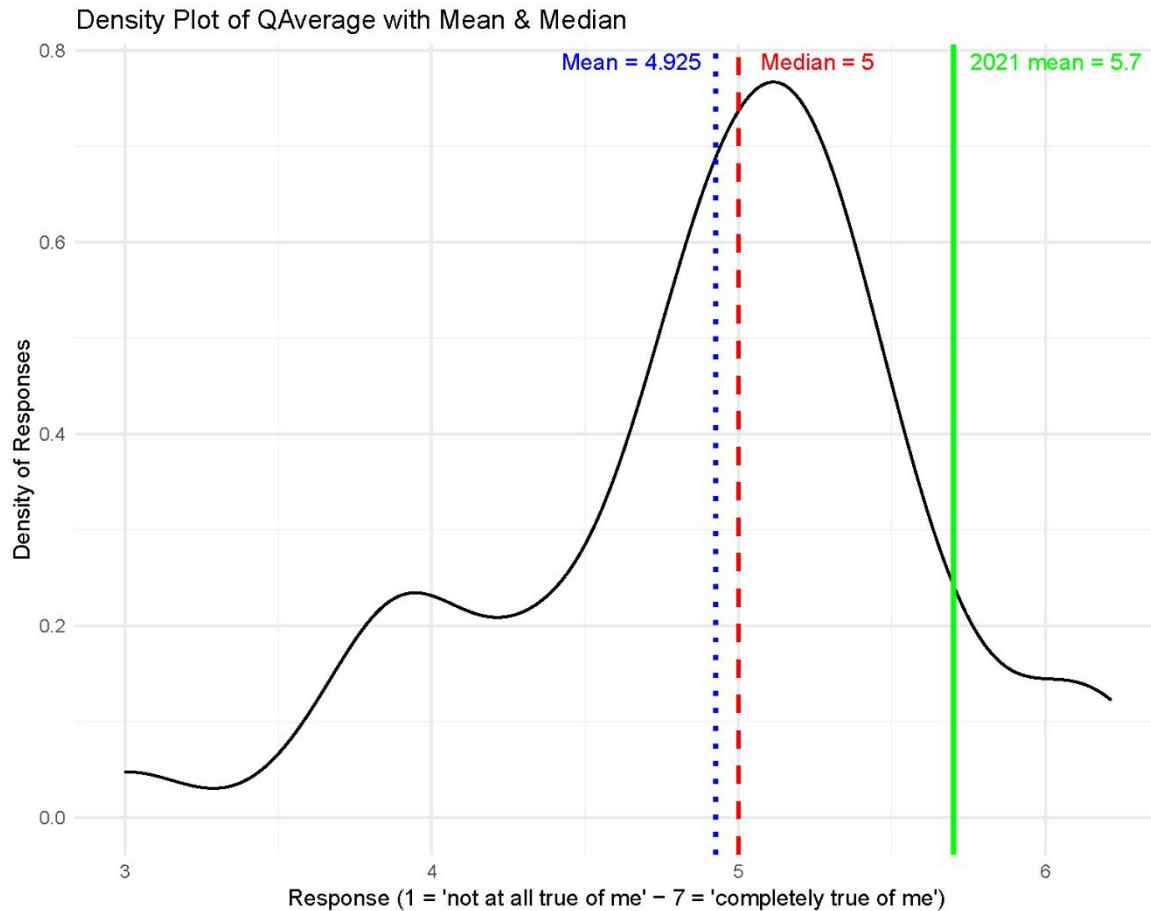


Figure 63. EID Questionnaire response densities, with included mean & median line for this research, as well as Clayton et al's (2021) mean (shown in green)

Once data were imported into RStudio and analyzed for summary and descriptive statistics, I was able to gain a more comprehensive understanding of my participants' demographic information as well (see Figures 64-71 below). Nearly 60% of my 41 participants were female. I attribute this to the fact that I (the P.I.) am a woman and so have greater social access to other women. Aside from this, the dataset was diverse, with participants across different ages, education levels, family sizes, and time spent residing in the study area. The majority of participants have a primary occupation as smallholder farmers, producing staple grains and cash crops such as fruits, vegetables, and spices such as turmeric and ginger. A smaller group of participants hold occupations in the local government, the local medical complex, schools, and in traditional occupations such as carpentry or the traditional

healing arts. Roughly one-third of my study participants have engaged in labor migration in the past, with the vast majority of those being men. And of my 41 participants, nearly 60% of them responded that someone in their immediate family was currently engaging in labor migration. This is on track with census reports stating that half of all Nepali households have recorded at least one person working abroad to bring income into the household (Government of Nepal, 2021), with these percentages even higher in the mid-west region of Nepal (ibid.).

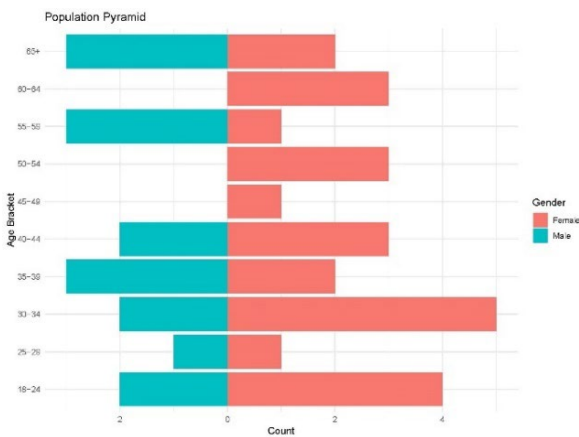


Figure 64. participant demographics: age and gender

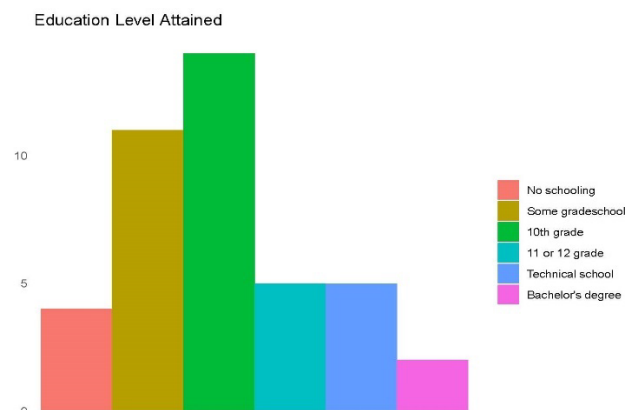


Figure 65. participant demographics: education level attained

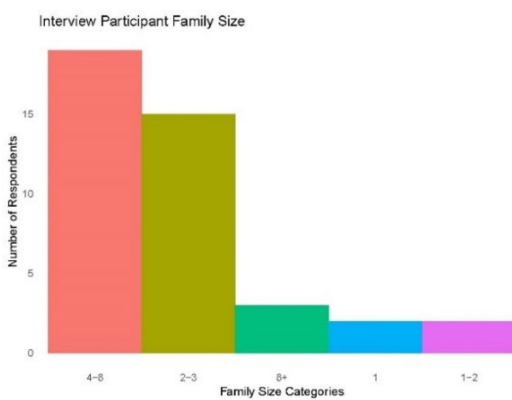


Figure 66. participant demographics: family size of participant

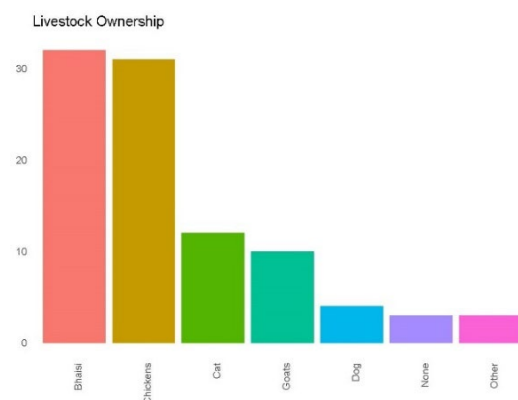


Figure 67. participant demographics: livestock ownership

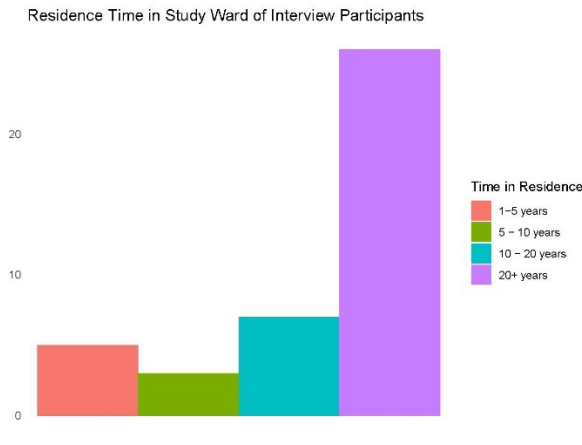


Figure 68. participant demographics: time spent living within the research site

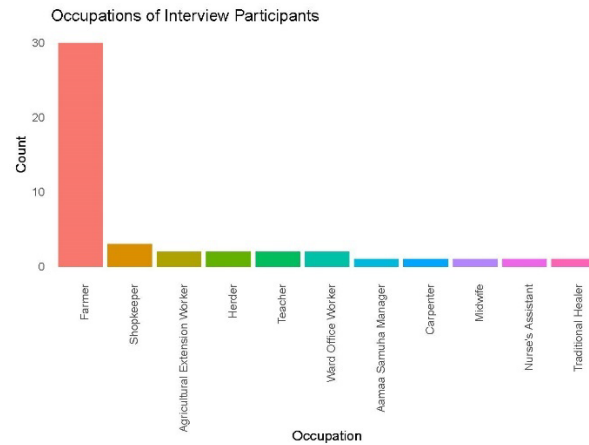


Figure 69. participant demographics: occupation

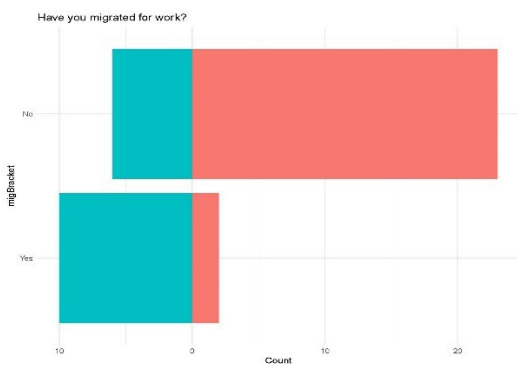


Figure 70. participant demographics: have you migrated for work?

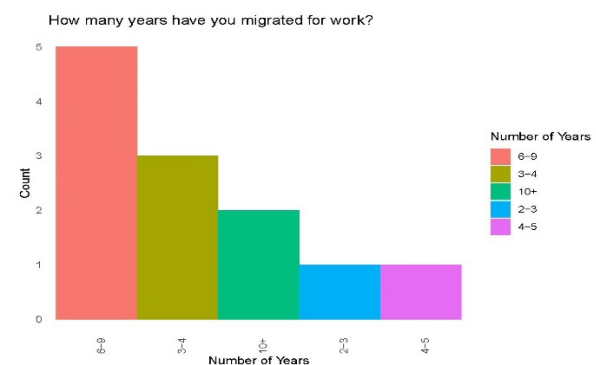


Figure 71. participant demographics: number of years spent migrating for work

This study found no statistically significant correlations between the EID scores of study participants and any demographic trait such as age, gender, occupation, whether or not they have engaged in labor migration, whether or not they have a family member who has engaged in labor migration, livestock holdings, whether or not they have a kitchen garden, education level, or family size (see table in Appendix B).

Within the qualitative analysis, many respondents did indicate that food practices, specifically familiarity with wild items and cash crops, were particularly important to them and how they form their identities within this social-ecological system. Some of the primary themes which revealed themselves centered on the importance of certain foods and practices to personal, cultural, and

community identity within this social ecological system, although some respondents did indicate that food practices were not particularly important to them in any way.

C. RESEARCH OBJECTIVE 2: PERCEIVED SHORTCOMINGS OF EXISTING EI ASSESSMENT SCALES RESULTING FROM THIS STUDY

Clayton et al.'s (2021) Environmental Identity Questionnaire was developed specifically for use in multicultural contexts. I was eager to determine if this assessment, and potentially others, would be helpful for describing the ecological identities of rural, indigenous smallholders in non-Western contexts, as to my knowledge these scales have very rarely been used in these communities. Despite the above findings' reliance upon Clayton et al.'s (2021) Environmental Identity Questionnaire, this study uncovered a few drawbacks of this questionnaire that could be easily remedied for use in multicultural and multi-geographic contexts.

Multiple questionnaires and assessments pertaining to EI or one of its counterparts (connectedness to nature, nature relatedness, environmental identity, etc.) were developed in collaboration with survey takers that skew urban and educated. There is nothing objectively or relatively "wrong" with either of these populations or their ecological identities. However, urban populations are less likely to view themselves as resource-dependent or resource-proximate, and the essence of their relationship with the natural environment is likely to differ from those in rural communities. Academics (primarily undergraduate students at universities where these scales were developed) are very familiar with the concept of being surveyed and may have received an ecological education which primes them to give certain answers, knowing what they mean to the overall survey. Both aspects of these populations may have served to skew the data in a direction that does not align with the ecological identities of resource-proximate smallholders who maintain intensive knowledge about and cultural practices pertaining to their specific SES.

Secondly, the process of collecting responses to the EID questionnaire revealed to me a series of simple cultural differences, misunderstandings, and confusions which more than likely contributed to lower scores amongst my study participants. Right off the bat, most of my participants were unfamiliar with the Likert-scale question structure employed in the EID questionnaire. I spent a lot of time explaining how every number corresponded to a value, and often was met with questions pertaining to

what qualified for a phrase such as “completely true of me”. Eventually I needed to make a key explaining what each number meant. There is some experience in the literature examining responses to certain question structures in multicultural contexts, which finds that culture can affect response patterns, especially using a Likert scale question structure (Lee, Jones, Mineyama, & Zhang, 2002; Wang, Hempton, Dugan, & Komives, 2008; D'Alonzo, 2011).

Another challenge in collecting answers to this questionnaire came in the way the questions themselves were phrased. Several questions dealing with psychological distance from nature phrased this concept as a similarity of human beings to other living creatures, such as animals. This concept was greatly upsetting to several of my survey participants, and merely unsettling for many more. Unsurprisingly these questions received very low scores and certainly dragged the average down. For example, participants chose to rate the statements in Questions 2 & 5, which deal with psychological distance between humans and animals, rather poorly, with an average response of 1 or 2 out of a possible score of 7. Perhaps this was due to cultural differences in how western societies view human proximity to animals, versus how this society perceives other-than-human beings. However, questions which deal with the emotional aspects of nature, such as Questions 9, 12, and 14, garnered much higher scores.

In addition, despite my best efforts to translate the survey into Nepali using the exact parameters given in Clayton et al.'s publication, participants expressed confusion about certain phrases pertaining particularly to the concept of “nature.” The Nepali language has at least four different translations for nature, each with their own specific meaning, shown below:

पृथ्वी= Literal name for the Earth

संसार= The World, and everything in it. A more abstract term.

प्रकृति = Everything in its natural form

भूमि = Nature as a sentient deity, personification of the Earth

वातावरण = Environment as a vague term for general surroundings

I used the term “प्रकृति वातावरण” (Natural Environment) for this questionnaire. However, it might have been the wrong choice as many participants asked me what I meant by this phrase.

Lastly, the EID questionnaire, unlike any other questionnaire that I could find, attempts to collect information on ecological knowledge, ecological management practices, and active environmental stewardship as an integral part of EI. The EID questionnaire specifically asks questions to determine the *likelihood* of engaging in environmental stewardship activities but does not ask if participants are *actively engaging* in environmental stewardship or ecological management practices. Therefore, in order to gauge the likelihood of engagement in stewardship activities, some assessment of prior knowledge and activity should be made.

D. RESEARCH OBJECTIVE 3: DESCRIBING THE RELATIONSHIP BETWEEN FOOD PRACTICES & TIME

Qualitative analysis of the short answer questions and field observation indicated several patterns amongst the general food practices of this community. Although participants indicated that they are intentionally and gradually changing their food habits over time, they also indicate that the use of many different kinds of food items is important to them for personal and cultural reasons, and that the use of wild food items has not decreased on a generational scale. See Figures 73 and 74 below for a detailed breakdown of the short answer questions and field observations.

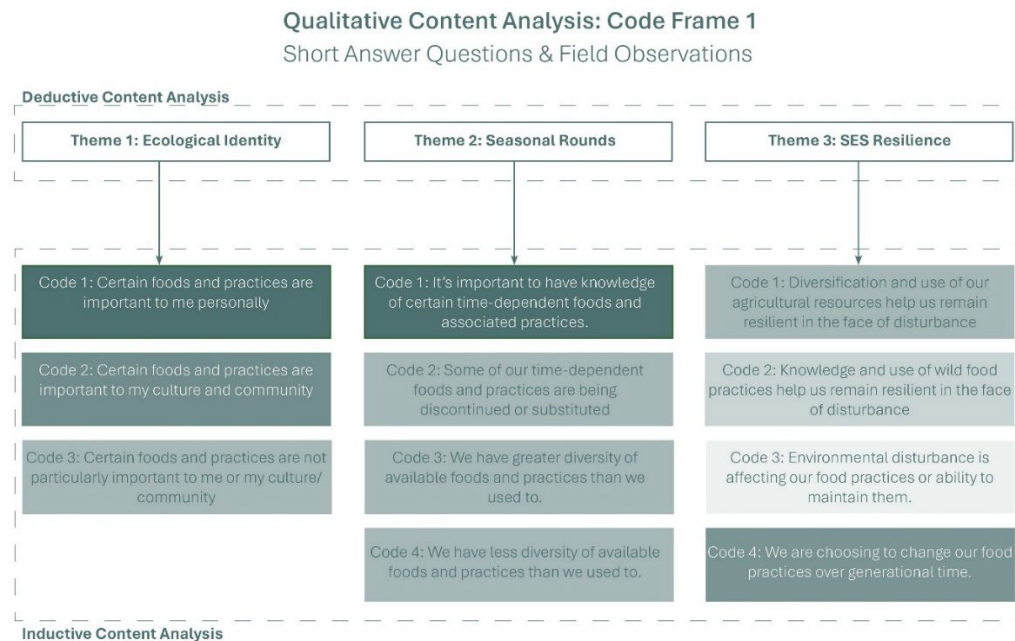


Figure 72. Deductive & Inductive content analysis of Short Answer Questions & Field Observations

Qualitative Content Analysis: Code Frame 2

Short Answer Questions only

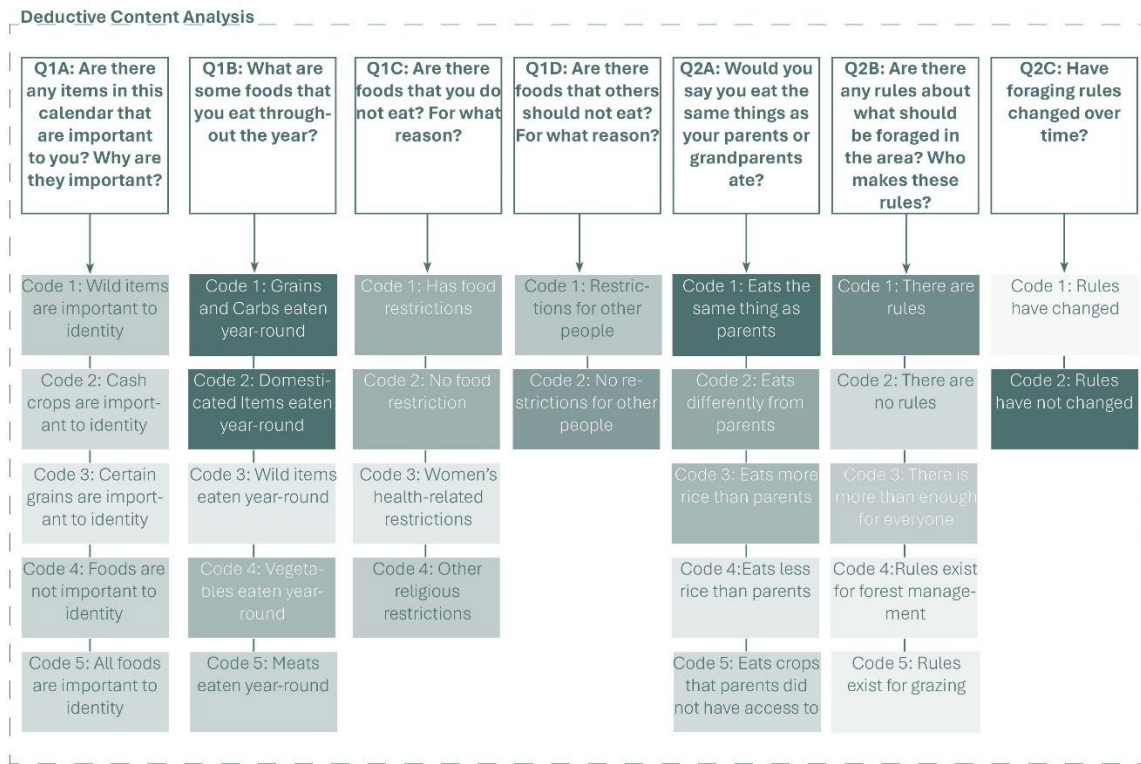


Figure 73. Deductive content analysis of Short Answer Questions only

Certain foods - for example, wild yams, wasps, and seasonal fruits and wild vegetables - are culturally important to respondents for specific festivals and celebrations. However, the day-to-day items they consume tend to be domesticated and plant-based, while wild items comprise part of their diet on a very seasonal or special occasion basis. Though food-related restrictions are common in Nepali communities at large, aside from the occasional restriction centering on religion or health, this community tends not to espouse many restrictions by individuals, nor did many respondents believe in many restrictions for others. Many respondents indicated that their current diet is different from that of their parents and grandparents, mainly in the consumption of more rice and wheat, as opposed to traditional grains such as millet, barley, and buckwheat. Respondents also indicated that their diet is less diverse than that of their parents, but also say that they have access to a more diverse diet and are merely choosing to eat less diversely. There are no rules on foraging in the wild areas and community forests around the settled areas, and most respondents stated that there was a bounty of wild foods for anyone who wished to forage for them. Rules do exist for the management of firewood groves, fodder trees, and grazing areas, but these have not changed in recent years.

In the Transformable Qualitative Analysis, my main goal was to interpret the relationships between items listed on the seasonal rounds, and time. I achieved this by utilizing methods from Ruelle et al. (2022) which examine the “sequences” (series of items which come into season sequentially), and “synchronies” (items which come into season and are utilized all within the same period of time). Additionally, I decided to determine the “densities” (average number of items in season at any one time per calendar), and community utilization of items (number of interview participants who utilize a particular item). As I counted and catalogued sequences, synchronies, densities and community utilization, patterns began to emerge amongst the characteristics of individual participants’ seasonal rounds. These patterns allowed me to sort individual calendars into eight separate “typologies” of seasonal rounds, pertaining to the characteristics of individual items, sequences, synchronies, and densities of participants’ Seasonal Rounds. Some of these characteristics, such as the presence of synchronies or a high density of item usage across time, comport with characteristics which researchers often associate with social-ecological systems resilience (SESR), such as the use of Traditional Ecological Knowledge (TEK), or the maintenance of biodiversity (Berkes & Folke, 1998; Glaser, Krause, Ratter, & Welp, 2008). Therefore, these typologies are ordered by the number of “resilient” traits exhibited (higher densities of usage, presence of many items on the seasonal rounds, many sequences and synchronies, etc.). Eight calendars which exemplify these typologies particularly well were chosen from the dataset, and their information compiled in visual displays which can be viewed in Figures 75-82 below:

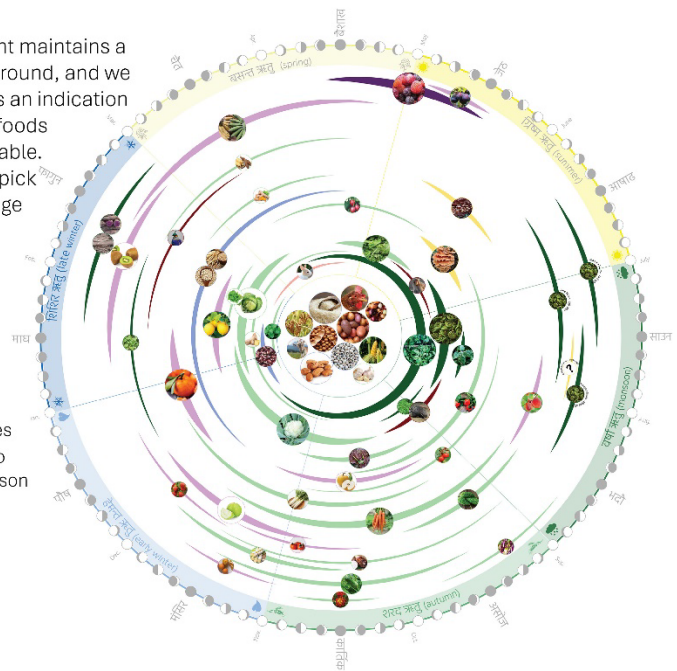
Type 1 (n = 11)

Looking at this seasonal round we see that the participant maintains a rich and diverse diet. There are no “sparse” areas on the round, and we can interpret the dense nature of the participant’s diet as an indication of SES resilience, by having the ability to switch to other foods should their typical seasonal diet foods become unavailable. The participant has many year-round items, and we can pick out many sequences and synchronies. Through knowledge of sequences and synchronies this participant is able to maintain resilience and food security in this social-ecological system.

Participant: 04

Age (range): 35-39
Gender: Female
Occupation: Farmer
Education: 10th
Level: Grade

of Family Members (range): 2-3
Do you have a kitchen garden?: Yes
Have you ever worked abroad?: No
Has family worked abroad?: 1 person



Sequences + Synchronies: Greater than 5

of Year-Round Items: Greater than 4

Density (of items): Dense

Figure 74. participant Seasonal Round profile: Typology 1

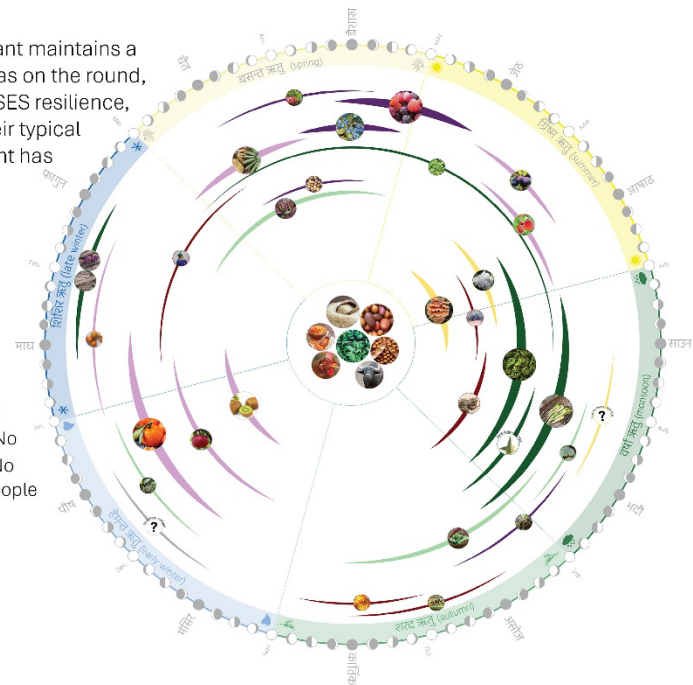
Type 2 (n = 2)

Looking at this seasonal round we see that the participant maintains a somewhat diverse diet. However there are “sparse” areas on the round, and we can interpret this as an indication of degrading SES resilience, by lacking the ability to switch to other foods should their typical seasonal diet foods become unavailable. The participant has many year-round items, and we can pick out many sequences and synchronies. Through knowledge of sequences and synchronies this participant is able to maintain resilience and food security in this social-ecological system.

Participant: 41

Age (range): 18-24
Gender: Male
Occupation: Herder
Education: Some Grade
Level: School

of Family Members (range): 4-8
Do you have a kitchen garden?: No
Have you ever worked abroad?: No
Has family worked abroad?: 3 people



Sequences + Synchronies: Greater than 5

of Year-Round Items: Greater than 4

Density (of items): Sparse

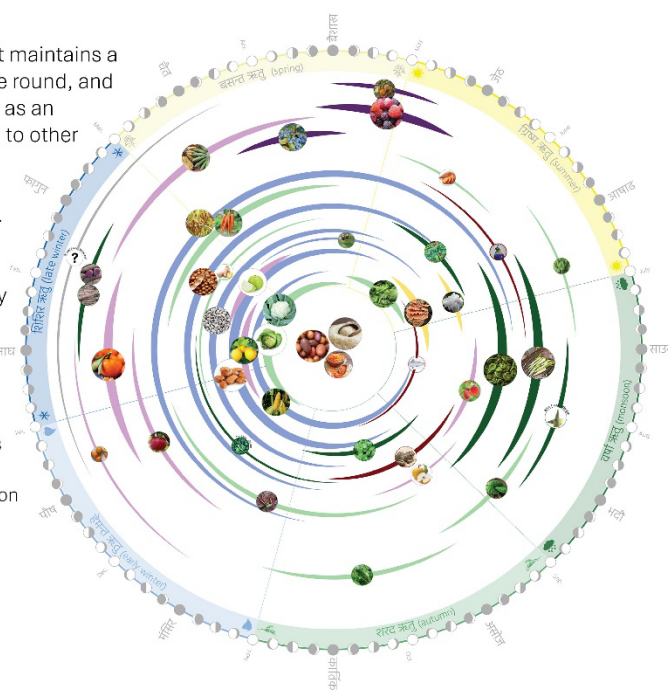
Figure 75. participant Seasonal Round profile: Typology 2

Type 3 (n = 6)

Looking at this seasonal round we see that the participant maintains a somewhat diverse diet. There are no “sparse” areas on the round, and we can interpret the dense nature of the participant’s diet as an indication of SES resilience, by having the ability to switch to other foods should their typical seasonal diet foods become unavailable. However the participant has few year-round items, which may affect their food security and resilience. We can pick out many sequences and synchronies. Through knowledge of sequences and synchronies this participant is able to maintain resilience and food security in this social-ecological system.

Participant: 33

Age (range):	30-34	# of Family Members (range):	4-8
Gender:	Female	Do you have a kitchen garden?:	Yes
Occupation:	Farmer	Have you ever worked abroad?:	No
Education Level:	Some Grade School	Has family worked abroad?:	1 person



Sequences + Synchronies: Greater than 5

of Year-Round Items: Less than, equal to 4

Density (of items): Dense

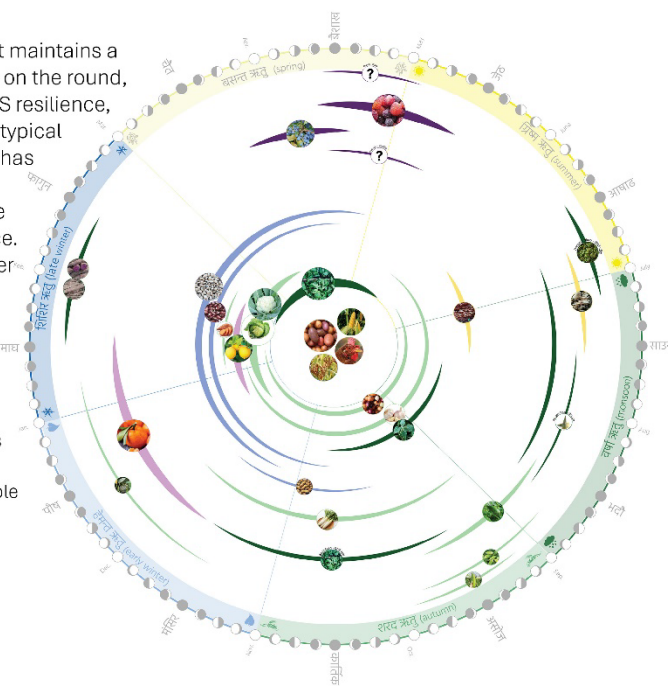
Figure 76. participant Seasonal Round profile: Typology 3

Type 4 (n = 2)

Looking at this seasonal round we see that the participant maintains a somewhat diverse diet. However there are “sparse” areas on the round, and we can interpret this as an indication of degrading SES resilience, by lacking the ability to switch to other foods should their typical seasonal diet foods become unavailable. The participant has fewer year-round items, however we can pick out many sequences of items which come into season one after the other, and synchronies which all come into season at once. Maintaining this knowledge allows the participant to gather many things at once, and to have knowledge of item availability through triangulation of other available items.

Participant: 28

Age (range):	40 - 44	# of Family Members (range):	2-3
Gender:	Female	Do you have a kitchen garden?:	Yes
Occupation:	Farmer	Have you ever worked abroad?:	No
Education Level:	Some Grade School	Has family worked abroad?:	2 people



Sequences + Synchronies: Greater than 5

of Year-Round Items: Less than, equal to 4

Density (of items): Sparse

Figure 77. participant Seasonal Round profile: Typology 4

Type 5 (n = 5)

Looking at this seasonal round we see that the participant maintains a less diverse diet. There are no “sparse” areas on the round, and we can interpret the dense nature of the participant’s diet as an indication of SES resilience, by having the ability to switch to other foods should their typical seasonal diet foods become unavailable. The participant has many year-round items, But we cannot pick out many sequences or synchronies. This adversely affects the participant and their ability to maintain resilience and food security within this social-ecological system.

Participant: 09

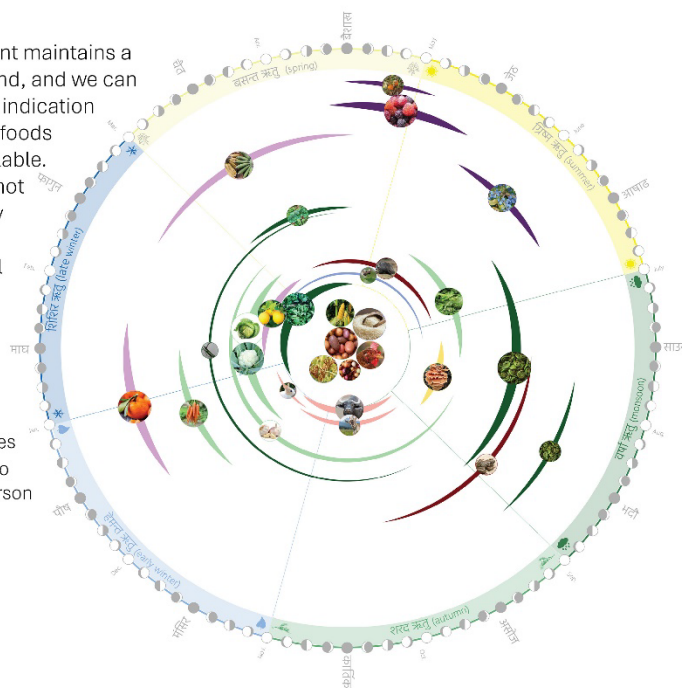
Age (range): 18-24
 Gender: Female
 Occupation: Farmer
 Education: 10th Grade
 Level:

of Family Members (range): 4-8

Do you have a kitchen garden?: Yes

Have you ever worked abroad?: No

Has family worked abroad?: 1 person



Sequences + Synchronies: Less than, equal to 5

of Year-Round Items: Greater than 4

Density (of items): Dense

Figure 78. participant Seasonal Round profile: Typology 5

Type 6 (n = 5)

Looking at this seasonal round we see that the participant does not maintain a very diverse diet. There are “sparse” areas on the round, and we can interpret this as an indication of degrading SES resilience, by lacking the ability to switch to other foods should their typical seasonal diet foods become unavailable. The participant has many year-round items, but we cannot pick out many sequences or synchronies. This adversely affects the participant and their ability to maintain resilience and food security within this social-ecological system.

Participant: 40

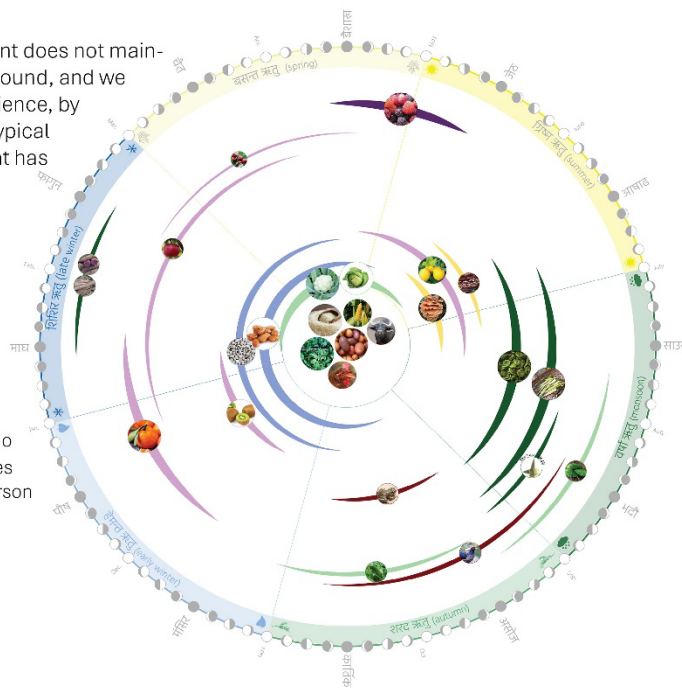
Age (range): 60-64
 Gender: Female
 Occupation: Farmer
 Education: 10th Grade
 Level:

of Family Members (range): 2-3

Do you have a kitchen garden?: No

Have you ever worked abroad?: Yes

Has family worked abroad?: 1 person



Sequences + Synchronies: Less than, equal to 5

of Year-Round Items: Greater than 4

Density (of items): Sparse

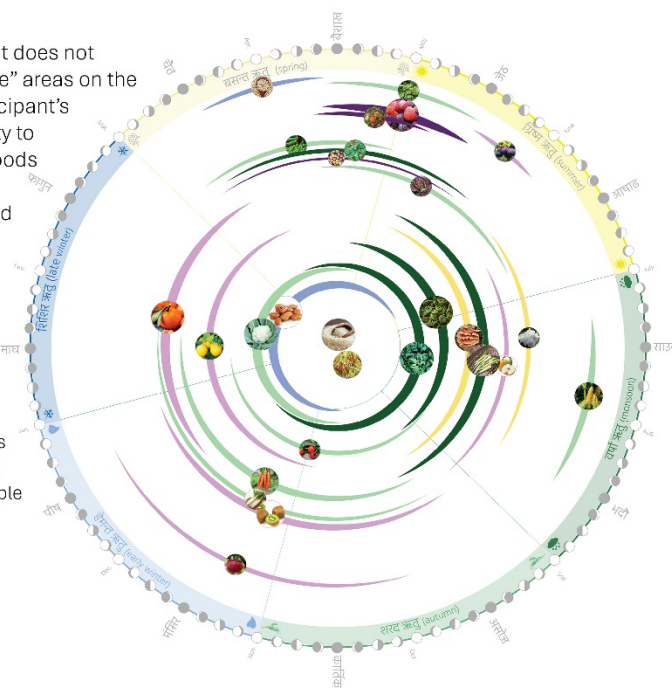
Figure 79. participant Seasonal Round profile: Typology 6

Type 7 (n = 3)

Looking at this seasonal round we see that the participant does not maintain a very diverse diet. However there are no “sparse” areas on the round, and we can interpret the dense nature of the participant’s diet as an indication of SES resilience, by having the ability to switch to other foods should their typical seasonal diet foods become unavailable. However the participant has few year-round items, which may affect their food security and resilience. We also cannot pick out many sequences or synchronies. This adversely affects the participant and their ability to maintain resilience and food security within this social-ecological system.

Participant: 02

Age (range):	50-54	# of Family Members (range):	1-2
Gender:	Female	Do you have a kitchen garden?:	Yes
Occupation:	Farmer	Have you ever worked abroad?:	No
Education Level:	Some Grade School	Has family worked abroad?:	2 people



Sequences + Synchronies: Less than, equal to 5

of Year-Round Items: Less than, equal to 4

Density (of items): Dense

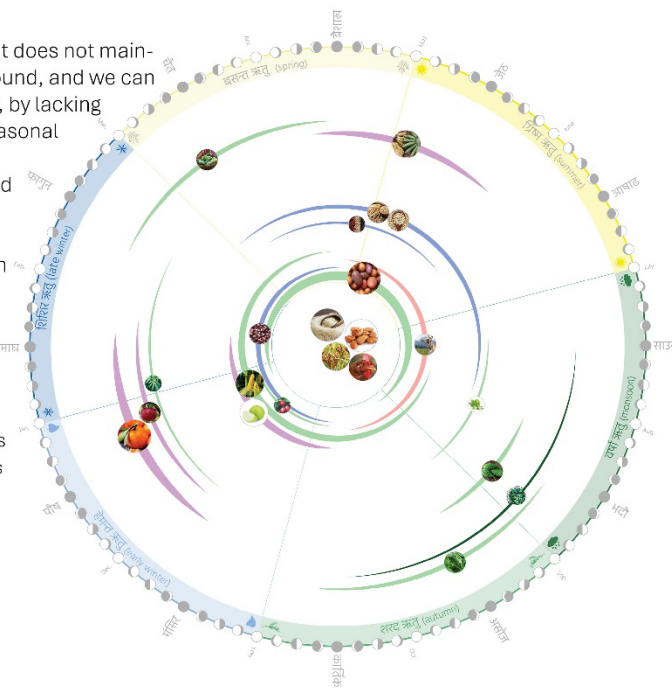
Figure 80. participant Seasonal Round profile: Typology 7

Type 8 (n = 8)

Looking at this seasonal round we see that the participant does not maintain a very diverse diet. There are “sparse” areas on the round, and we can interpret this as an indication of degrading SES resilience, by lacking the ability to switch to other foods should their typical seasonal diet foods become unavailable. The participant has few year-round items, which may affect their food security and resilience. We cannot pick out many sequences or synchronies. This adversely affects the participant and their ability to maintain resilience and food security within this social-ecological system.

Participant: 35

Age (range):	35-39	# of Family Members (range):	2-3
Gender:	Male	Do you have a kitchen garden?:	Yes
Occupation:	Unemployed	Have you ever worked abroad?:	Yes
Education Level:	11th or 12th Grade	Has family worked abroad?:	No



Sequences + Synchronies: Less than, equal to 5

of Year-Round Items: Less than, equal to 4

Density (of items): Sparse

Figure 81. participant Seasonal Round profile: Typology 8

Additionally, a chart consisting of each participant's seasonal round traits and subsequent typologies has been compiled for purposes of comparison and can be viewed below:

Table 3. Participant Sequences, Synchronies, Densities, and Typologies

Tag	Count	Synchronies	Sequences	# of Year-Round items	Are there gaps or thin areas?	Typology
P01	11	Wild fruits in Springtime Wild vegetables in Monsoon Fungi in Monsoon Domesticated fruits in Winter Wild marine animals in Monsoon	Vining plants -> Grains & pulses Brassicas -> Root vegetables Wild animals -> Grains & pulses	11	No	1
P02	3	Wild fruits in Springtime Wild vegetables in Monsoon	Root vegetables -> Domesticated Fruits	2	No	7
P03	5	Domesticated fruits in Winter Domesticated vegetables in Winter Wild fruits in Springtime	Brassicas -> Root vegetables Wild animals -> Domesticated animals	4	Yes	8
P04	10	Wild vegetables in Monsoon Fungi in Monsoon Domesticated fruits in Autumn Domesticated fruits in Winter Grains & pulses in Winter Wild fruits in Springtime Domesticated vegetables in Autumn	Wild vegetables -> Domesticated vegetables Domesticated fruits -> Grains & pulses Vining plants -> Root vegetables	11	No	1
P05	7	Wild fruits in Springtime Fungi in Monsoon Wild vegetables in Monsoon Grains & pulses in Winter	Brassicas -> Leafy Greens Wild vegetables -> Domesticated vegetables Fruiting vegetables -> Root vegetables	4	No	3
P06	7	Wild fruits in Springtime Fungi in Monsoon Wild vegetables in Monsoon Grains & pulses in Winter	Brassicas -> Leafy Greens Wild vegetables -> Domesticated vegetables Fruiting vegetables -> Root vegetables	4	No	3
P07	6	Wild fruits in Springtime Domesticated fruits in Springtime Wild vegetables in Monsoon Domesticated vegetables in Winter Fungi in Monsoon	Wild vegetables -> Domesticated vegetables	4	Yes	4

Tag	Count	Synchronies	Sequences	# of Year-Round items	Are there gaps or thin areas?	Typology
P08	7	Grains & pulses in Winter Domesticated fruits in Springtime Domesticated vegetables in Winter Wild vegetables in Monsoon	Grains & pulses -> Fungi Wild vegetables -> Domesticated vegetables Domesticated vegetables -> Grains & pulses	6	No	1
P09	3	Domesticated animals in Autumn Domesticated vegetables in Winter Wild fruits in Springtime	Wild vegetables -> Domesticated vegetables	6	No	5
P10	5	Wild vegetables in Monsoon Grains & pulses in Winter Fungi in Monsoon Domesticated vegetables in Autumn	Wild vegetables -> Domesticated vegetables Domesticated animals -> Grains & pulses	5	No	5
P11	2	Grains & pulses in Winter Domesticated vegetables in Winter		4	Yes	8
P12	2	Domesticated vegetables in Winter Domesticated fruits in Winter		3	Yes	8
P13	9	Domesticated vegetables in Monsoon Domesticated vegetables in Winter Grains & pulses in Winter Domesticated fruits in Winter Wild vegetables in Monsoon Domesticated animals in Autumn	Wild vegetables -> Domesticated vegetables Domesticated animals -> Grains & pulses Domesticated fruits -> Grains & pulses	3	No	3
P14	2	Grains & pulses	Domesticated vegetables -> Grains & pulses	4	Yes	8
P15	7	Wild vegetables in Monsoon Domesticated vegetables in Winter Domesticated fruits in Winter Wild animals in Winter Wild animals in Monsoon	Domesticated vegetables -> Wild animals Domesticated fruits -> Domesticated vegetables	7	Yes	2
P16	8	Grains & pulses in Winter Domesticated vegetables in Winter Domesticated animals in Winter Domesticated fruits in Winter Fungi in Monsoon	Grains & pulses -> Domesticated vegetables Domesticated fruits -> Grains & pulses Fungi -> Domesticated animals	4	No	3
P17	4	Wild vegetables in Monsoon Domesticated fruits in Winter Wild fruits in Springtime	Domesticated fruits -> Grains & pulses	3	No	7

Tag	Count	Synchronies	Sequences	# of Year-Round items	Are there gaps or thin areas?	Typology
P18	7	Fungi in Monsoon Wild vegetables in Monsoon Grains & pulses in Winter Wild fruits in Springtime Domesticated fruits in Monsoon	Domesticated fruits -> Grains & pulses Fungi -> Domesticated fruits	11	No	1
P19	7	Fungi in Monsoon Wild vegetables in Monsoon Grains & pulses in Winter Wild fruits in Springtime Domesticated fruits in Monsoon	Domesticated fruits -> Grains & pulses Fungi -> Domesticated fruits	11	No	1
P20	4	Grains & pulses in Winter Domesticated vegetables in Winter Wild fruits in Springtime	Domesticated vegetables -> Domesticated fruits	2	Yes	8
P21	5	Domesticated vegetables in Autumn Grains & pulses in Winter Domesticated animals in Winter Wild fruits in Springtime	Domesticated vegetables -> Grains & pulses	1	Yes	8
P22	3	Grains & pulses in Autumn Domesticated fruits	Grains & pulses -> Domesticated fruits	5	Yes	6
P23	5	Wild fruits in Springtime Domesticated fruits in Winter Domesticated vegetables in Winter	Domesticated vegetables -> Domesticated fruits Domesticated vegetables -> Wild fruits	4	Yes	8
P24	2	Wild vegetables in Monsoon Domesticated fruits in Winter		8	Yes	6
P25	3	Grains & pulses in Winter Wild vegetables in Monsoon Wild animals in Monsoon		6	Yes	6
P26	4	Grains & pulses in Winter Wild fruits in Springtime Domesticated fruits in Winter	Domesticated fruits -> Grains & pulses	4	No	7
P27	4	Wild vegetables in Monsoon Domesticated fruits in Winter Domesticated vegetables in Winter	Wild vegetables -> Grains & pulses	9	No	5

Tag	Count	Synchronies	Sequences	# of Year-Round items	Are there gaps or thin areas?	Typology
P28	6	Wild fruits in Springtime Grains & pulses in Winter Domesticated vegetables in Autumn Wild vegetables in Monsoon Domesticated vegetables -> Grains & pulses	Domesticated vegetables -> Grains & pulses Grains & pulses -> Wild fruits	4	Yes	4
P29	5	Wild animals in Monsoon Domesticated vegetables in Autumn Domesticated vegetables in Winter Domesticated fruits in Winter	Wild animals -> Domesticated vegetables	8	No	5
P30	7	Domesticated vegetables in Monsoon Domesticated vegetables in Autumn Domesticated vegetables in Winter Domesticated fruits in Winter Fungi in Monsoon	Domesticated vegetables -> Domesticated fruits	14	No	5
P31	7	Wild fruits in Springtime Wild vegetables in Monsoon Wild animals in Monsoon Domesticated fruits in Winter Grains & pulses in Winter	Domesticated fruits -> Grains & pulses Wild vegetables -> Domesticated vegetables	5	No	1
P32	9	Wild fruits in Springtime Wild vegetables in Summer Wild vegetables in Monsoon Fungi in Summer Domesticated fruits in Winter Grains & pulses in Winter	Wild vegetables -> Grains & pulses Domesticated fruits -> Grains & pulses Grains & pulses -> Wild fruits	5	No	1
P33	10	Grains & pulses in Autumn Grains & pulses in Winter Domesticated fruits in Winter Domesticated vegetables in Winter Wild fruits in Springtime Wild vegetables in Monsoon Fungi in Monsoon	Wild fruits -> Wild vegetables Wild vegetables -> Grains & pulses Wild vegetables -> Domesticated fruits	3	No	3
P34	7	Grains & pulses in Winter Wild vegetables in Monsoon Fungi in Monsoon Domesticated vegetables in Autumn Domesticated fruits in Winter	Wild animals -> Grains & pulses Fungi -> Wild vegetables	4	No	3

Tag	Count	Synchronies	Sequences	# of Year-Round items	Are there gaps or thin areas?	Typology
P35	2	Domesticated fruits in Winter Domesticated vegetables in Autumn		3	Yes	8
P36	9	Wild fruits in Springtime Wild fruits in Summer Wild vegetables in Summer Domesticated animals in Winter Grains & pulses in Winter Domesticated fruits in Winter	Domesticated fruits -> Wild vegetables Domesticated vegetables -> Grains & pulses Domesticated fruits -> Wild fruits	5	No	1
P37	9	Grains & pulses in Winter Domesticated fruits in Winter Wild fruits in Springtime Wild vegetables in Summer Wild vegetables in Monsoon Domesticated animals in Winter	Wild animals -> Wild vegetables Grains & pulses -> Domesticated animals Domesticated animals -> Domesticated fruits	6	No	1
P38	12	Wild fruits in Springtime Fungi in Summer Wild vegetables in Summer Wild vegetables in Monsoon Wild animals in Monsoon Domesticated fruits in Winter Grains & pulses in Winter Domesticated vegetables in Winter	Wild fruits -> Wild vegetables Wild animals -> Grains & pulses Wild animals -> Domesticated fruits Fungi -> wild animals	12	No	1
P39	5	Wild vegetables in Monsoon Grains & pulses in Winter Domesticated fruits in Winter		6	Yes	1
P40	8	Wild fruits in Springtime Fungi in Monsoon Wild vegetables in Monsoon Domesticated fruits in Winter Wild animals in Autumn	Fungi -> Wild vegetables Wild animals -> Grains & pulses	6	Yes	6
P41		Wild vegetables in Monsoon Domesticated fruits in Winter	Wild fruits -> Wild vegetables Fungi -> Wild vegetables	7	Yes	2

E. RESEARCH OBJECTIVE 4: THE USE OF SEASONAL ROUNDS TO DESCRIBE HOW FOOD PRACTICES CONTRIBUTE TO TRADITIONAL ECOLOGICAL KNOWLEDGE & MANAGEMENT PRACTICES

As a tool for describing and assessing food practices, Traditional Ecological Knowledge (TEK), and ecological management practices within this social-ecological system and study, the use of Seasonal Rounds was an effective, engaging, participatory methodology. At the individual and community level, examination of Seasonal Rounds found no correlation between food habits and practices, and demographic characteristics such as age, gender, occupation, whether or not they have engaged in labor migration, whether or not they have a family member who has engaged in labor migration, livestock holdings, whether or not they have a kitchen garden, education level, or family size.

Traditional Ecological Knowledge (TEK) and Ecological Management Practices are established social mechanisms of SESR (Berkes & Folke, 1998), and this was reflected in every analysis concerning Seasonal Rounds and the data adjacent to the Seasonal Rounds. Participants' short answer questions and field observations indicated that those with more diverse diets, food practices, and ecological management practices tend to have an easier time maintaining their resilience to disturbance, as the quote below demonstrate:

"I think in this season the wild foods are important. We can't have vegetables from our garden until Kartik or Mangsir, so the niuro and wild saag is helpful." -Participant 09, Seasonal Round Type 5

To me the kiwi and oranges are important. Last year we made enough with those two to pay for Yuki's education in Pokhara. This year the hail killed all of it. -Participant 25, Seasonal Round Type 6

All the foods we eat in the wintertime are important. Pumpkins and cabbage are how we get our nutrients, and in the spring we seen naani up to the Lekh for the early spring fruits. -Participant 38, Seasonal Round Type 1

I spent most of my time at the goth. If I want fresh vegetables I have to ask aamaa to send them. So I mostly eat what I can find in the woods plus whatever meat and grains come to me. -Participant 41, Seasonal Round Type 2

Qualitative analysis of the Seasonal Rounds supports these observations, as rounds with more density and diversity connote redundancy of food systems and a lesser likelihood of food insecurity. We can observe the redundancy of item usage on certain rounds, and the scarcity of usage on others through the count of items and their utilization, and easily compare these observations to the answers

of interview participants which pertain to how food practices and ecological management practices directly contribute to their resilience to disturbance. Interview participants believe that the use and management of wild foods and practices around wild foods management aids them in maintaining resilience to disturbances such as the annual monsoon. Participants' Seasonal Rounds back up this sentiment, as it can clearly be seen on many of them that there is a heavy dependence on wild plants, animals, and fungi during periods of disturbance. Additionally, responses from the EID Questionnaire and the Short Answer Question indicate that many of these same participants view themselves as a steward of their natural resources and believe it a personal responsibility to live a sustainable lifestyle and support practices which enhance the resilience of the mid-hills social-ecological system.

Transformable Qualitative Analysis of the Seasonal Rounds yielded several themes, which exemplify exactly how food practices contribute to the development of TEK and ecological management practices. Along with the indication of knowledge and management practices, these themes also speak to an individual's ability to maintain or enhance resilience to disturbances within their social-ecological system through the use of their food and ecological management practices:

A foundation of grains: Grains such as rice, millet, wheat, and barley comprise a huge part of the Nepali diet. Many of these grains come into season sequentially throughout the year, with each of the six seasons promising at least one foundational grain, such as rice, wheat, millet, barley, corn, amaranth, or a variety of other minor crops. This diversity across time ensures that if one crop fails, the chances of food insecurity are slimmer due to the diversity of grains in cultivation. During more scarce seasons, many Nepali interview participants rely upon grains and pulses, and the importance of rice and other grains is engrained in Nepalese culture (Hitchcock, 1961). Interview participants whose seasonal rounds do not embrace the annual dance of grains and pulses may potentially be more susceptible to food insecurity and the suffering which can come with environmental disturbance.

The necessity of wild foods in the monsoon: During the monsoon, one of Nepal's six seasons, the country receives 90% of its annual rainfall within 2-3 months. Few domesticated crops can survive the incessant beating rain or withstand the constant landslides and resulting soil erosion. Every single participant named at least one wild item in their seasonal rounds, with many participants naming a significant number of wild items.

1. Wild Vegetables: Wild vegetables during the monsoon are expressed as a synchrony by 25/41 interview participants, and by looking at the finished seasonal rounds we can deduce that wild

vegetables during this period constitute a large portion of many peoples' diets. Were this practice to disappear, we might expect to see significant food insecurity during the monsoon season in this community.

2. Fungi during monsoon: This synchrony was expressed by 13/41 interview participants. In a society where meat is less common in the diet, wild fungi help people meet their need for nutrients such as protein and vitamin B, and minerals such as selenium and copper which are vital to healthy bodily functioning but difficult to find in other foods. The monsoon is also a time of fewer festivals which necessitate less butchering of animals, and less opportunity for animal-based protein.
3. Wild animals during monsoon: During the monsoon there is an absence of major holidays and festivals which often necessitate the slaughter of domesticated animals such as chickens, goats, and water buffalo. During this time, 11/41 participants turn to wild sources of protein, such as porcupine, frogs, freshwater crabs, and various wild pheasants. This is not as common as the usage of fungi, but still a notable observation, and much more prominent than in more urban, industrialized societies.

The duality of wild and domestic fruits: Looking through the 41 separate calendars, the availability of wild and domestic fruits occur on opposite ends of the seasonal round. This reflects a logical tactic on the part of survey participants and the community at large, to focus on cultivating domestic fruits which mostly flower and bear in the winter, while managing and caring for wild species which mostly flower and bear in the spring and early summer. This practice also ensures a nearly year-round supply of fruits, and the maintenance of food security and the likelihood of greater resilience within this social-ecological system.

Transformative Quantitative Analysis yielded results which comported with and contributed to the results seen in the Transformable Qualitative Analysis. These results are visualized in Figures 83-87 below. Numeration of the items and information within the seasonal rounds and completion of summary statistics revealed an average of 38 items per seasonal round, with the smallest number of items on a round at 18 and the largest at 64. Nearly all participants identified usage of certain items, with the ten most popular being (1) Oranges (Suntalaa), (2) Rice (Bhaat), (3) Potatoes (aalu), (4) Cauliflower (kauli), (5) Wild Fiddlehead Ferns (niyuro), (6) Common Bayberry (Seto Kaphaal), (7) Cabbage (Bandaa), (8) Beans (Simi), (9) Kiwi (Kiwi), and (10) Wild Red Mushroom (Raato Chyaau).

Interview participants in this study have a clear dominant usage of plant-based items such as domesticated and wild vegetables, rather than animal and fungi items, with an overall average of 30 plant items, 4 animal items, and 2 fungi items. However, except for grains and pulses that can be dried, and certain plants which can be preserved through the fermenting of gundruk or achaars, most plant items demonstrated short seasonality. Most animal items and products such as honey and milk were noted as available in the community for large portions of the year, and often year-round, while certain cultivable mushrooms are available at a cultivator's convenience.

There is also a clear dichotomy in the usage of wild and domesticated items. Participants listed an overall mean of 12 wild items in each seasonal round. This number is significantly higher than in many industrialized societies. Participants also listed an overall mean of 25 domesticated items in each calendar. Wild items were fewer than domesticated items for both plants and animals, but not by as much as in typical industrialized societies.

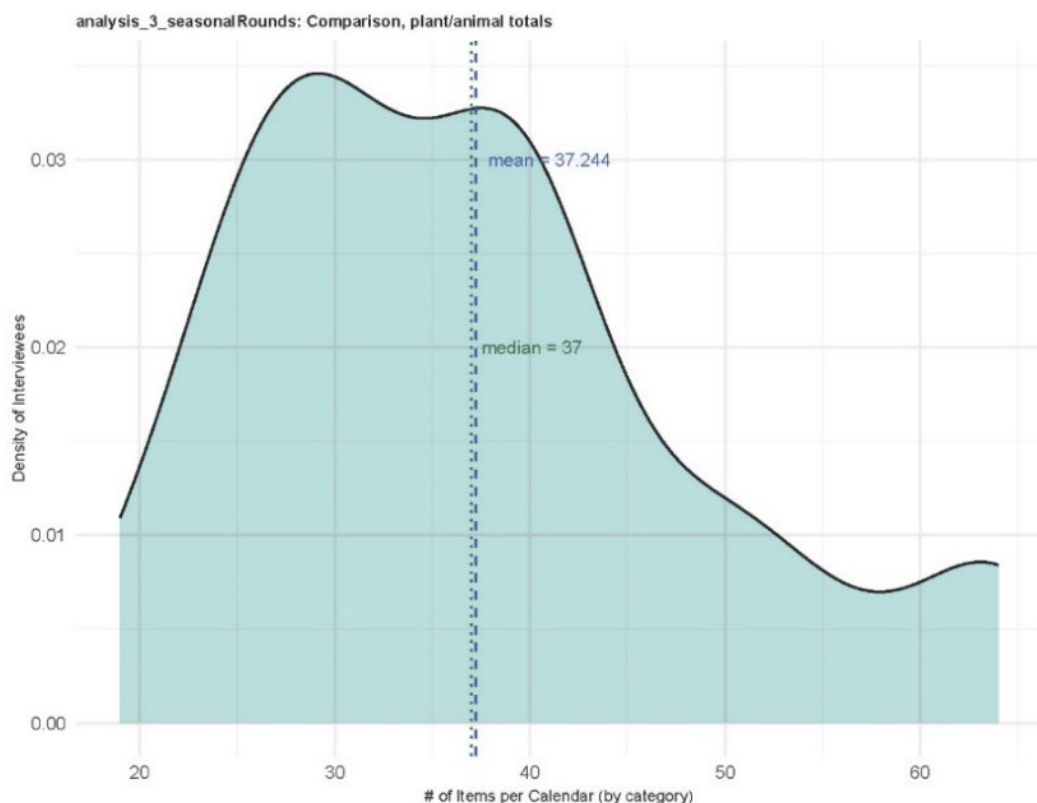


Figure 82. Total number of items in individual Seasonal Rounds, plotted by number of times that number is attained amongst participants (density)

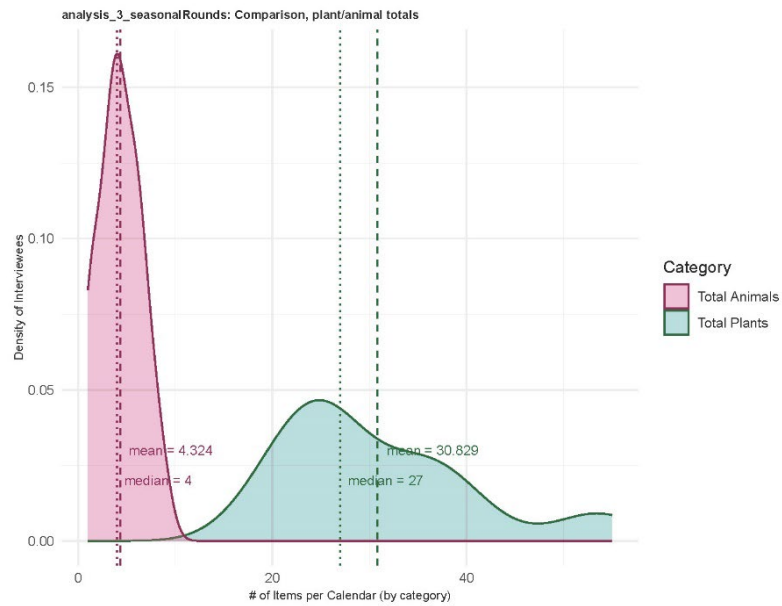


Figure 83. Total number of animals and plants in individual Seasonal Rounds, plotted by number of times that number is attained amongst participants (density)

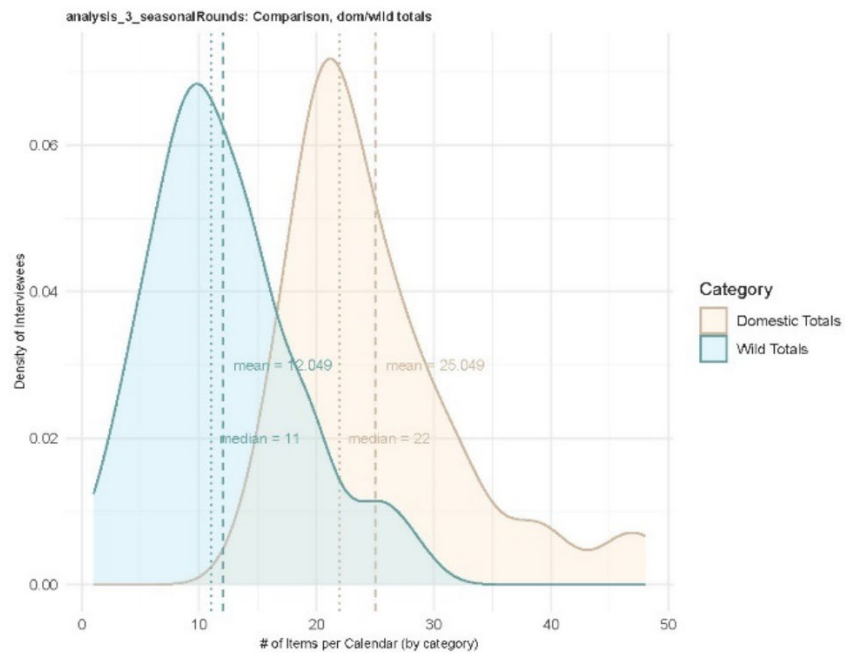


Figure 84. Total number of domesticated items and wild items in individual Seasonal Rounds, plotted by number of times that number is attained amongst participants (density)

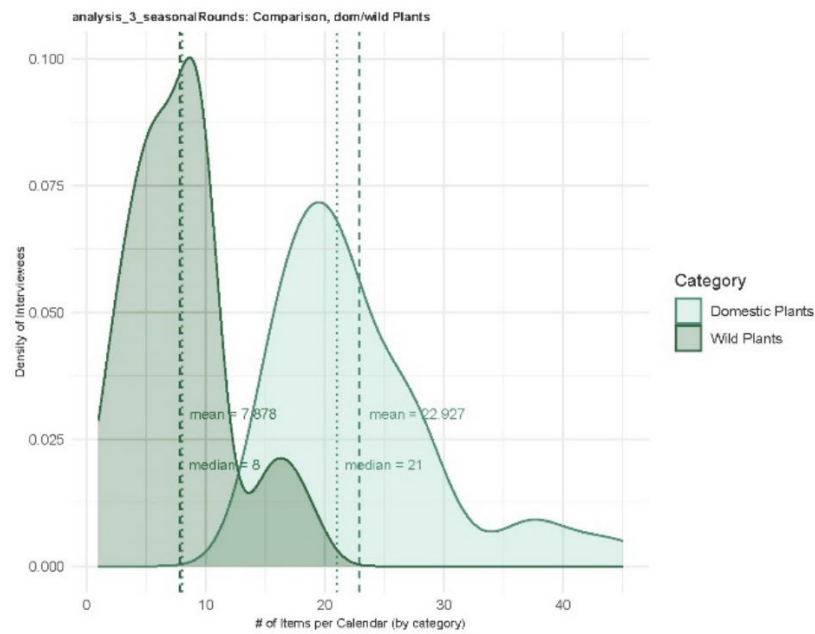


Figure 85. Total number of domesticated plants and wild plants in individual Seasonal Rounds, plotted by number of times that number is attained amongst participants (density)

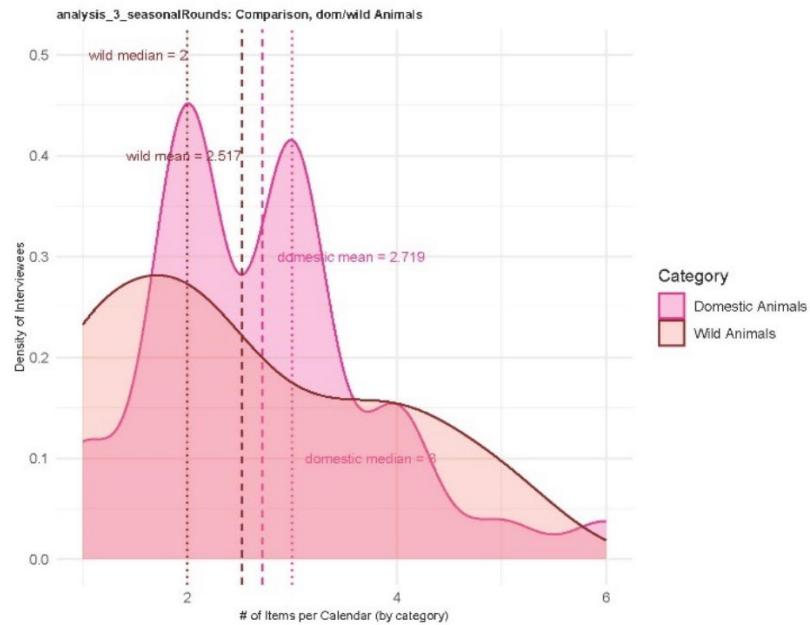


Figure 86. Total number of domesticated animals and wild animals in individual Seasonal Rounds, plotted by number of times that number is attained amongst participants (density)

Participants tend to utilize many different wild items during shorter stretches of time, while domesticated items demonstrated longer seasonality. The vast majority of domesticated items are cultivated, with an exception being the occasional purchase of rice and eggs (see figure 88).

Despite the findings supporting the use of Seasonal Rounds as a method of assessing TEK and Ecological Management Practices, for informational purposes and as a tool for describing SESR, Mixed Methods analysis also revealed that study participants are maintaining a less diverse diet as time goes on, despite having more access to more kinds of foods. However, they maintain that they are consuming the same number of wild food items as they always have. Rather, the decrease has been applied to their transition towards certain cash crops or gathering certain items for medicinal sale. Several participants were also reluctant to admit that they consumed certain wild foods which are restricted by the national government, but these are noted in the Short Answer Question responses. Many of these items are notably absent from the Seasonal Rounds and subsequent item counts. Also missing from the Seasonal Rounds and items counts are preserved food products, which exclusively use cultivated foods. Instead, the seasonality for the items which may become preserves are listed.

F. RESEARCH OBJECTIVE 5: THE USE OF SEASONAL ROUNDS IN DESCRIBING ECOLOGICAL IDENTITY

This study examined several datasets using a mixed methodology to determine whether Seasonal Rounds might be applicable as a participatory data collection tool for assessing EI or as a data transformable supplementary method for informing and supporting existing scales. This involved searching for correlations and patterns between EID scores and the Seasonal Round data, collected in collaboration with the study participants. Mixed Methods analysis revealed a correlation between the number of total items contained within Seasonal Rounds and the EID scores of interview participants, with a statistically significant r-squared of .308 between the two variables (see Figure 88 below). Further statistical analysis through the use of a Chi-square ($p = 0.0393$) and F test value confirmed statistical significance between these two datasets.

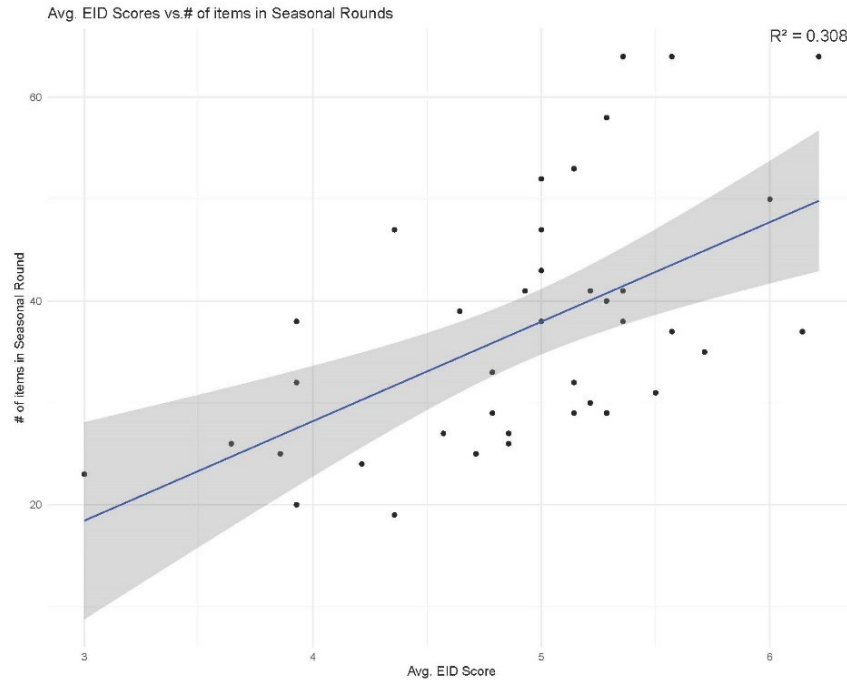


Figure 88. Number of items in individual Seasonal Rounds, plotted in relation to participants' average EID score..

There were no meaningful correlations between food practices demonstrated within the Seasonal Rounds, EID scores, and any demographic characteristics, as can be seen in Figures 89-95 below:

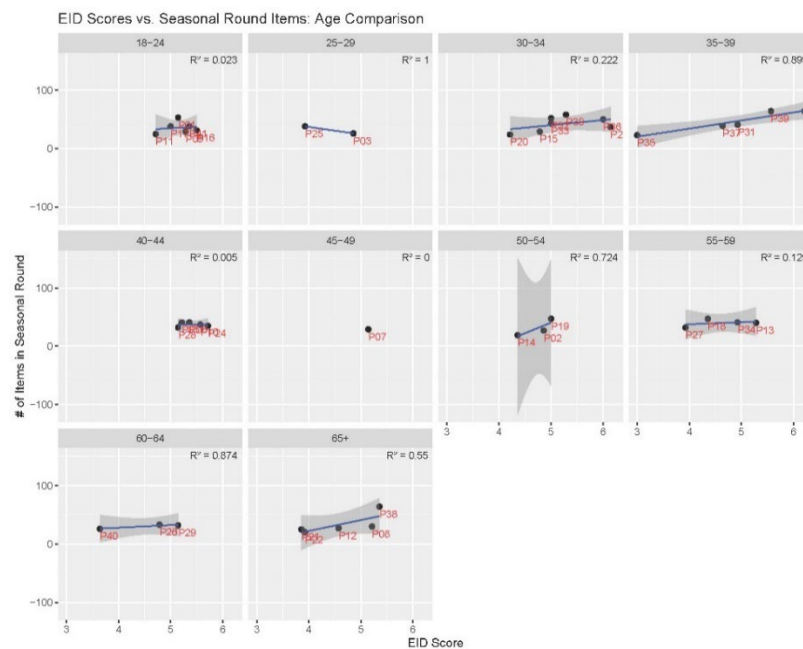


Figure 89. Number of items in individual Seasonal Rounds, plotted in relation to participants' average EID score, and color-coded by age. No significant relationship concluded

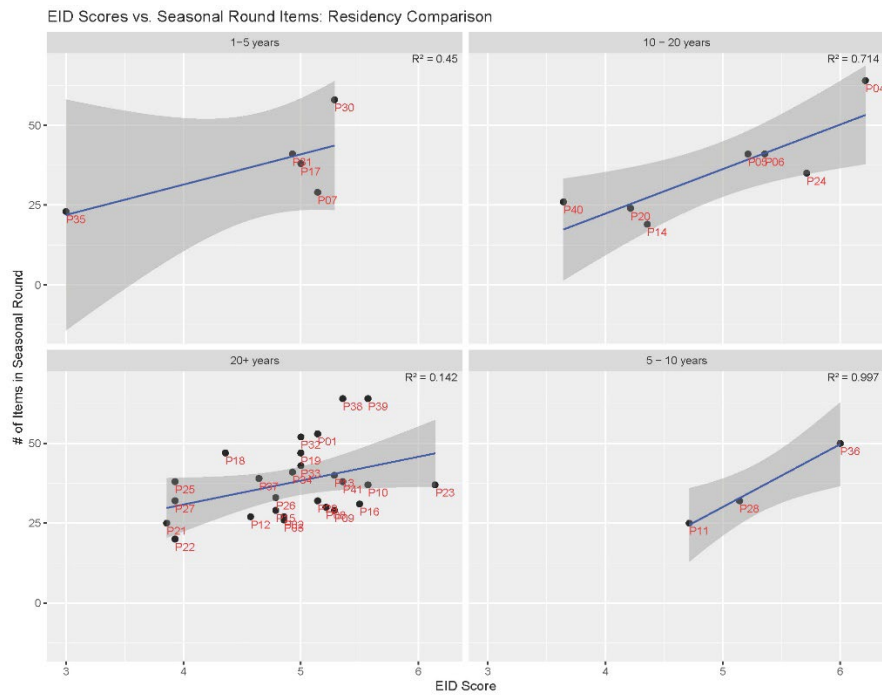


Figure 90. Number of items in individual Seasonal Rounds, plotted in relation to participants' average EID score, and color-coded by time of residency at the research site. No significant relationship concluded

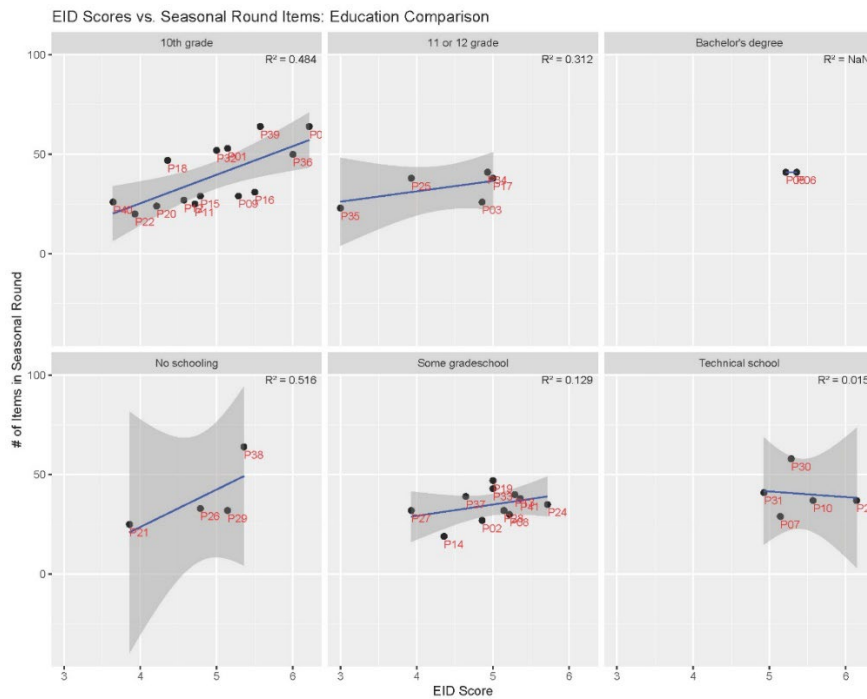


Figure 91. Number of items in individual Seasonal Rounds, plotted in relation to participants' average EID score, and color-coded by education level attained. No significant relationship concluded

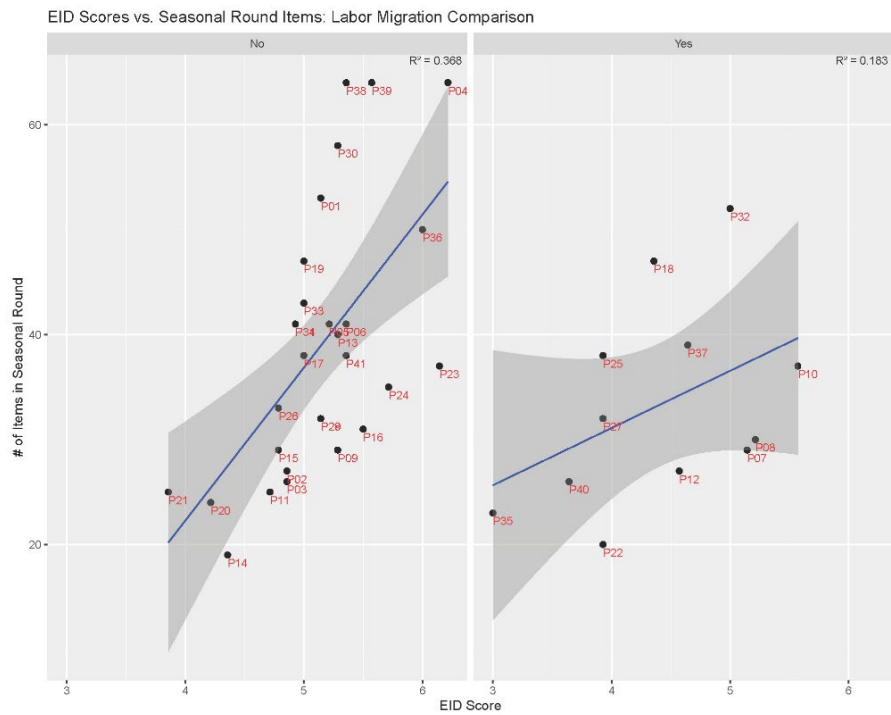


Figure 92. Number of items in individual Seasonal Rounds, plotted in relation to participants' average EID score, and color-coded by whether participants engaged in labor migration. No significant relationship concluded

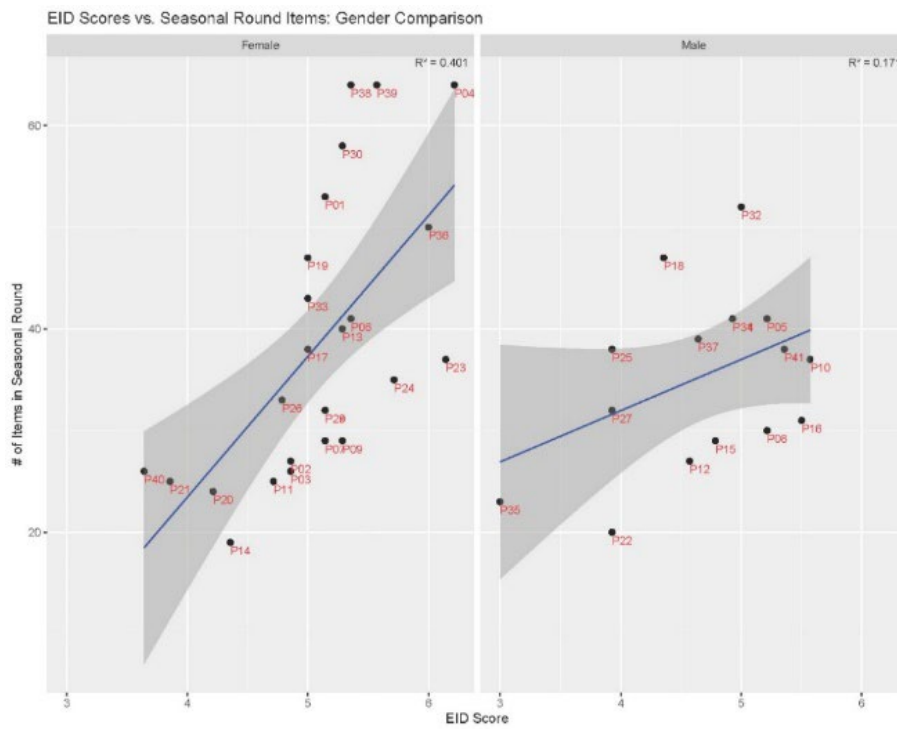


Figure 93. Number of items in individual Seasonal Rounds, plotted in relation to participants' average EID score, and color-coded by gender. No significant relationship concluded.

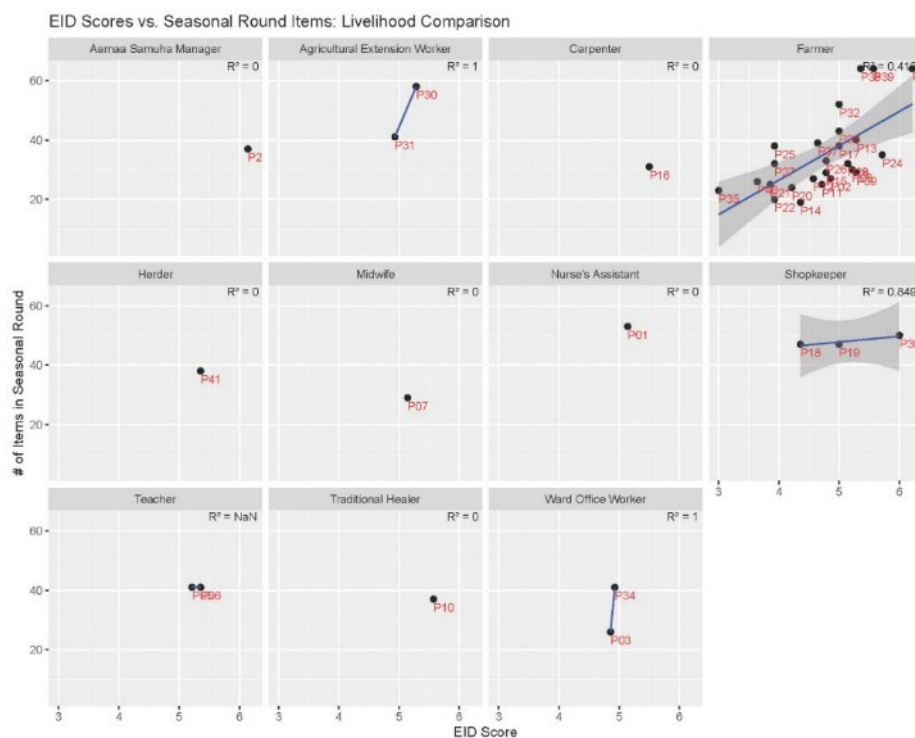


Figure 94. Figure 94. Number of items in individual Seasonal Rounds, plotted in relation to participants' average EID score, and color-coded by occupation. No significant relationship concluded.

Additionally, participants expressed in their Short Answer Questions that certain foods and practices are both culturally important and personally important to them, and they worry that the potential disappearance of these practices from their Seasonal Rounds may contribute to a loss of identity. Primary themes centered on the importance of certain foods and practices to personal, cultural, and community identity within this social ecological system, although some respondents did indicate that food practices were not particularly important to them in any way. Many interview participants indicated that certain foods and practices are important to their identities and cultures within the Nepali mid-hill social-ecological system, as shown in the following quotes:

"I think tarul (wild yam) is probably the only thing I go to the forest for. I just do it for Maagh Sankranti." -Participant 03

"I think they're (the foods) all important to me. We need to eat these foods at different times of the year to stay healthy. And lots of foods that we use for celebrations are available during those times." -Participant 23

“I think in this season the wild foods are important. We can't have vegetables from our garden until Kartik or Mangsir, so the niuro and wild saag is helpful. We use these foods for celebrations like Saun Sakranti as well.” -Participant 09

Participants also worry that the loss of some of these practices may lead to a shift in how they view themselves as members of this social-ecological system. Responses to certain questions in the EID Questionnaire (Clayton et al., 2021) comport with this sentiment:

“Yes I eat the same as they did. Maybe they ate more wild foods than me. They cared a lot more about eating the foods that can be found here, because it is important to Magar culture.” -Participant 32

G. RESEARCH OBJECTIVES 6&7: SITUATING AND OPERATIONALIZING ECOLOGICAL IDENTITY WITHIN THE SOCIAL ECOLOGICAL SYSTEMS RESILIENCE LITERATURE AND PRACTICE

Qualitative analysis of the EID questionnaire (Clayton et al., 2021), Short Answer Questions, and Field Observations reveal that food practices, specifically familiarity with wild items and cash crops, were particularly important to participants and how they form their identities within this social-ecological system. Some of the primary themes which emerged from this analysis centered on the importance of certain foods and practices to personal, cultural, and community identity within this social ecological system, although some respondents did indicate that food practices were not particularly important to them in any way. Participants noted that many of their practices were being discontinued or substituted over time, and this was associated with an intentional change in food practices over generational time, with many younger respondents stating that their diet is significantly different than that of their parents and grandparents. There are a number of statements that recent diversification of agriculture has allowed respondents to remain resilient in the face of environmental disturbances, with a nearly equal number of statements that knowledge and use of wild food practices also contribute towards individual and community resilience.

The themes, ideas and opinions presented in the Qualitative analysis paired with quantitative analysis of the EID questionnaire, Seasonal Rounds, and demographic information would suggest that EI functions as a driver in the accumulation of TEK and Ecological Management Practices. There is a correlation present between EID scores and the number of total items in participants' Seasonal

Rounds which supports the idea that participants with “stronger” Ecological Identities are more likely to accumulate and utilize TEK and management practices which maintain and enhance resilience to disturbance within their SES. Along with the clear relationship between EID scores and overall number of items in participants’ Seasonal Rounds, there was a less obvious but still present relationship between EID scores and overall number of wild items within the Seasonal Rounds. Paired with the knowledge that participants utilize wild foods when domesticated food items are scarce, this supports the idea that TEK and management practices, with EI as a driver, contribute toward maintaining and enhancing resilience to disturbances such as monsoon, drought, or hail that disrupt normal crop production.

V. DISCUSSION & FUTURE RESEARCH

A. ECOLOGICAL IDENTITY IN THE NON-WESTERN, SMALLHOLDER CONTEXT

Prior researchers have endeavored to identify certain demographic traits which align with strong EID scores, Connected to Nature results, or other nature relatedness metrics (Mayer & Franz, 2004; Clayton et al., 2021; Ajibade & Boateng, 2021; Aricio & Mosca, 2023). Past research has found slight discrepancies along gender or age lines. The closest that my research has come to these conclusions is the identification of a potential statistical correlation between gender, EID scores, and the number of items within individual seasonal rounds. Aside from this, my research found no further meaningful correlations between the EID scores of study participants and any demographic trait, such as gender or occupation. The meaning we can distill from these various findings is that there does not seem to be a significant relationship between who people are according to traditional demographic variables and who they are in relation to the natural world (Mayer & Frantz, 2004; Ajibade & Boateng, 2021). Rather, this study finds that the significant relationship seems to manifest itself between how people identify as a component of the natural world, and the activities they carry out in that world. This would imply that there is potential for anyone to cultivate a relationship with the natural world that is meaningful to them and comprises a significant piece of their individual identity.

The study determined several small shortcomings of Clayton et al.'s (2021) EID scale, which expended much previous effort at cross-cultural collaboration to create an EI assessment scale which can be applied across a diversity of locations, languages and cultures. For the most part, scales such as Clayton et al.'s (2021) EID are developed in collaboration with urban or academic study populations, with less consideration towards resource-proximate or rural individuals and communities (Soga & Gaston, 2023). This is in keeping with decadal trends showing a growth in urban areas and the decline of the rural community (Government of Nepal, 2021), however, it renders scales such as this less useful for work with rural communities that currently exist. Aside from this, my research determined some cultural differences which affected how the responses were collected and the answers that my respondents felt they needed to provide. Likert-scale questions are less suitable for use in Asian communities generally (Lee, Jones, Mineyama, & Zhang, 2002; Wang, Hempton, Dugan, & Komives, 2008; D'Alonzo, 2011), and several translational issues arose, especially pertaining to conceptions of nature, what it is, and how people relate to it based on definition (Lei, 2021) Finally, certain questions which might not sow discord with Western audiences were not well received by the

study participants, particularly where existential distance between humans and animals was concerned.

There is the potential to make some simple amendments to existing EI assessment which may help to paint a more complete picture of EI amongst culturally and linguistically diverse individuals and communities. Some simple changes to the question structure may prove useful, as Likert-type questions can prove confusing for non-Western survey participants. Removing linguistic and cultural barriers to the comprehension of these questions will improve the accuracy of responses received. Concepts of “nature” vary worldwide, as well as language used to depict these relationships. Additionally, polarizing questions pertaining to psychological distance from nature are often rooted in Westernized understandings of human relationships to animals and other living beings and may not be as well received in other cultures (Lei, 2007), which skews the data. Reframing a question like “I feel that I have a lot in common with wild animals” to “I feel I have a lot in common with other living beings” neutralizes this polarization.

Future research endeavors fall into several topics: validation of this study’s findings, testing of assessment scale amendments, comparison of new assessment in different geographical contexts, and comparison between different societal contexts. Further investigation is needed into whether similar issues reveal themselves amongst other indigenous communities, rural areas, geographic locations, and countries. Following this, any new amendments would need to be retested amongst these same communities for validation and further amendment if needed. In particular, due to the phenomenon of rural-urban migration currently taking place in the mid-hills of Nepal, I would personally be interested in a comparison study of indigenous urban and indigenous rural communities to determine how ecological identity might vary along the rural-urban spectrum. Visitors to Nepal might notice that certain agricultural and cultivating practices are present in even the most dense urban areas, and practices like this are likely to sustain the ecological identities of urban communities and individuals.

B. THE VERSATILE APPLICATIONS OF SEASONAL ROUNDS, TEK, & ECOLOGICAL MANAGEMENT PRACTICES

The co-creation of Seasonal Rounds during this research proved to be an engaging and participatory method which actively excited the study participants. The creation of Seasonal Rounds

demonstrated that even within this small rural community and amongst only 41 study participants, there is a huge diversity of food practices which translate into ecological management practices to maintain those foodways. Although participants indicated that they are intentionally and gradually changing their food habits over time, they also indicate that the use of many different kinds of food items is important to them for personal and cultural reasons, and the use of wild food items has not decreased on a generational scale.

Study participants indicated through the creation of their Seasonal Rounds and the responses to the Short Answer Questions that they believe a diversity of food habits and their resultant practices contributes towards not only the maintenance of their unique culture, but as a means of upholding the social-ecological systems resilience (SESR) of the region. In casual conversation (recorded in Field Observations) participants expressed the following ways in which their food practices contributed to the biocultural diversity of the region. These practices can be observed in the Seasonal Rounds of the participants and are further described below:

1. *Traditional Nepali agroforestry in the mid-hills:* Traditional Nepali agroforestry involves a triadic relationship between fruit and fodder trees, mixed plantings in the form of grain and vegetable *khets* (small terraces), and livestock holdings. Fruit and fodder trees provide nutrition to both humans and livestock. Livestock manure is coveted for its ability to quickly decompose into valuable compost, which is deposited in the fields in a laborious several days during the winter plowing season, providing fortification in the khets which serve as habitat for local birds, amphibians, and small mammals.
2. *Maintenance of goat pastures providing habitat for rare birds:* Several study participants indicated they consume certain pheasants and junglefowl which are restricted from consumption by the Nepali government. These same fowl find useful habitats in the rice and grain fields surrounding Nepali mid-hills villages, and on the hilltops where shepherds maintain herds of goats which keep these high-altitude areas clear and prevent reforestation. Without these two practices, open field habitat for such birds in Nepal would be restricted to above the tree line, and some study participants argued that due to their management practices, these birds were plentiful in their area, and that it was not a crime to consume them on occasion.

3. *Cultivation of fruit trees both domestic and wild:* In the fields surrounding the villages, fruit tree cultivation is quite popular as a cash crop. The cultivation of trees prevents erosion and maintains soil health (Shrestha, 1992; Adhikari, 2015). Nepali foragers maintain complementary care for the wild fruits which bear fruit primarily at the high-altitude areas above the main villages, clearing away brush and protecting trees against vines and pestilence when they see it. These practices provide more fruit not only for human occupants of the area, but for wild birds, primates, and mammals.

Despite this great diversity, 15/41 study participants elaborated that their food practices are less diverse than in the past. However, as uncovered in content analysis of the Short Answer Questions, many respondents did not believe that this development was affecting their ability to remain resilient in the face of disturbance.

This study examined several datasets using a mixed methodology to determine whether Seasonal Rounds might be applicable as a participatory data collection tool for assessing EI. This involved searching for correlations and patterns between EID scores and the Seasonal Round data, specifically the number of total items within a seasonal round. There were no meaningful correlations between food habits and practices demonstrated within the Seasonal Rounds and any demographic characteristics, exhibiting that once again, there are no precursor traits for holding ecological knowledge and maintaining certain practices. However, there were several correlations between participant EID scores and different aspects of the Seasonal Round data. Mixed Methods analysis revealed correlations between Seasonal Round typologies, the number of wild items contained within Seasonal Rounds, and the number of total items contained within Seasonal Rounds. Additionally, participants expressed in their Short Answer Questions that certain foods and practices are both culturally important and personally important to them, and they worry that the potential disappearance of these practices from their Seasonal Rounds may contribute to a loss of identity.

Here we discuss the three main goals of the EID, ways in which use of the scale alone may not be meeting these goals, and how the creation and interpretation of Seasonal Rounds may or may not ameliorate or supplement these issues:

1. *Demonstrating psychological integration within a social-ecological system:* As discussed above, several questions within the EID questionnaire address psychological distance and integration with nature (as a concept), but my data collection and analysis revealed several

issues when working with indigenous rural communities in cultural contexts that are dissimilar from the contexts in which the scale was originally developed. The creation of Seasonal Rounds can be used here to demonstrate integration within a social-ecological system through use and management of resources.

2. *Demonstrating environmental stewardship*: If the purpose of an EIS is to demonstrate the potential for engagement in environmental stewardship activities, then it would be likewise worthwhile to investigate current activities in environmental stewardship. There are currently no sections within any ecological assessment scale that I am aware of which address current environmental stewardship amongst participants. The creation of Seasonal Rounds can help address this, as each Seasonal Round is a tangible demonstration of food practices, ecological management activities which contribute to those food practices, and environmental stewardship which contributes to any individual EI.
3. *Demonstrating association with other environmentalists*: In prior assessment scales for EI, questions have aimed to answer whether an individual associates as an environmentalist or with other environmentalists as a group by simply asking them if that is the case. I think there may be potential to analyze Seasonal Rounds and engage in some type of cross-comparison to understand if there is any group environmentalist mentality behind certain practices, but I cannot make any certain statements here on whether that would be a good use of Seasonal Round creation. Further research would winnow down the uncertainties in this inquiry.

The concept and use of Seasonal Rounds is far from new, especially in the context of resource management in indigenous communities. However, their creation and application in the research literature as a tool to communicate foodways and management practices, as in Ruelle et al., 2022, is very novel. Further investigation should be done into the use of Seasonal Rounds as a method of describing food practices and traditional ecological management practices. In particular, I would support inquiry into the qualitative analysis of Seasonal Rounds, and the potential applications of these analyses towards assisting communities in re-establishing food sovereignty, building adaptive capacity to environmental change and disturbance, and maintaining their biocultural practices. Similarly, further research and validation on the use of Seasonal Rounds in EI assessment is necessary; this study is currently the only one examining the use of Seasonal Rounds in this light.

C. FRAMING ECOLOGICAL IDENTITY AS A SOCIAL MECHANISM OF SESR

My third research question poses the idea that EI could function as a social mechanism of SESR, not just in Nepali mid-hills indigenous communities but in the wider world as well. To test this hypothesis, we must consider first how EI could be *situated* within SESR theory as a social mechanism, and then how it could be *operationalized* towards maintaining and enhancing the resilience of people within a system to disturbances of that system.

The singular and mixed methods analyses of different datasets revealed that there was a statistically significant correlation between EID scores and numbers of items within Seasonal Rounds (see fig. 88), and that interview participants believe that maintaining a diversity of food habits contributes towards maintaining biocultural diversity and resilience to disturbances. Prior research has established that the maintenance of biocultural diversity and cultural landscapes, such as the indigenous communities of Nepal's mid-hills, contribute towards the maintenance of a landscape's resilience to disturbances (Badenoch, 2010; Gret-Regamey, Huber, & Huber, 2019; Palazzo & Bardsley, 2021) . Therefore, maintaining biocultural diversity is important, and if we seek to achieve that, we must examine the drivers of biocultural practices, the *social mechanisms*, such as the strength and structure of institutions, the conservation and expansion of traditional and local ecological knowledge, etc. And we must add EI to that list as an essential driver of resilience-enhancing practices.

Worldwide, smallholder farmers are responsible for the majority of the food burden, and a large portion of the land management burden. Depending on who is asked, smallholder and family farms are responsible for producing between 30% (Ritchie, 2021) and 80% (Lowder, Sanchez, & Bertini, 2021) of the world's food. They are also responsible for a significant portion of the land management burden (Fa et al., 2020). This is true of the rural smallholder farmers of Nepal, as in many other nations, who are responsible for producing the majority of the country's food supply (Roka, 2018). Nepal's indigenous ethnic groups, such as the Magar community, also take up the mantle of managing and maintaining the biodiversity of their surrounding SES (Adhikari, 2015). The outcomes of smallholder farmers matter both to overall food security and environmental security. In order to operationalize EI within Nepal's mid-hill social-ecological system and elsewhere, managers and actors within SES need adequate support in maintaining Ecological Identities which sustain biocultural diversity and overall resilience. Governments can craft policy which better supports

smallholder families, or we can come to understand that unique indigenous cultures which assist in maintaining these systems and landscapes are not to be taken for granted.

The bulk of the research literature on EI lies outside the field of human dimensions of natural resources management, in areas such as environmental psychology. In the future I would be pleased to see more integrations between the development of Ecological Identity Scales (EIS) and assessment tools, and tangible applications with case communities in human dimensions fields. Scales developed to assess the likelihood of engagement in environmental stewardship should be leveraged and validated for use in resource-proximate communities of practice. Additionally, further validation of social mechanisms such as EI which contribute towards the maintenance of resilience in SES should be undertaken. Studies established the presence or absence of certain social mechanisms should be undertaken in distinct communities, and the effects of their presence or absence noted.

D. IMPLICATIONS FOR HUMAN DIMENSIONS RESEARCH & CONSERVATION MANAGEMENT PRACTICES

This study constitutes the latest in a growing field of research disputing that “successful conservation outcomes require ‘pristine’ wilderness free from human inhabitants” (Abulu, 2021). The concept of a wilderness free from human presence and influence is slowly becoming seen as a failing concept (Fletcher, Hamilton, Dressler, & Palmer, 2021). This “ideal” of a pristine wilderness fails to reflect the truth of species conservation and the maintenance of biodiversity in established global hotspots: that many of these hotspots would not exist without human presence, involvement, management, and care. There is a significant and growing body of research arguing that conservation initiatives are more impactful when local and indigenous peoples are involved and empowered to carry out their traditional management practices (Popova, 2013; Oldekop, Harris, & Evans, 2015; Dickson, 2016; Dawson, et al., 2021). Similarly, in systems bereft of state-enacted conservation measures, the research literature concludes that the traditional and cultural management practices and foodways of indigenous communities provide a means by which to maintain or increase biodiversity and subsequent resilience within the systems in question (Crabtree, Bird, & Bird, 2019; Corrigan, et al., 2018; Bird, et al., 2018; Levis, et al., 2024; Unuigbo, 2024).

For better or worse, humans and human societies of all kinds are dependent upon our natural resources and the resilience of the social-ecological systems (SES) in which we reside. Resource-dependent groups such as the Magar community often abide by a stark yet grounded reality: that their Ecological Identities and subsequent ecological management practices are integral components of a complex system that maintains biocultural diversity and SESR to disturbances which threaten the functioning of this system.

At present, modern-day conservation programs and initiatives, and the institutions which fund and govern them, operate on the basis of Enlightenment-era philosophies which support an apartheid between humanity and the natural world, “position[ing] humans as phage, as virus, as infection of an otherwise healthy system” (Tidball & Stedman, 2013). In the past, these philosophies have guided the gradual disenfranchisement of indigenous groups living in areas marked for conservation.

Once the land is empty of people, governments and corporations are theoretically in possession of land that has been freed up for species conservation. This land can be further leveraged for income, whether through eco-tourism or the extraction of resources not deemed useful towards the end goal of species conservation, as with mining. In Nepal, a small yet resource-rich country straddling the rapidly developing economies of China and India, it’s not out of the realm of possibility to imagine a reality in which conservation areas and national parks are cleared of human inhabitation, paving the way (literally) for the construction of sustainable hydro-electric power and mineral endeavors (Hyoelmo & Abulu, 2024) which are siphoned away to hungrier countries footing the investment bill. Research is already established in this specific topic, with more underway (Lord, Austin, 2016; Lord, 2020).

To say this situation has not generated the desired outcomes is an understatement. The state of duress in which we find ourselves regarding global biodiversity levels and the stability of SES necessitates a paradigm shift away from Enlightenment-era mindset currently dominating conservation and development strategies. This study contributes to the growing body of knowledge regarding the beneficial influence of human stewardship within SES and attempts to illuminate several potential futures for the indigenous peoples of Nepal’s mid-hills.

This dichotomy lays the groundwork for two futures. In the first, governments wield the strong arm of conservation agencies and the institutions which fund them towards enacting and enforcing blanket conservation measures, actively severing people from their traditional ecological practices and livelihoods, from representation in management of these areas, and finally from their ecological

identities. We've seen this future before, in Botswana (Mushonga, 2021), in the American West (Sapignoli & Hitchcock, 2023), and even elsewhere in contemporary Nepal (Deuja, 2022). These estrangements lower the likelihood of an individual re-developing a strong Ecological Identity, as well as the subsequent use of traditional and local ecological practices and livelihoods which contribute towards social-ecological systems resilience (Schaefer, 2010; Bliska, Vidra, & Burke, 2024).

In a second future, conservation is not wielded as a tool of control, but as a means for collaboration with indigenous and local peoples living in biodiverse areas targeted for species conservation initiatives. In the mid-hills of Nepal, which means examining and finding ways to nurture the ecological identities of individuals and communities that depend upon, manage, and care for their surrounding social-ecological system.

VI. CONCLUSION

This research constitutes one work in a growing body of research which finds that conservation and resource management which excludes human individuals and communities is not conservation and management at its most beneficial. To arrive at this conclusion, I examined Ecological Identity (EI), Traditional Ecological Knowledge (TEK) and management practices, and social-ecological systems resilience (SESR), three seemingly disparate concepts, through the case of a smallholder and resource-proximate indigenous community in the rural mid-Hills of Western Nepal. My goal was to ascertain how study participants view themselves as a member of an integrated SES, the implications for environmental stewardship, and for the maintenance and enhancement of resilience to disturbance within that social-ecological system.

Through the utilization of a mixed methodology and the collection and analysis of diverse sets of data, including a participatory method in the creation of the Seasonal Rounds, this research uncovered a breadth of findings pertaining to Ecological Identity (EI), Traditional Ecological Knowledge (TEK) and management practices, social-ecological systems resilience (SESR), and the ways in which these three concepts interact within human individuals and communities to maintain biocultural diversity, prevent homogenization of both culture and environment, and uphold protective factors against both social and environmental disturbance and perturbation. The findings imply a role for human individuals and communities within social-ecological systems (SES) who through their Ecological Identities, and ecological knowledge and management practices, act as both benefactor and beneficiary within a complex system. Strong Ecological Identities, and subsequent ecological knowledge and management practices, aid these individuals and communities in meeting their needs, while contributing to the welfare and functionality of a bioculturally diverse and resilient social-ecological landscape.

As a result of this work and for future research endeavors, I suggest focusing on 1) further inquiry and expansion in studies with larger sample sizes into social mechanisms of social-ecological resilience, such as EI, TEK etc.; how they operate within SES and scales for assessing and describing them, 2) Further development of EI assessment scales, and the incorporation of ecological management/ stewardship practice indicators into their structure, and 3) Further inquiry and experimentation with methodologies centering on Seasonal Rounds, ecological knowledge, and

ecological management practices, and their potential as a tool for building adaptive capacity to disturbances and perturbations.

VII. REFERENCES

- Abulu, L. (2021, October 12). 'Pristine wilderness' without human presence is a flawed construct, study says. Retrieved from Mongabay.com: <https://news.mongabay.com/2021/10/pristine-wilderness-without-human-presence-is-a-flawed-construct-study-says/>
- Adhikari, J. (2015). Integrating indigenous, local and modern knowledge for sustainable conservation and management of forest ecosystems in Nepal. *UN PPCR Nepal*.
- Agrawal, N., Udas, E., Leikanger, I., Bhatta, L., Sharma, E., Joshi, K., . . . Ayal, D. (2021). Resilience Building Solutions for Mountain Smallholders: Catalyzing Transformations with an Integrated Modular Approach in the Hindu Kush Himalaya. In D. Ayal, & J. M. Luetz, *Handbook of Climate Change Management: Research, Leadership, Transformation* (pp. 3165-3183). Cham: Springer International Press.
- Ahearn, L. M. (2002). The Magars of Banyan Hill and Junigau: a "Granddaughter's" Reflections. *HIMALAYA, the Journal of the Association for Nepal and Himalayan Studies*, 22(1). Retrieved from <https://digitalcommons.macalester.edu/himalaya/vol22/iss1/9>
- Ajibade, I., & Boateng, G. O. (2021). Predicting why people engage in pro-sustainable behaviors in Portland Oregon: The role of environmental self-identity, personal norm, and socio-demographics. *Journal of Environmental Management*, 289.
- Alaska Native Knowledge Network. (2006). *The Four Corners of Life: A Traditional Seasonal Round*. Fairbanks: University of Alaska.
- Albers, M. J. (2017). *Introduction to Quantitative Data Analysis in the Behavioral and Social Sciences*. London: Wiley.
- Alexander, C., Bynum, N., Johnson, E., King, U., Mustonen, T., Neofotis, P., & Oettle, N. (2011). Linking Indigenous and Scientific Knowledge of Climate Change. *BioScience*, 61(6), 477-484. doi:10.1525/bio.2011.61.6.10
- Ariccio, S., & Mosca, O. (2023). Revised environmental identity scale: Adaptation and preliminary examination on a sample of Italian pet owners. *Frontiers in Psychology*, 13. doi:10.3389/fpsyg.2022.892841
- Armatas, C., Venn, T. J., McBride, B. B., Watson, A., & Carver, S. (2016). Opportunities to utilize traditional phenological knowledge to support adaptive management of social-ecological systems vulnerable to changes in climate and fire regimes. *Ecology and Society*, 21(1). doi:10.5751/ES-07905-210116
- Aryal, S. (2015). *The socio-ecological impacts of structural changes in the transhumance system of the mountainous area of Nepal*. University of Southern Queensland Press.
- Aryal, S., Cockfield, G., & Maraseni, T. (2018). Globalisation and traditional social-ecological systems: Understanding impacts of tourism and labour migration to the transhumance systems in the Himalayas. *Environmental Development*, 25, 73-84. doi:10.1016/j.envdev.2017.09.001
- Axelrod, L. J. (1994). Balancing Personal Needs with Environmental Preservation: Identifying the Values that Guide Decisions in Ecological Dilemmas. *Journal of Social Issues*, 50(3), 85-104. doi:0022.4537/9410900.0085\$03 ooil
- Badenoch, N. (2010). Biocultural Diversity: Towards Resilience in Social-Ecological Systems. *International Symposium on Geoinformatics for Spatial Infrastructure Develop in Earth and Allied Sciences*. Kyoto: Center for Southeast Asian Studies.

- Baker, L. (2006). Observation: A Complex Research Method. *Library Trends*, 55(1), 171-189. doi:10.1353/lib.2006.0045
- Balundė, A., Jovarauskaite, L., & Simas Poškus, M. (2019). Exploring the Relationship Between Connectedness With Nature, Environmental Identity, and Environmental Self-Identity: A Systematic Review and Meta-Analysis. *SAGE Open*. Retrieved from <https://doi.org/10.1177/2158244019841925>
- Bateson, G. (2000). *Steps to an Ecology of Mind: Collected Essays in Anthropology, Psychiatry, Evolution, and Epistemology*. Chicago: University of Chicago Press.
- Bausch, K. C. (2001). *The Emerging Consensus in Social Systems Theory*. New York, NY: Springer Science & Business Media.
- Beazley, R. E., & Lassoie, J. P. (2017). *Himalayan Mobilities: An Exploration of the Impact of Expanding Rural Road Networks on Social and Ecological Systems in the Nepalese Himalaya*. Cornell University Press.
- Berkes, F., & Folke, C. (1998). *Linking Social and Ecological Systems: Management Practices and Social Mechanisms for Building Resilience*. Cambridge: Cambridge University Press.
- Berkes, F., Colding, J., & Folke, C. (2002). Synthesis: building resilience and adaptive capacity in social–ecological systems (Chapter 14) - Navigating Social-Ecological Systems. In F. Berkes, J. Colding, & C. Folke, *Navigating Social-Ecological Systems* (pp. 352-388). Cambridge: Cambridge University Press.
- Bhaskar, R. (2008). *Dialectic: The Pulse of Freedom*. London: Routledge.
- Bhaskar, R., & Norrie, A. (1998). Dialectic and dialectical critical realism. In R. Bhaskar, & A. Norrie, *Critical Realism: Essential Readings* (p. 14). Routledge.
- Bird, R. B., Bird, D. W., Fernandez, L. E., Taylor, N., Taylor, W., & Nimmo, D. (2018). Aboriginal burning promotes fine-scale pyrodiversity and native predators in Australia's Western Desert. *Biological Conservation*, 110-118.
- Bista, D. (1967). *People of Nepal*. Kathmandu: Asian Book Corporation of America.
- Boas, F. (1964). *The Central Eskimo*. United States: University of Nebraska Press.
- Bonaiuto, M., Carrus, G., Martorella, H., & Bonnes, M. (2002). Local identity processes and environmental attitudes in land use changes: case of natural protected areas. *Journal of Economic Psychology*, 23, 631-653.
- Bragg, E. A. (1996). Towards Ecological Self: Deep Ecology meets Constructionist Self-Theory. *Journal of Environmental Psychology*, 16(2), 93-108. doi:<https://doi.org/10.1006/jevp.1996.0008>
- Brick, C., & Lai, C. K. (2018). Explicit (but not implicit) environmentalist identity predicts pro-environmental behavior and policy preferences. *Journal of Environmental Psychology*, 58, 8-17. doi:<https://doi.org/10.1016/j.jenvp.2018.07.003>
- Brügger, A., Kaiser, F. G., & Roczen, N. (2011). One for All? *European Psychologist*, 16(4). Retrieved from <https://econtent.hogrefe.com/doi/10.1027/1016-9040/a000032>
- Brügger, A., Kaiser, F., & Roczen, N. (2011). One for all? Connectedness to Nature, Inclusion of Nature, Environmental Identity, and Implicit Association with Nature. *European Psychologist*.
- Budha-Magar, S. (2020). Ethnic Uses of Plant species Among Magar People in Nepal. In S. Budha-Magar, *Wild Plants of Nepal*. Kathmandu: CRC Press.
- Catton, W. R., & Dunlap, R. E. (1980). A New Ecological Paradigm for Post-Exuberant Sociology. *American Behavioral Scientist*, 24(1), 15-47.
- Cemjong, I. S. (2003). *History and Culture of the Kirat People*. Ann Arbor: Kirat Yaktung .

- Chambers, L., Plotz, R., Lui, S., Aiono, F., Tofaeono, T., Hiriasia, D., & Tahani, L. (2021). Seasonal Calendars Enhance Climate Communication in the Pacific. *Weather, Climate, and Society*, 13(1), 159-172. doi:10.1175/WCAS-D-20-0035.1
- Chandra, Y., & Shang, L. (2019). Inductive Coding. In Y. Chandra, & L. Shang, *Qualitative Research Using R: A Systematic Approach* (pp. 91-106). Singapore: Springer, Singapore.
- Chen, C., Noble, I., Hellmann, J., Coffee, J., Murillo, M., & Chawla, N. (2023). *University of Notre Dame Global Adaptation Initiative*. South Bend: University of Notre Dame.
- Chisholm-Hatfield, S., Marino, E., Whyte, K., Dello, K., & Mote, P. (2018). Indian time: time, seasonality, and culture in Traditional Ecological Knowledge of climate change. *Ecological Processes*, 7(1), 25. doi:10.1186/s13717-018-0136-6
- Clayton, S. (2003). Environmental identity: A conceptual and an operational definition.
- Clayton, S., Czellar, S., Nartova-Bochaver, S., Jeffrey, S. C., Salazar, G., Tseng, Y.-C., . . . Fredy S. Monge Rodriguez. (2021). Cross-Cultural Validation of A Revised Environmental Identity Scale. *Sustainability*, 13(4), 2387. doi:https://doi.org/10.3390/su13042387
- Cochran, F., Brunsell, N. A., Cabalzar, A., van der Veld, P.-J., Azevedo, E., & Azevedo, R. (2016). Indigenous ecological calendars define scales for climate change and sustainability assessments. *Sustainability Science*, 11(1), 69-89. doi:10.1007/s11625-015-0303-y
- Cooksey, R. W. (2020). Descriptive Statistics for Summarising Data. In R. W. Cooksey, *Illustrating Statistical Procedures: Finding Meaning in Quantitative Data* (pp. 61-139). Singapore: Springer, Singapore.
- Corrigan, C., Bingham, H., Shi, Y., Lewis, E., Chauvenet, A., & Kingston, N. (2018). Quantifying the contribution to biodiversity conservation of protected areas governed by indigenous peoples and local communities. *Biological Conservation*, 403-412.
- Cowie, L. J., Greaves, L. M., Milfont, T. L., Houkamau, C. A., & Sibley, C. G. (2016). Indigenous Identity and Environmental Values: Do Spirituality and Political Consciousness Predict Environmental Regard Among Māori? *International Perspectives in Psychology*, 5(4). doi:https://doi.org/10.1037/ipp0000059
- Crabtree, S. A., Bird, D. W., & Bird, R. B. (2019). Subsistence Transitions and the Simplification of Ecological Networks in the Western Desert of Australia. *Human Ecology*, 165-177.
- Creamer, E. (2018). *An Introduction to Fully Integrated Mixed Methods Research*. Los Angeles, CA: Sage Books.
- Creswell, J., & Plano Clark, V. (2011). *Designing and Conducting Mixed Methods Research*. Thousand Oaks, CA: SAGE Publications.
- Croes, K. D. (2007). *Nature of a nation: Monarchy, development, and culture in Nepal's Annapurna Conservation Area Project*. Proquest.
- Cronenberg, S. (2020). Paradigm Parley: A Framework for the Dialectic Stance. *Journal of Mixed Methods Research*, 4(1), 26-46. doi:10.1177/1558689818777925
- Dakos, V., & Kéfi, S. (2022). Ecological resilience: what to measure and how. *Environmental Research Letters*, 17(4), 043003. doi:10.1088/1748-9326/ac5767
- D'Alonzo, K. T. (2011). Evaluation and revision of questionnaires for use among low-literacy immigrant Latinos. *Rev Lat Am Enfermagem*, 1255-1264.
- Dangi, M., Chaudhary, R., Rijal, K., Stahl, P., Belbase, S., Gerow, K., . . . Pyakurel, B. (2018). Impacts of environmental change on agroecosystems and livelihoods in Annapurna Conservation Area, Nepal. *Environmental Development*, 25, 59-72. doi:10.1016/j.envdev.2017.10.001

- Dawson, N. M., Coolsaet, B., Sterline, E. J., Loveridge, R., Gross-Camp, N. D., Wongbusarakum, S., . . . Zafra-Calvo, N. (2021). The role of Indigenous peoples and local communities in effective and equitable conservation. *Ecology and Society*.
- de Sales, A. (2011). Time, Identity, and Historical Change in the Hills of Nepal. In EBHR, *EBHR 39 Autumn-Winter 2011* (pp. 106-128). Heidelberg: University of Heidelberg Press.
- Deuja, J. (2022, April 13). *Conservation and discrimination: case studies from Nepal's national parks*. Retrieved from Greeneconomycoalition.org: <https://www.greeneconomycoalition.org/news-and-resources/conservation-and-discrimination-case-studies-from-nepals-national-parks>
- Devine-Wright, P., & Clayton, S. (2010). Introduction to the special issue: Place, identity and environmental behaviour. *Journal of Environmental Psychology*, 30(3), 267-270. doi:[https://doi.org/10.1016/S0272-4944\(10\)00078-2](https://doi.org/10.1016/S0272-4944(10)00078-2)
- Devkota, R., Pandey, V. P., Bhattarai, U., Shrestha, H., Adhikari, S., & Dulal, K. (2017). Climate change and adaptation strategies in Budhi Gandaki River Basin, Nepal: a perception-based analysis. *Climatic Change*, 140(2), 195-208. doi:10.1007/s10584-016-1836-5
- Dhahal, S., Nepal, S. K., & Schuett, M. A. (2014). Examining Marginalized Communities and Local Conservation Institutions: The Case of Nepal's Annapurna Conservation Area. *Environmental Management*, 53(1), 219-230. doi:10.1007/s00267-013-0204-8
- Dhakal, B., Chand, N., Shrestha, A., Dhakal, N., Karki, K., Shrestha, H., . . . Adhikari, B. (2022). How Policy and Development Agencies Led to the Degradation of Indigenous Resources, Institutions, and Social-Ecological Systems in Nepal: Some Insights and Opinions. *Conservation*, 2(1), 134-173. doi:10.3390/conservation2010011
- Di Fabio, A., & Svicher, A. (2023). The Eco-Generativity Scale (EGS): A New Resource to Protect the Environment and Promote Health. *International Journal of Environmental Research and Public Health*, 20(15), 6474. doi:10.3390/ijerph20156474
- Dickson, A. (2016). Inclusion of Local People and Their Cultural Practices in Biodiversity Conservation: Lessons from Successful Nations. *American Journal of Environmental Protection*, 67-78.
- Dunlap, J. C., Loros, J. J., & DeCoursey, P. J. (2004). *Chronobiology: Biological Timekeeping*. Sunderland: Sinauer Associates.
- Dunlap, R. E. (2008). The New Environmental Paradigm Scale: From Marginality to Worldwide Use. *The Journal of Environmental Education*, 40(1), 3-18. doi:<https://doi.org/10.3200/JOEE.40.1.3-18>
- Dunlap, R. E., Van Liere, K. D., Mertig, A. G., & Emmet Jones, R. (2000). Measuring endorsement of the new ecological paradigm: A revised NEP scale. *Journal of Social Issues*, 56(3), 425-442. doi:<https://doi.org/10.1111/0022-4537.00176>
- Eckstein, D., Kunzel, V., Schafer, L., & Wings, M. (2020). *GLOBAL CLIMATE RISK INDEX 2020*. Berlin: Germanwatch.
- Emerson, R. (2021). Convenience Sampling Revisited: Embracing Its Limitations Through Thoughtful Study Design. *Journal of Visual Impairment & Blindness*, 115(1).
- Epstein, K., DiCarlo, J., Marsh, R., Ray, I., & Maren, I. (2017). Coping Strategies of Smallholder Farming Communities after the 2015 Nepal Earthquake: Insights into Post-Disaster Resilience and Social-Ecological Change. *Case Studies in the Environment*, 1(1), 1-12. doi:10.1525/cse.2017.000612
- Evans-Pritchard, E. E. (1939). Nuer Time-Reckoning. *Africa: Journal of the International African Institute*, 12(2), 189-216. Retrieved from <https://www.jstor.org/stable/1155085>

- Fa, J., Watson, J. E., Leiper, I., Potapov, P., Evans, T. D., Burgess, N. D., . . . Duncan, T. (2020). Importance of Indigenous Peoples' lands for the conservation of Intact Forest Landscapes. *Frontiers in Ecology and the Environment*, 18(3), 135-140. doi:<https://doi.org/10.1002/fee.2148>
- Fairlamb, H. (1979). Reviewed Work(s): Mind and Nature: A Necessary Unity by Gregory Bateson. *Comparative Literature*, 94(5), 1218-1228. Retrieved from <https://www.jstor.org/stable/2906578>
- Fetters, Curry, & Creswell. (2013). Achieving Integration in Mixed Methods Designs—Principles and Practices. *Health Services Research*, 48(6), 2134-2156.
- Fetters, M. D., & Tajima, C. (2022). Joint Displays of Integrated Data Collection in Mixed Methods Research. *International Journal of Qualitative Methods*.
- FiveCrows, J., DeCoteau, A., Hess, J., Hatch, D., & Narum, S. (2023). Sharing biological information across generations: Parallels between indigenous knowledge and genetics for fisheries recovery in the Columbia River Basin. *Molecular Ecology Resources*. doi:10.1111/1755-0998.13815
- Fletcher, M.-S., Hamilton, R., Dressler, W., & Palmer, L. (2021). Indigenous knowledge and the shackles of wilderness. *Environmental Sciences*, 118(40).
- Folke, C. (2006). Resilience: The emergence of a perspective for social–ecological systems analyses. *Global Environmental Change*, 16(3), 253-267. doi:10.1016/j.gloenvcha.2006.04.002
- Folke, C., Biggs, R., Norström, A., Reyers, B., & Rockström, J. (2016). Social-ecological resilience and biosphere-based sustainability science. *Ecology and Society*, 21(3).
- Gatersleben, B., Murtagh, N., & Abrahamse, W. (2014). Values, identity and pro-environmental behaviour. *Contemporary Social Science*, 9(4), 374-392.
- Gautam, Y. (2017). Seasonal Migration and Livelihood Resilience in the Face of Climate Change in Nepal. *Mountain Research and Development*, 37(4), 436-445. doi:10.1659/MRD-JOURNAL-D-17-00035.1
- Ghasemi, B., & Kyle, G. (2023). Hunters' opposition to harmful hunting practices on ecosystems: values, beliefs, norms, and identities. *The Journal of Wildlife Management*, 87(6), e22449. doi:10.1002/jwmg.22449
- Glaser, M., Krause, G., Ratter, B., & Welp, M. (2008). Human/Nature Interaction in the Anthropocene Potential of Social-Ecological Systems Analysis. *GAIA - Ecological Perspectives for Science and Society*, 17(1), 77-80. doi:10.14512/gaia.17.1.18
- Gooch, M. (2002). A sense of place: Ecological identity as a driver for catchment volunteering. *Australian Journal on Volunteering*.
- Gopirajan, S., Kumar, P., & Joshi, P. (2022). Unraveling the complex and dynamic Himalayan socio-ecological systems: a systematic review. *Environment, Development and Sustainability*, 24(2), 1532-1559. doi:10.1007/s10668-021-01527-5
- Government of Nepal. (2019). *National Agroforestry Policy*. Kathmandu: Government of Nepal.
- Government of Nepal. (2021). *Census of Nepal*. Kathmandu: Government of Nepal.
- Green, D., & Raygorodetsky, G. (2010). Indigenous knowledge of a changing climate. *Climatic Change*, 100, 239-242. doi:10.1007/s10584-010-9804-y
- Green, D., Billy, J., & Tapim, A. (2010). Indigenous Australians' knowledge of weather and climate. *Climatic Change*, 100(2), 337-354. doi:10.1007/s10584-010-9803-z
- Greene, J. (2007). *Mixed methods in social inquiry*. Jossey-Bass.

- Greene, J., Caracelli, V., & Graham, W. (1989). Toward a conceptual framework for mixed method evaluation designs. *Educational Evaluation and Policy Analysis*, 11, 255-274.
- Gret-Regamey, A., Huber, S. H., & Huber, R. (2019). Actors' diversity and the resilience of social-ecological systems to global change. *Nature Sustainability*, 290-298.
- Gupta, H., Nishi, M., & Gasparatos, A. (2021). Community-based responses for tackling environmental and socio-economic change and impacts in mountain social-ecological systems. *Ambio: A Journal of Environment and Society*, 1123-1142.
- Haag, I. (2021). *Climate trend detection in a data-scarce environment : a transdisciplinary study in the Pamir Mountains of Tajikistan*. Bayreuth: University of Bayreuth Press. Retrieved from <https://epub.uni-bayreuth.de/id/eprint/5711/>
- Hart, R., & Ranjitkar, S. (2019). Monitoring Rhododendron Flowering Times in a Changing Climate. In A. R. Society, *Rhododendrons International* (pp. 126-140).
- Hays, J. (2022). *Middle Hills People of Nepal: Pahari, Brahmans, Chhetris and Gurung | Facts and Details*. Retrieved from https://factsanddetails.com/south-asia/Nepal/Ethnic_Groups_and_Minorities_Nepal/entry-7833.html
- Hitchcock, J. T. (1961). A Nepalese Hill Village and Indian Employment. *Asian Survey*, 1(9), 15-20. Retrieved from <https://www.jstor.org/stable/3023505>
- Hitchcock, J. T. (1966). *The Magars of Banyan Hill*. Madison: Henry Holt.
- Holling, C. (2001). Understanding the Complexity of Economic, Ecological, and Social Systems. *Ecosystems*, 4(5), 390-405. doi:10.1007/s10021-001-0101-5
- Holling, C. S. (1973). Resilience and Stability of Ecological Systems. *Annual Review of Ecology and Systematics*, 4, 1-23. Retrieved from <https://www.jstor.org/stable/2096802>
- Holling, C. S. (1996). Engineering Resilience versus Ecological Resilience. In N. A. Engineering, *Engineering Within Ecological Constraints* (pp. 31-43). Washington, D.C.: National Academies Press.
- Howe, K., & Eisenhart, M. (1990). Standards for qualitative (and quantitative) research: A prolegomenon. *Educational Researcher*, 19(4), 2-9.
- Hyoimo, S. L., & Abulu, L. (2024, August 12). *Reporting confirms alleged Indigenous rights violations in Nepal hydropower project*. Retrieved from Mongabay.com: <https://news.mongabay.com/2024/08/reporting-confirms-alleged-indigenous-rights-violations-in-nepal-hydropower-project/>
- Jean Blair, M., Mabee, W. E., & Kobayashi, A. (2020). *Resilience*. Oxford: Elsevier.
- Jenkins, C. (2010). What is Ontological Realism? *Philosophy Compass*, 5(10), 880-890.
- Johnson, R., & Onwuegbuzie, A. (2004). Mixed methods research: A research paradigm whose time has come. *Educational Researcher*, 33(7), 14-26.
- Kalikoski, D. C., Quevedo Neto, P., & Almudi, T. (2010). Building adaptive capacity to climate variability: The case of artisanal fisheries in the estuary of the Patos Lagoon, Brazil. *Marine Policy*, 34(4), 742-751. doi:10.1016/j.marpol.2010.02.003
- Karki, S., Burton, P., & Mackey, B. (2020). Climate change adaptation by subsistence and smallholder farmers: Insights from three agro-ecological regions of Nepal. *Cogent Social Sciences*, 6(1), 1720555. doi:10.1080/23311886.2020.1720555
- Karki, S., Burton, P., Mackey, B., & Adam, E. (2020). Climate change adaptation by subsistence and smallholder farmers: Insights from three agro-ecological regions of Nepal. *Cogent Social Sciences*, 6(1), 1720555. doi:10.1080/23311886.2020.1720555

- Kassam, K.-A. (2010). Pluralism, Resilience, and the Ecology of Survival: Case Studies from the Pamir Mountains of Afghanistan. *Ecology and Society*, 15. doi:10.5751/ES-03485-150208
- Kassam, K.-A. S., Baumflek, M., Ruelle, M., & Wilson, N. J. (2011). Human Ecology of Vulnerability, Resilience and Adaptation: Case Studies of Climate Change from High Latitudes and Altitudes. In H. K. Juan Blanco, *Climate Change - Socioeconomic Effects* (pp. 217-236). InTechOpen.
- Kassam, K.-A., & Bernardo, J. (2022). Role of Biodiversity in Ecological Calendars and Its Implications for Food Sovereignty: Empirical Assessment of the Resilience of Indicator Species to Anthropogenic Climate Change. *GeoHealth*, 6(10). doi:10.1029/2022GH000614
- Kassam, K.-A., Ruelle, M., Samimi, C., Trabucco, A., & Xu, J. (2018). Anticipating Climatic Variability: The Potential of Ecological Calendars. *Human Ecology*, 46(2), 249-257. doi:10.1007/s10745-018-9970-5
- Kerner, D. A., & Thomas, S. J. (2014). Resilience Attributes of Social-Ecological Systems: Framing Metrics for Management. *Resources*, 3(4), 672-702. doi:10.3390/resources3040672
- Khattari, M. B. (2003). Agriculture and Ritual Landscape: A case study from the Magars of Argal, Baglung District, Nepal. *Occasional Papers in Sociology and Anthropology*, 8. doi:https://doi.org/10.3126/opsa.v8i0.1123
- Konchar, K. M., Staver, B., Salick, J., Chapagain, A., Joshi, L., & Karki, S. (2015). Adapting in the Shadow of Annapurna: A Climate Tipping Point. *Journal of Ethnobiology*, 449-471.
- Kroeber, A. L. (1939). *Culture and Natural Areas of Native North America*. Berkeley: University of California Press.
- Kumar Jha, S., Negi, A., Alatalo, J. M., & Negi, R. (2021). Socio-ecological vulnerability and resilience of mountain communities residing in capital-constrained environments. *Mitigation and Adaptation Strategies for Global Change*, 26(38).
- Kutal, D., Kunwar, R. M., Baral, K., Sapkota, P., Sharma, H. P., & Rimal, B. (2021). Factors that influence the plant use knowledge in the middle mountains of Nepal. *PLOS ONE*, 16(2). doi:10.1371/journal.pone.0246390
- Lantz, T., & Turner, N. (2003). Traditional phenological knowledge of Aboriginal Peoples in British Columbia. *Journal of Ethnobiology*, 23.
- Lecomte-Tilouine, M. (1996). The Cult of the Earth Goddess Among the Magar of Nepal. *Diongenes*, 44(174), 27-44. doi:10.1177/039219219604417403
- Lee, H., & Youn, Y.-C. (2022). Relevance of cultural ecosystem services in nurturing ecological identity values that support restoration and conservation efforts. *Forest Ecology and Management*, 505. doi:https://doi.org/10.1016/j.foreco.2021.119920
- Lee, J. W., Jones, P. S., Mineyama, Y., & Zhang, X. E. (2002). Cultural differences in responses to a Likert scale. *Res Nurs Health*, 295-306.
- Levis, C., Flores, B., Campos-Silva, J., Peroni, N., Staal, A., Padgurschi, M. C., . . . Kuikuro, T. (2024). Contributions of human cultures to biodiversity and ecosystem conservation. *Nature Ecology & Evolution*, 866-879.
- Light, A. (2000). What is an ecological identity? *Environmental Politics*, 9(4), 59-81. doi:https://doi.org/10.1080/09644010008414551
- Lillesø, J., Shrestha, T., Dhakal, L., Nayaju, R., & Shrestha, R. (2005). *The map of potential vegetation of Nepal: a forestry/agro-ecological/biodiversity classification system*. Copenhagen: CIFOR.

- Ljubicic, G., Okpakok, S., Robertson, S., & Mearns, R. (2018). Uqsuqtuurmiut inuita tuktimi qaujimaningit (Inuit knowledge of caribou from Gjoa Haven, Nunavut): Collaborative research contributions to co-management efforts. *Polar Record*, 54(3), 213-233. doi:10.1017/S0032247418000372
- Lord, A. (2020, August 21). *The Temporal Politics and Ethics of Hydropower Development in the Himalayas*. Retrieved from advancedsciencenews.com: <https://www.advancedsciencenews.com/the-temporal-politics-and-ethics-of-hydropower-development-in-the-himalayas/>
- Lord, Austin. (2016). Citizens of a hydropower nation: Territory and agency at the frontiers of hydropower development in Nepal. *Economic Anthropology*, 146-160.
- Lowder, S. K., Sanchez, M. V., & Bertini, R. (2021). Which farms feed the world and has farmland become more concentrated? *World Development*, 142.
- Mathison, S. (1988). Why Triangulate? *Educational Research*, 17(2), 13-17.
- Maxwell, J. (2015). Expanding the History and Range of Mixed Methods Research. *Journal of Mixed Methods Research*, 10(1), 12-27. doi:<https://doi.org/10.1177/1558689815571132>
- Mayer, F. S., & Frantz, C. M. (2004). The connectedness to nature scale: A measure of individuals' feeling in community with nature. *Journal of Environmental Psychology*, 24(4), 503-515. doi:<https://doi.org/10.1016/j.jenvp.2004.10.001>
- McGunnigle, N., Bardsley, D., Nuberg, I., Cedamon, E., & Pandit, B. (2023). The Succession of Farmers' Perceptions of Transitioning Landscapes – A Case Study of Agroforestry in the Middle Hills of Nepal. *Human Ecology*, 51(4), 699-717. doi:10.1007/s10745-023-00423-y
- Mehta, J., & Heinen, J. T. (2001). Does Community-Based Conservation Shape Favorable Attitudes Among Locals? An Empirical Study from Nepal. *Environmental Management*, 28(2), 165-177. doi:10.1007/s002670010215
- Mehta, J., & Kellert, S. R. (1998). Local attitudes toward community-based conservation policy and programmes in Nepal: a case study in the Makalu-Barun Conservation Area. *Environmental Conservation*, 25(4), 320-333. doi:10.1017/S037689299800040X
- Merchant, C. (2005). *Radical Ecology: The Search for a Livable World*. New York: Routledge. doi:<https://doi.org/10.4324/9780203084212>
- Messerschmidt, D. (1976). Ecological Change and Adaptation among the Gurungs of the Nepal Himalaya. *Human Ecology*, 4(2), 167-185.
- Mikesell, S. L. (2002). The Legacy of John Hitchcock's Cultural Ecology in the Anthropology of the Himalayas. *HIMALAYA, the Journal of the Association for Nepal and Himalayan Studies*, 13-20.
- Mikesell, S. L. (2002). The Legacy of John Hitchcock's Cultural Ecology in the Anthropology of the Himalayas. *HIMALAYA*, 22(1).
- Miles, M., Huberman, M., & Saldana, J. (2018). *Qualitative Data Analysis: A Methods Sourcebook*. Thousand Oaks: SAGE Publications.
- Morse, J. (1991). Approaches to Qualitative-Quantitative Methodological Triangulation. *Nursing Research*, 40(2), 120-123.
- Mushonga, T. (2021). The Militarisation of Conservation and Occupational Violence in Sikumi Forest Reserve, Zimbabwe. *Conservation & Society*, 3-12.
- Nartova-Bochaver, S., Donat, M., Kiral Ucar, G., Korneev, A. A., Heidmets, M. E., Kamble, S., . . . Kryazh, I. (2022). The role of environmental identity and individualism/collectivism in

- predicting climate change denial: Evidence from nine countries. *Journal of Environmental Psychology*.
- Nepal MoPE. (2016). *Nationally Determined Contribution*. Kathmandu: Government of Nepal.
- Niiniluoto, I. (2002). Realism in Ontology. In I. Niiniluoto, *Critical Scientific Realism* (pp. 21-41). Oxford: Oxford Academic.
- Nisbet, E. K., Zelenski, J. M., & Murphy, S. A. (2008). The Nature Relatedness Scale: Linking Individuals' Connection With Nature to Environmental Concern and Behavior. *Environment and Behavior*, 41(5). doi:<https://doi.org/10.1177/0013916508318748>
- Nurani, L. M. (2008). Critical Review of Ethnographic Approach. *Jurnal Sosioteknologi*, 14(7), 441-447.
- Nyong, A., Adesina, F., & Osman, E. (2007). The value of indigenous knowledge in climate change mitigation and adaptation strategies in the African Sahel. *Mitigation and Adaptation Strategies for Global Change*, 12(5), 787-797. doi:10.1007/s11027-007-9099-0
- OED. (2023). *Oxford English Dictionary*. Oxford: Oxford University Press.
- Ohnishi, T., Khadka, S., Sanchez, G., & Dhamala, T. (2013). Environmental Attitude of Young Nepalese and its Comparison with the Attitude of Environmentally Developed Costa Ricans. *International Journal of Sociology of Education*, 2(1), 26-50. doi:10.4471/rise.2013.20
- Oldekop, J., Harris, W., & Evans, K. (2015). A global assessment of the social and conservation outcomes of protected areas. *Conservation Biology*, 133-141.
- Olivoa, P., Aragonés, J. I., & Amérigo, M. (2011). The Connectedness to Nature Scale and it's Relationship with Environmental Beliefs and Identity. *IPHJ*, 4(1), 5-19.
- Olivos, P., & Aragonés, J. (2011). Psychometric properties of the Environmental Identity Scale (EID). *Psycology*, 2(1), 65-74.
- Olivos, P., Aragonés, J. I., & Amerigo, M. (2011). The Connectedness to Nature Scale and it's relationship with environmental beliefs and identity. *IPHJ*, 5-19.
- O'Reilly, K. (2011). *Ethnographic Methods*. London: Routledge. doi:<https://doi.org/10.4324/9780203864722>
- Palazzo, E., & Bardsley, D. (2021). Adaptive mechanisms in a continuing landscape: assessing biocultural diversity as a form of resilience. *Journal of Cultural Heritage Management and Sustainable Development*, 367-391.
- Palinkas, L. A., Horwitz, S. M., & Hoagwood, K. (2015). Purposeful Sampling for Qualitative Data Collection and Analysis in Mixed Method Implementation Research. *Administration and Policy in Mental Health and Mental Health Services Research*, 42, 533-544.
- Pandey, R. (2019). Farmers' perception on agro-ecological implications of climate change in the Middle-Mountains of Nepal: a case of Lumle Village, Kaski. *Environmental Development and Sustainability*, 221-247.
- Pandey, R., & Bardsley, D. K. (2015). Social-ecological vulnerability to climate change in the Nepali Himalaya. *Applied Geography*, 64, 74-86. doi:10.1016/j.apgeog.2015.09.008
- Partelow, S. (2018). A review of the social-ecological systems framework: applications, methods, modifications, and challenges. *Ecology and Society*, 23(4). Retrieved from <https://www.jstor.org/stable/26796887>
- Paudel, D., Tiwari, K., Raut, N., Sitaula, B., & Poudel, P. (2019). Agroforestry Practices in Midhills of Nepal from Gender Perspective. *Open Journal of Forestry*, 9(4), 323-340. doi:10.4236/ojfor.2019.94018

- Petzold, J., Andrews, N., Ford, J. D., Hedemann, C., & Postigo, J. C. (2020). Indigenous knowledge on climate change adaptation: a global evidence map of academic literature. *Environmental Research Letters*, 15(11). doi:10.1088/1748-9326/abb330
- Pimm, S. L. (1984). The complexity and stability of ecosystems. *Nature*, 307(5949), 321-326. doi:10.1038/307321a0
- Popova, U. (2013). Conservation, Traditional Knowledge, and Indigenous Peoples. *American Behavioral Scientist*, 58(1), 197-214.
- Rabbani, G., Shafeeqa, F., & Sharm, S. (2016). *Assessing the Climate Change Environmental Degradation and Migration Nexus in South Asia*. Dhaka: IOM Bangladesh.
- Regmi, S., Johnson, B., & Dahal, B. (2020). Analysing the Environmental Values and Attitudes of Rural Nepalese Children by Validating the 2-MEV Model. *Sustainability*, 12(1), 164. doi:10.3390/su12010164
- Reichardt, C., & Cook, T. (1979). Beyond qualitative versus quantitative methods. In C. Reichardt, & T. Cook, *Qualitative and quantitative methods in evaluation research* (pp. 7-32). Thousand Oaks, CA: Sage.
- Ritchie, H. (2021). *Smallholders produce one-third of the world's food, less than half of what many headlines claim*. Retrieved from OurWorldInData.org: <https://ourworldindata.org/smallholder-food-production>
- Roka, H. (2018). The Status of Smallholder Farmers in Nepal's Agricultural Development Strategy (2015–2035). *Agrarian South*, 354-372.
- Roszak, T. (2001). *The Voice of the Earth: An Exploration of Ecopsychology*. United States: Phanes Press.
- Roxburgh, N., Stringer, L. C., Evans, A., GC, R. K., Malleson, N., & Heppenstall, A. J. (2021). Impacts of multiple stressors on mountain communities: Insights from an agent-based model of a Nepalese village. *Global Environmental Change*, 66, 102203. doi:10.1016/j.gloenvcha.2020.102203
- Ruelle, M. L., & Kassam, K.-A. (2011). Diversity of Plant Knowledge as an Adaptive Asset: A Case Study with Standing Rock Elders. *Economic Botany*, 65(3), 295-307. doi:10.1007/s12231-011-9168-x
- Ruelle, M., Kassam, K.-A., Haag, I., Bulbulshoev, U., Kaziev, D., Louis, L., . . . Samimi, C. (2021). Engaging Transformation: Using Seasonal Rounds to Anticipate Climate Change. *Human Ecology*, 49(5), 509-523. doi:10.1007/s10745-021-00269-2
- Ruelle, M., Skye, A., Collins, E., & Kassam, K.-A. (2022). Ecological Calendars, Food Sovereignty, and Climate Adaptation in Standing Rock. *GeoHealth*, 6(12). doi:10.1029/2022GH000621
- Sapignoli, M., & Hitchcock, R. (2023). Fortress Conservation: Removals of Indigenous People from Protected Areas in the United States. In M. Sapignoli, & R. Hitchcock, *People, Parks, and Power: The Ethics of Conservation-Related Resettlement* (pp. 15-29). Springer.
- Sapkota, P. (2008). Ethno-ecological Observation of Magar of Bukini, Baglung, Western, Nepal. *Dhaulagiri Journal of Sociology and Anthropology*, 2, 227-252. doi:10.3126/dsaj.v2i0.1366
- Schoon, M. L., & Cox, M. E. (2012). Understanding Disturbances and Responses in Social-Ecological Systems. *Society & Natural Resources*, 25(2), 141-155. doi:10.1080/08941920.2010.549933
- Schreier, M. (2014). Qualitative Content Analysis. In *The SAGE Handbook of Qualitative Data Analysis* (pp. 170-183). Thousand Oak: SAGE Publications Ltd.

- Schultz, P. W. (2002). Inclusion with Nature: The Psychology Of Human-Nature Relations. In P. W. Schultz, *Psychology of Sustainable Development* (pp. 61-78). Boston.
doi:https://doi.org/10.1007/978-1-4615-0995-0_4
- Schultz, P. W., & Tabanico, J. (2007). Self, Identity, and the Natural Environment: Exploring Implicit Connections With Nature. *Journal of Applied Social Psychology*, 37(6), 1219-1247. doi:
<https://doi.org/10.1111/j.1559-1816.2007.00210.x>
- Shrestha, R. (1992). Chapter 2: Agro-ecosystem of the Mid-Hills. In J. Abington, *Sustainable livestock production in the mountain agro-ecosystem of Nepal*. Rome: UN FAO.
- Sierra-Barón, W., Olivos-Jara, P., Gómez-Acosta, A., & Navarro, O. (2023). Environmental Identity, Connectedness with Nature, and Well-Being as Predictors of Pro-Environmental Behavior, and Their Comparison between Inhabitants of Rural and Urban Areas. *Sustainability*, 15(5).
doi:<https://doi.org/10.3390/su15054525>
- Soga, M., & Gaston, K. J. (2023). Global synthesis reveals heterogeneous changes in connection of humans to nature. *One Earth*. doi:<https://doi.org/10.1016/j.oneear.2023.01.007>
- Sõukand, R., Kalle, R., Prakofjewa, J., Sartori, M., & Pieroni, A. (2024). The importance of the continuity of practice: Ethnobotany of Kihnu island (Estonia) from 1937 to 2021. *Plants, People, Planet*, 6(1), 186-196. doi:10.1002/ppp3.10423
- Stapp, J., Lilieholm, R., Leahy, J., & Upadhyaya, S. (2016). Linking Attitudes, Policy, and Forest Cover Change in Buffer Zone Communities of Chitwan National Park, Nepal. *Environmental Management*, 57(6), 1292-1303. doi:10.1007/s00267-016-0682-6
- Sterling, E., Ticktin, T., Morgan, T., Cullman, G., & Alvira, D. (2017). Culturally Grounded Indicators of Resilience in Social-Ecological Systems. *Environment and Society*, 8(1), 63-95.
doi:10.3167/ares.2017.080104
- Stern, P. C., & Dietz, T. (1994). The Value Basis of Environmental Concern. *Journal of Social Issues*, 50(3), 65-84. doi:0022-4537/94/0900-0065\$03.00/ I
- Stets, J. E., & Biga, C. F. (2003). Bringing Identity Theory into Environmental Sociology. *Sociological Theory*, 21(4), 398-423.
- Steward, J. H. (1938). Basin-plateau aboriginal sociopolitical groups. *Bureau of American Ethnology Bulletin*, 120, 1-346.
- Sujahku, N., Banjitkar, S., Niraula, R., Pokharel, B., Schmidt-Vogt, D., & Xu, J. (2016). Farmers' Perceptions of and Adaptations to Changing Climate in the Melamchi Valley of Nepal. *Mountain Research and Development*, 36(1), 15-30. doi:<https://doi.org/10.1659/MRD-JOURNAL-D-15-00032.1>
- Swim, J. K., Zawadzki, S. L., Cundiff, J. L., & Lord, B. (2014). Environmental Identity and Community Support for the Preservation of Open Space. *Human Ecology Review*, 20(2), 133-155.
Retrieved from <https://www.jstor.org/stable/24707630>
- Teddlie, C., & Tashakkori, A. (2006). A general typology of research designs featuring mixed methods. *Research in the Schools*, 13(1), 12-28.
- Teddlie, C., & Tashakkori, A. (2009). *Foundations of Mixed Methods Research*. Thousand Oaks, CA: SAGE Publications.
- Thapa Magar, G. (2019). *Magars in the Eyes of Western Writers: A Socio-Anthropological Review*. Kathmandu: Magar Studies Center.
- Thomashow, M. (1996). *Ecological Identity: Becoming a Reflective Environmentalist*. Boston: MIT Press.

- Tidball, K. G. (2012). *Greening in the Red Zone: Valuing Community-Based Ecological Restoration in Human Vulnerability and Security Contexts*. Ithaca: Cornell University Press.
- Tidball, K., & Stedman, R. (2013). Positive dependency and virtuous cycles: From resource dependence to resilience in urban social-ecological systems. *Ecological Economics*, 86, 292-299. doi:<https://doi.org/10.1016/j.ecolecon.2012.10.004>
- Tiscarena-Osorno, X., Hossaini, J., Chabursky, S., Sayed, N., Temizarabaci, I., Hahl, W., & Beckmann, J. (2022). Does socioeconomic position and gender affect human-nature interactions? *Journal of Public Health*, 2123-2130.
- Tiscarena-Osorno, X., Hossaini, J., Chabursky, S., Sayed, N., Temizarabaci, I., Hähl, W., & Beckmann, J. (2022). Does socioeconomic position and gender affect human-nature interactions? *Journal of Public Health*, 1-8. doi:10.1007/s10389-022-01762-8
- Toffin, G. (2009). The Janajati/Adivasi Movement in Nepal: Myths and Realities of Indigeneity. *Sociological Bulletin*, 58(1), 25-42. doi:10.1177/0038022920090103
- Turner, B., Lambin, E. F., & Reenberg, A. (2007). The emergence of land change science for global environmental change and sustainability. *Proceedings of the National Academy of Sciences*, 104(52).
- Turner, N. (2014). *Ancient Pathways, Ancestral Knowledge*. Montreal: McGill-Queen's University Press.
- Turner, N. J., & Reid, A. J. (2022). "When the Wild Roses Bloom": Indigenous Knowledge and Environmental Change in Northwestern North America. *GeoHealth*, 6(11). doi:10.1029/2022GH000612
- Turner, N., Ignace, M., & Ignace, R. (2000). Traditional Ecological Knowledge and Wisdom of Aboriginal Peoples in British Columbia. *Ecological Applications*, 10(5), 1275-1287. doi:10.1890/1051-0761(2000)010[1275:TEKAWO]2.0.CO;2
- UN Convention on Biological Diversity. (2023). *Nepal - Country Profile*. Montreal: United Nations Press.
- Unuigbo, N. F. (2024). Promoting Food Sovereignty in the Sahel: Lessons from Indigenous Food Systems. In A. Kallhoff, & E. Liedauer, *Greentopia: Utopian Thought in the Anthropocene* (pp. 139-152). Singapore: Springer.
- Upadhyay, K. (1970). Forestry and Farming System in the Mid-Hills of Nepal. *Occasional Papers in Sociology and Anthropology*, 3, 1-27. doi:10.3126/opsa.v3i0.1073
- van der Werff, E., Steg, L., & Kees, K. (2013). The value of environmental self-identity: The relationship between biospheric values, environmental self-identity and environmental preferences, intentions and behaviour. *Journal of Environmental Psychology*, 34, 55-63. doi:<https://doi.org/10.1016/j.jenvp.2012.12.006>
- Vansittart, E. (1895). The Tribes, Clans, and Castes of Nepal. *Journal of the Asiatic Society of Bengal*, 63, 213-249. Retrieved from https://www.google.com/books/edition/Journal_of_the_Asiatic_Society_of_Bengal/3xngAAAA_MAAJ?hl=en&gbpv=0
- Virapongse, A., Brooks, S., Metcalf, E., Zedalis, M., Gosz, J., Kliskey, A., & Alessa, L. (2016). A social-ecological systems approach for environmental management. *Journal of Environmental Management*, 178, 83-91. doi:10.1016/j.jenvman.2016.02.028
- Vitousek, P. M., Mooney, H. A., Lubchenco, J., & Melillo, J. M. (1997). Human Domination of Earth's Ecosystems. *Science*, 277(5325), 494-499. doi:10.1126/science.277.5325.49

- Walker, B. (2020). Resilience: what it is and is not. *Ecology and Society*, 25(2). doi:10.5751/ES-11647-250211
- Walker, B., Holling, C., Carpenter, S., & Kinzig, A. (2004). Resilience, Adaptability and Transformability in Social-ecological Systems. *Ecology and Society*, 9(2). doi:10.5751/ES-00650-090205
- Walton, T. N., & Jones, R. E. (2018). Ecological Identity: The Development and Assessment of a Measurement Scale. *Environment and Behavior*, 50(6), 657-689. doi:https://doi.org/10.1177/0013916517710310
- Wang, R., Hempton, B., Dugan, J. P., & Komives, S. R. (2008). Cultural Differences: Why Do Asians Avoid Extreme Responses? *Survey Practice*.
- Wang, S., Lee, K., & Kim, G. (2018). Understanding the Relationships in Nature-Human Systems to Improve Social-Ecological Resilience in the Hindu-Kush Himalayas. *Asian Journal of Conservation Biology*, 7(1), 17-27.
- Wetcher-Hendrick, D. (2011). *Analyzing Quantitative Data: An Introduction for Social Researchers*. Wiley.
- Whitburn, J., Linklater, W., & Abrahamse, W. (2019). Meta-analysis of human connection to nature and proenvironmental behavior. *Conservation Biology*, 34(1), 180-193. doi:10.1111/cobi.13381
- Whitmarsh, L., & O'Neill, S. (2010). Green identity, green living? The role of pro-environmental self-identity in determining consistency across diverse pro-environmental behaviours. *Journal of Environmental Psychology*, 30(3), 305-314. doi:https://doi.org/10.1016/j.jenvp.2010.01.003
- Whyte, K. (2017). Indigenous Climate Change Studies : Indigenizing Futures, Decolonizing the Anthropocene. *English Language Notes*, 55(1), 153-162. Retrieved from <https://muse.jhu.edu/pub/4/article/711473>
- Whyte, K. (2017). What Do Indigenous Knowledges Do for Indigenous Peoples? 1-20. Retrieved from <https://papers.ssrn.com/abstract=2612715>
- Wilson, E. O. (1984). *Biophilia: the human bond with other species*. Cambridge: Harvard University Press.
- Wilson, N. J. (2014). The Politics of Adaptation: Subsistence Livelihoods and Vulnerability to Climate Change in the Koyukon Athabascan Village of Ruby, Alaska. *Human Ecology*, 42(1), 87-101. doi:10.1007/s10745-013-9619-3
- Winter, D. d. (2003). *Ecological psychology: Healing the split between planet and self*. United Kingdom: Lawrence Erlbaum.
- Woodward, E. (2010). Creating the Ngan'gi Seasons calendar: reflections on engaging Indigenous knowledge authorities in research. *Learning Communities: International Journal of Learning in Social Contexts*, 2, 125-137.
- Woodward, E., & Marrfurra McTaggart, P. (2019). Co-developing Indigenous seasonal calendars to support 'healthy Country, healthy people' outcomes. *Global Health Promotion*, 26(3), 26-34. doi:10.1177/1757975919832241
- Wyss, R., Luthe, T., Pedoth, L., Schneiderbauer, S., Adler, C., Apple, M., . . . Thaler, T. (2022). Mountain Resilience: A Systematic Literature Review and Paths to the Future. *Mountain Research and Development*, A23-A36.
- Yadav, S. K. (2018). Nepalese Adolescent's Environmental Discourses. *Italian Sociological Review*, 217-242.
- Zavestoski, S. (2003). Constructing and Maintaining Ecological Identities: The Strategies of Deep Ecologists. In S. Clayton, & S. Opatow, *Identity and the Natural Environment: The*

Psychological Significance of Nature (pp. 297-315). Cambridge: MIT Press.
doi:10.7551/mitpress/3644.001.0001

I. APPENDICES

APPENDIX A: SURVEY INSTRUMENTS

ACKNOWLEDGEMENT OF CONSENT

I am asking you to participate in a research study titled “Transience and Vulnerability Along the Rural-Urban Continuum in Nepal”. I will describe this study to you and answer any of your questions. This study is being led by Jessie Hughes, Department of Natural Resources at Cornell University. The Faculty Advisor for this study is Keith Tidball, Department of Natural Resources at Cornell University.

What the study is about

The purpose of this research is to explore the relationships between EI, ecological knowledge and food systems, and a changing climate in rural Nepal.

What we will ask you to do

I will ask you to answer any questions asked to the best of your ability. I anticipate this interview taking between than 90 minutes, and if work or family commitments interrupt our time together those commitments will be respected and the interview will end. You will not be asked to answer any question that you feel uncomfortable or unknowledgeable answering.

Risks and discomforts

I do not anticipate any risks from participating in this research.

Benefits

There are no direct benefits to the participant in the immediate moment. We anticipate that the information gained from this study may benefit others (smallholder farmers, local and federal governments, NGOs) in the future.

Compensation for participation

Participants will receive no compensation in exchange for their participation in this study.

Audio/Video Recording

The PI would like to make an audio recording of this interview, in order to transcribe it from Nepali into English, and analyze it for data collection and posterity. Audio recordings will be archived after transcription on an encrypted device, and destroyed after 5 years.

Please sign below if you are willing to have this interview recorded by audio. You may still

participate in this study if you are not willing to have the interview recorded.

☐ I do not want to have this interview recorded.

☐ I am willing to have this interview recorded:

Signed: _____

Date: _____

Privacy/Confidentiality/Data Security

Interviews will be spoken entirely in Nepali. Interviews will be recorded in 30-90 minutes and data will not use identity. Data collection will include the use of two phones, with data storage occurring both on safe devices and through Cornell Box.

Sharing De-identified Data Collected in this Research

Data from this study may be shared with the research community to advance science and health. Transcripts will be created from audio recordings, which does not use your name. No one will know you from the information we share. Despite these measures, we cannot guarantee safety of your personal information.

Taking part is voluntary

Your involvement in this study is voluntary, and you may refuse to participate before the study begins, discontinue at any time, or skip any questions/procedures that may make you feel uncomfortable, with no penalty to you.

Follow up studies

We may contact you again to request your help in another study. As always, your help is voluntary and we will ask for your consent to participate in any of the follow up studies.

May we contact you again for

another study?

Yes/No If you have questions

The main researcher conducting this study is Jessie Hughes, a graduate student at Cornell University. Please ask any questions

you have now. If you have questions later, you may contact Jessie Hughes at

jah667@cornell.edu or at +1 (315)-694-3216. If you have any questions or concerns

regarding your rights as a subject in this study, you may contact the Institutional Review Board (IRB) for Human Participants at +1 607-255-5138 or access their website at

<http://www.irb.cornell.edu>. You may also report your concerns or complaints anonymously through Ethicspoint online at www.hotline.cornell.edu or by calling toll free at 1-866-293-

3077. Ethicspoint is an independent organization that communicates between the University and the person bringing the complaint so that anonymity can be ensured.

Statement of Consent

I have read the above information, and have received answers to any questions I

asked. I will take part in the study. Your Signature_____Date

Your Name (printed)

Signature of person obtaining consent (PI)_____Date

Printed name of person obtaining consent (PI)

This consent form will be kept by the researcher for five years beyond the end of the study.

सहमतिको स्वीकृति

म िपाईलाई "नेपालमा ग्रामीण-शहरी तनरन्िरिको साथमा पारस्पररकिा र जोखिम" शीर्षकको अनुसन्धान अध्ययनमा भाग ललन आग्रह गर्दैछु। म िपाईलाई यो अध्ययन वणषन गनेछु र िपाईका कुनै पतन प्रश्नहरूको जवाफ दर्दनेछु। यो अध्ययन कनेल युतनभलसषटीको ग्लोबल डेभलपमेन्ट ववभाग जेसी ह्युजेसको नेित्वमा भइरहेको छ। यस अध्ययनका लागग संकाय सल्लाहकार ककथ दटडबल हुन्, कनेल ववश्वववद्यालयको ग्लोबल ववकास ववभाग।

अध्ययनको बारेमा के हो

यस अनुसन्धानको उद्देश्य श्रम आप्रवासन, पाररस्थतिक पदहचान, पाररस्थतिक ज्ञान र िाद्य प्रणाली, र ग्रामीण नेपालको बर्दललंदो जलवायु बीचको सम्बन्धको अन्वेर्ण गनुष हो।

हामी तपाईंलाई के गनन सोध्नेछौं

म िपाईलाई िपाईको क्षमिा को सबै भन्दा राम्रो मा सोगधएको कुनै पतन प्रश्नको जवाफ दर्दन सोध्नेछु। म यो अन्िवाषिष 90 लमनेट भन्दा बढी लाग्ने अनुमान गछुष र यदर्द काम वा पाररवाररक प्रतिबद्धिले हाम्रो समय सँगै बाधा पुर्याउँछ भने िी प्रतिबद्धिहरूलाई सम्मान गरनेछ र अन्िवाषिष समाप्ि हुनेछ। िपाईलाई कुनै पतन प्रश्नको जवाफ दर्दन सोगधने छैन जुन िपाईले असहज महसुस गनषुहुन्छ वा अनजान जवाफ दर्दनुहुन्छ।

जोखिम र असुविधा

म यस अनुसन्धानमा भाग ललनबाट कुनै पतन जोखिमको अनुमान गदर्दषन।

फाइदाहरू

वित्तीय पलमा सहभागीलाई कुनै प्रत्यक्ष लाभ छैन। हामी आशा गर्छौं कक यस अध्ययनबाट प्राप्ति जानकारीले भवव्ययमा अरु (सानो ककसानहरू, स्थानीय र संघीय सरकारहरू, गैरसरकारी संस्थाहरू) लाभान्वित हुन सक्छ।

सहभागिताको लागग क्षततपूतन

सहभागीहरूले यस अध्ययनमा उनीहरूको सहभागिताको बर्दलामा कुनै क्षतिपूतिष पाउने छैनन्।

अडियो/भभडियो रेकडिनड

PI ले यो अन्विषाषिको अडडयो रेकडडषड बनाउन चाहानुहुन्छ, यसलाई नेपालीबाट अंग्रेजीमा ट्रान्सक्राइब गनष र डेटा सड्कलन र भवव्ययका लागग ववश्लेर्ण गनष चाहनुहुन्छ। अडडयो रेकडडषडहरू एस्क्रप्टेड उपकरणमा ट्रान्सकक्रप्शन पतछ अलभलेमा राखिनेछ, र 5 वर्ष पतछ नष्ट हुनेछ।

❑ म यो अन्विषाषिकेकडष गनष चाहन्न

❑ म यो अन्विषाषिकेकडष गनष ड्छु क छु

हस्िाक्षर: _____

लमति: .

यता/गोपनीयता/िेटा सुरक्षा

अन्विषाषि पूरै नेपालीमा बोललनेछ। अन्विषाषिहरू 30-90 लमनेटमा रेकडष गररनेछ र डाटाले पदहचान प्रयोग गर्दैन्। डाटा सड्कलनमा दुई फोनको प्रयोग समावेश हुनेछ, डाटा भण्डारण दुवै सुरक्षि उपकरणहरूमा र कनेल बक्स माफष िने हुने।

यस अनुसन्धानमा संकभलत डि-पहहचान िेटा साझेदारी गर्दै

यस अध्ययनबाट प्राप्ति डाटा ववज्ञान र स्वास््यलाई अगाड बढाउन अनुसन्धान समुर्दायसँग साझेदारी गनष सककन्छ। ट्रान्सकक्रप्टहरू अडडयो रेकडडषडहरूबाट लसजषना गररनेछ, जसले िपाईको नाम प्रयोग गर्दैन्, हामीले साझेदारी गने जानकारीबाट िपाईलाई कसैले गचब्दैन्। यी उपायहरूको बावजुर्द, हामी िपाईको व्यस्क्िगि जानकारीको सुरक्षाको ग्यारेन्टी गनष सत्रदैन्।

भाग भलनु स्िैच्छक हो

यस अध्ययनमा िपाईको संलग्गिना स्वैस्च्छक हो, र िपाई अध्ययन सुरु हुनु अतघ भाग ललन अस्वीकार गनष सकनुहुन्छ, कुनै पतन समयमा बब्द गनष सकनुहुन्छ, वा िपाईलाई कुनै जररवाना बबना, िपाईलाई असहज महसुस गराउन सकने कुनै पतन प्रश्न/प्रकक्रयाहरू छोड्न सकनुहुन्छ।

अध्ययनहरू पालन गनुहोस्

अको अध्ययनमा िपाईको मद्दि अनुरोध गनष हामी िपाईलाई फेरर सम्पकष गनष सकछौं। सधैं जस्िै, िपाईको मद्दि स्वैस्च्छक हो र हामी कुनै पतन फलो-अप अध्ययनहरूमा भाग ललनको लागग िपाईको सहमति माग्नेछौं।

के हामी िपाईलाई अको अध्ययनको लागग फेरर सम्पकष गनष सकछौं? हो / होइन

यहद तपाईंसँग प्रश्नहरू छन्

यो अध्ययन सञ्चालन गने मुख्य अनुसन्धानका कनेल ववश्ववद्यालयका स्नािक ववद्याथी जेसी ह्युजेस हुन। कृ पया िपाईसँग कुनै

प्रश्नहरू सोध्नुहोस्। यदद िपाईसँग पतछ प्रश्नहरू छन् भने, िपाई जेसी ह्युजेसलाई jah667@cornell.edu मा वा +1 (315)-694-

3216 मा सम्पकष गनष सक्नुहुन्छ। यदद िपाईसँग यस अध्ययनको ववर्यको रूपमा िपाईको अगधकारको बारेमा कुनै प्रश्न वा गचन्िा छ भने, िपाई मानव सहभागीहरूको लागग संस्थागि समीक्षा बोडष (IRB) लाई +1 607-255-5138 मा सम्पकष गनष सक्नुहुन्छ वा <http://www.irb> मा उनीहरूको वेबसाइट पहुँच गनष सक्नुहुन्छ। .cornell.edu।

िपाईले आफ्ना गचन्िा वा गुनासोहरू अजाि रूपमा Ethicspoint अनलाइन www.hotline.cornell.edu माफष िि वा 1-866-293-3077 मा टोल फ्री कल गरेर पतन ररपोटष गनष सक्नुहुन्छ। एगथक्सपोइन्ट एउटा स्विन्न संस्था हो जसले ववश्ववद्यालय र उजुरी ल्याउने व्यस्कि बीच सञ्चार गछष ििकक अजाििा सुतनस्श्च गनष सककन्छ।

सहमततको कथन

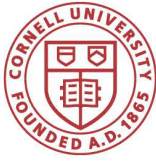
मैले मागथको जानकारी पढेको छु, र मैले सोधेका कुनै पतन प्रश्नहरूको जवाफ प्राप्ि गरेको छु। म अध्ययनमा भाग ललन्छु। हस्िाक्षर_____Date_____

िपाईको नाम (मुदिि)_____

Signature of person obtaining consent (PI)_____Date_____

Printed name of person obtaining consent (PI)_____

यो सहमति फारम अनुसन्धानकािले अध्ययनको अन्त्य पतछ पाँच वर्षसम्म राख्नेछ।



Cornell University
Office of
Research Integrity and Assurance

Institutional Review Board for Human Participants
Cornell University
395 Pine Tree Road, Suite 320
Ithaca, NY 14850
<https://researchservices.cornell.edu/offices/IRB>

Institutional Review Board for Human Participants

Concurrence of Exemption Notice

To: Jessie Hughes (jah667)
Protocol Number: IRB0010665 (2110010665)
Protocol Title: Transience, vulnerability, and evolving livelihood strategies along the rural-urban continuum in Nepal
Approval Date: 07/07/2023
Expiration Date: None

Your request for the following change(s) to the protocol referenced above has been approved:

- Conducting follow-up interviews.

Your protocol continues to be eligible for exemption from IRB review according to Cornell IRB policy and under the Department of Health and Human Services Code of Federal Regulations 45CFR46.104(d).

Please note the following:

- Investigators are responsible for ensuring that the welfare of research subjects is protected and that methods used and information provided to gain participant consent are appropriate to the activity. Please familiarize yourself with and conduct the research in accordance with the ethical standards of the [Belmont Report](#).
- Investigators are responsible for notifying the IRB office of change or amendments to the protocol and acquiring approval or concurrence BEFORE their implementation.
- Progress reports, requests for personnel or other administrative changes, or requests for continuation of approval are not required for the study. However, upon conclusion of the study, please submit a Project Closure request through [RASS-IRB](#).

For questions related to this application or for IRB review procedures, please contact the IRB office at irbhp@cornell.edu or 607-255-6182. Visit the [IRB website](#) for policies, procedures, FAQs, forms, and other helpful information about Cornell's Human Participant Research Program.

APPENDIX B: SUPPLEMENTARY ANALYSES

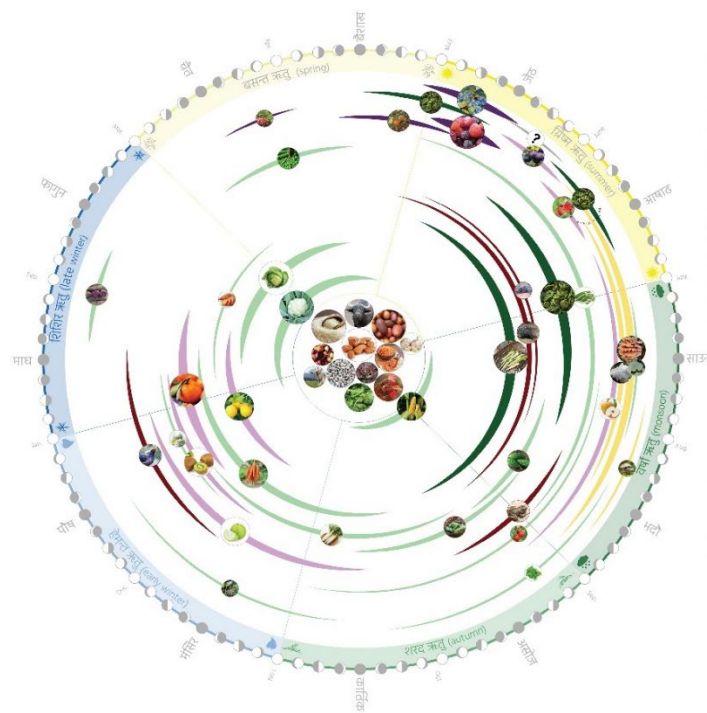
Table 4. Interview participant demographics & EID scores (continued on next page)

	EID Score	Age?	Gender	Occupation	Educational Level	Time lived in Ward	How often do you go to Temple?	How many people in family?	Do you have a kitchen garden?
P01	5.1428571	18-24	Female	Nurse's Assistant	10th grade	20+ years	1-2 times/month	4-8 Yes	
P02	4.8571429	50-54	Female	Farmer	Some gradeschool	20+ years	A few times a year	1-2 Yes	
P03	4.8571429	25-29	Female	Ward office manager	11 or 12 grade	20+ years	1-2 times/month	2-3 No	
P04	6.2142857	35-39	Female	Farmer	10th grade	10 - 20 years	1-2 times/month	2-3 Yes	
P05	5.2142857	40-44	Male	Teacher	Bachelor's degree	10 - 20 years	A few times a year	4-8 Yes	
P06	5.3571429	40-44	Female	Teacher	Bachelor's degree	10 - 20 years	A few times a year	4-8 Yes	
P07	5.1428571	45-49	Female	Milwaffe	Technical school	1-5 years	1-2 times/month	1 No	
P08	5.2142857	65+	Male	Farmer	Some gradeschool	20+ years	A few times a year	4-8 Yes	
P09	5.2857143	18-24	Female	Farmer	10th grade	20+ years	1-2 times/month	4-8 Yes	
P10	5.5714286	40-44	Male	Traditional healer	Technical school	20+ years	Once a week	2-3 Yes	
P11	4.7142857	18-24	Female	Farmer	10th grade	5 - 10 years	A few times a year	1-2 Yes	
P12	4.5714286	65+	Male	Farmer	10th grade	20+ years	Once a week	More than 8	
P13	5.2857143	55-59	Female	Farmer	Some gradeschool	20+ years	A few times a year	2-3 Yes	
P14	4.3571429	50-54	Female	Farmer	Some gradeschool	10 - 20 years	Once a week	2-3 Yes	
P15	4.7857143	30-34	Male	Farmer	10th grade	20+ years	A few times a year	1 No	
P16	5.5	18-24	Male	Carpenter, farmer	10th grade	20+ years	Once a week	2-3 Yes	
P17	5	18-24	Female	Farmer	11 or 12 grade	1-5 years	Once a week	2-3 Yes	
P18	4.3571429	55-59	Male	Shopkeeper, farmer	10th grade	20+ years	1-2 times/month	More than 8	
P19	5	50-54	Female	Shopkeeper, farmer	Some gradeschool	20+ years	1-2 times/month	Yes	
P20	4.2142857	30-34	Female	Farmer	10th grade	10 - 20 years	1-2 times/month	2-3 Yes	
P21	3.8571429	65+	Female	Farmer	No schooling	20+ years	1-2 times/month	4-8 No	
P22	3.9285714	65+	Male	Farmer	10th grade	20+ years	1-2 times/month	4-8 No	
P23	6.1428571	30-34	Female	Aamma Samula manager, far	Technical school	20+ years	1-2 times/month	4-8 Yes	
P24	5.7142857	40-44	Female	Farmer	Some gradeschool	10 - 20 years	1-2 times/month	4-8 Yes	
P25	3.9285714	25-29	Male	Farmer	11 or 12 grade	20+ years	A few times a year	2-3 Yes	
P26	4.7857143	60-64	Female	Farmer	No schooling	20+ years	1-2 times/month	4-8 Yes	
P27	3.9285714	55-59	Male	Farmer	Some gradeschool	20+ years	Never	Yes	
P28	5.1428571	40-44	Female	Farmer	Some gradeschool	5 - 10 years	A few times a year	2-3 Yes	
P29	5.1428571	60-64	Female	Farmer	No schooling	20+ years	A few times a year	2-3 Yes	
P30	5.2857143	30-34	Female	Agriculture extension worker	Technical school	1-5 years	Once a week	2-3 Yes	
P31	4.9285714	35-39	Male	Veterinary extension worker	Technical school	1-5 years	1-2 times/month	2-3 Yes	
P32	5	30-34	Male	Farmer	10th grade	20+ years	A few times a year	4-8 Yes	
P33	5	30-34	Female	Farmer	Some gradeschool	20+ years	1-2 times/month	4-8 Yes	
P34	4.9285714	55-59	Male	Ward worker	11 or 12 grade	20+ years	1-2 times/month	2-3 Yes	
P35	3	35-39	Male	Unemployed	11 or 12 grade	1-5 years	A few times a year	2-3 Yes	
P36	6	30-34	Female	Shopkeeper	10th grade	5 - 10 years	Once a week	4-8 Yes	
P37	4.6428571	35-39	Male	Farmer, herder	Some gradeschool	20+ years	A few times a year	4-8 Yes	
P38	5.3571429	65+	Female	Farmer	No schooling	20+ years	1-2 times/month	4-8 Yes	
P39	5.5714286	35-39	Female	Farmer	10th grade	20+ years	1-2 times/month	4-8 Yes	
P40	3.6428571	60-64	Female	Retired farmer	10th grade	10 - 20 years	Once a week	2-3 No	
P41	5.3571429	18-24	Male	Herder	Some gradeschool	20+ years	Never	4-8 No	

What kinds of animals do you own?	Have you engaged in labor migration?	If so, how many years?	Has someone in your family engaged in labor migration?	Person 1	Person 2	Person 3	Person 4
Dog, Bhaisi	No						
Chickens, Bhaisi	No		Yes, 2 people	2	10+		
None	No		No				
Chickens, Cat, Bhaisi	No		Yes, 1 person	4-5			
Chickens, Bhaisi	No		No				
Chickens, Bhaisi	No		No				
Cat	Yes		3-4 No				
Goats, Chickens, Bhaisi	Yes		6-9 Yes, 1 person	2			
Goats, Chickens, Bhaisi	No		Yes, 1 person	2			
Goats, Chickens, Dog, Cat, Bhaisi, Other	Yes		3-4 No				
Chickens, Bhaisi	No		No				
Bhaisi	Yes		6-9 Yes, 1 person	5-6			
Chickens, Cat, Bhaisi, Other	No		Yes, 2 people	3-4	7-8		
Chickens, Cat, Bhaisi	No		Yes, 1 person	10+			
Chickens, Cat, Bhaisi	No		No				
Chickens	No		No				
Dog, Bhaisi	Yes		6-9 Yes, 3 people	5-6	3-4	3-4	2-3
Dog, Bhaisi	No		Yes, 3 people	4-5	3-4	3-4	2-3
Goats, Chickens, Bhaisi	No		Yes, 1 person	8-9			
None	No		Yes, 2 people	4-5	7-8		
None	Yes	10+	Yes, 2 people	3-4	7-8		
Chickens, Cat	No		No				
Goats, Chickens, Bhaisi	No		Yes, 1 person	4-5			
Chickens, Bhaisi	Yes		3-4 No				
Goats, Chickens, Bhaisi	No		Yes, 2 people	8-9	3-4		
Goats, Chickens, Bhaisi	Yes		6-9 Yes, 2 people	7-8	3-4		
Chickens, Bhaisi	No		Yes, 2 people	4-5	2-3		
Chickens, Bhaisi	No		Yes, 1 person	2-3			
Chickens, Bhaisi	No		Yes, 1 person	4-5			
Chickens, Bhaisi	No		No				
Chickens, Cat, Bhaisi	Yes		6-9 No				
Chickens, Cat, Bhaisi	No		Yes, 1 person	8-9			
Goats, Chickens	No		Yes, 1 person	4-5			
Chickens, Bhaisi	Yes	10+	No				
Chickens, Bhaisi	No		No				
Goats, Chickens, Bhaisi, Other	Yes		4-5 No				
Chickens, Cat, Bhaisi	No		Yes, 2 people	8-9	10+		
Chickens, Cat, Bhaisi	No		Yes, 1 person	8-9			
Cat	Yes		2-3 Yes, 1 person	10+			
Goats, Bhaisi	No		Yes, 2 people	3-4	8-9		



141



Participant P01

Ethnographic Observation:

P01 has grown in her role at the health post in the last five years. She tells me she does not want to go to school for nursing, but she seems to do nearly all the nursing work at the health post anyways. She has no plans to leave village, since all of her friends are here and she has heard people complain about the dirty/loud cities with no green spaces. She has as much experience as any of the traveling nurses that come and stay for 18 month rotations, and she has no desire to leave the village. She knows quite a lot more about the local wild plants and animals than I previously thought she did, and tells me that her dad used to take her up to the Lekh when she was younger. She showed me some Yasaargumba that another villager brought from the forest for her, tell me that it's quite expensive and she intends to keep it for medicine. She was the first person I conducted an interview with, and seemed happy if confused to help me work out the kinks in my participatory process.

EID Score: 5.14/7

Calendar Information:

Total # of Items in Calendar:	53
Total Plants:	41
Wild:	11
Domesticated:	29
Total Animals:	8
Wild:	5
Domesticated:	3
Total Fungi:	4

Figure 97. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P01

Participant P02

Ethnographic Observation:

P02 has gained another grandchild, and her daughter was here visiting during the school break while I was here doing my field work. She also has a new daughter in law, whom I will come back later to interview. She's had to cut back on some of her farming because of older age but is still doing oranges and kiwis for herself and grandchildren and also to sell. Told me that there was a series of hailstorms early in the year that took out her entire fruit crop and she's pretty upset about it. Also told me they've had an unpredictable monsoon season so far, and seems tired.

EID Score: 4.85/7.00

Calendar Information:

Total # of Items in Calendar:	27
Total Plants:	25
Wild:	7
Domesticated:	18
Total Animals:	0
Wild:	0
Domesticated:	0
Total Fungi:	2

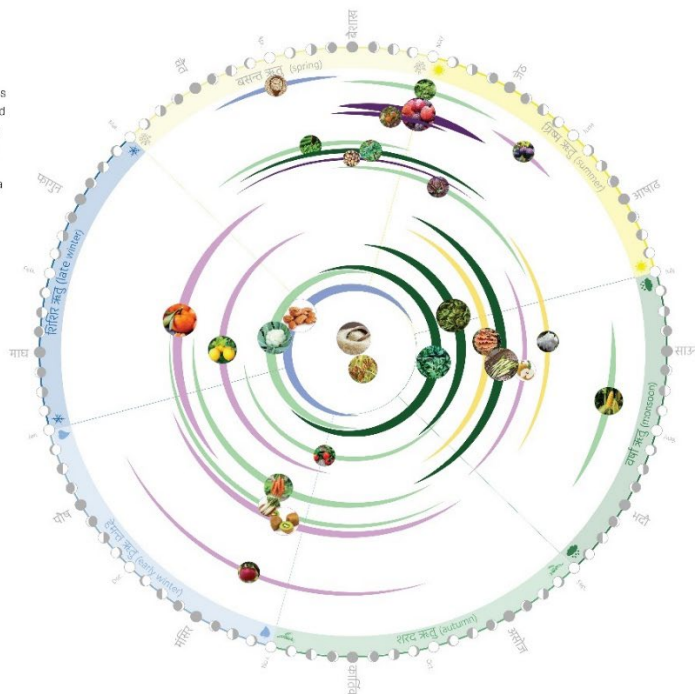
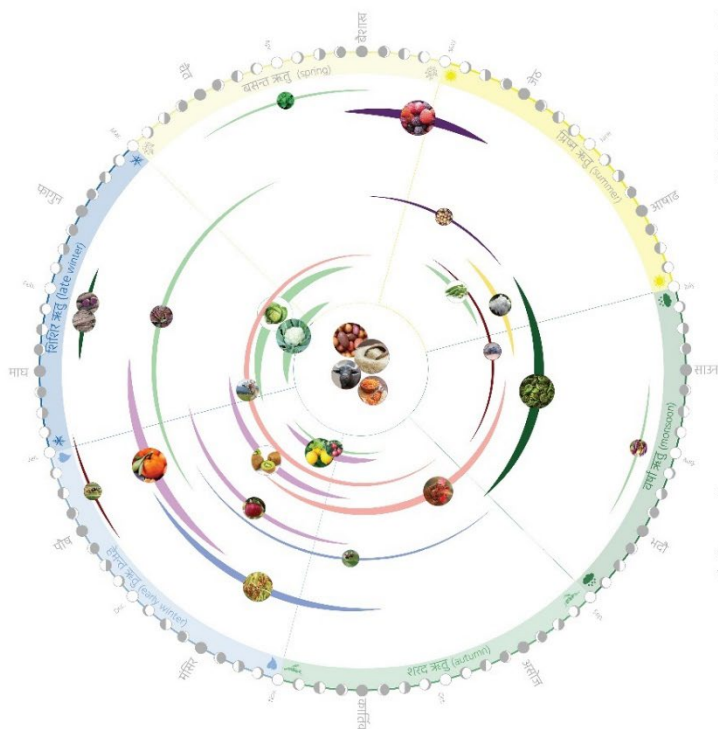


Figure 98. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P02



Participant P03

Ethnographic Observation:

P03 is still working in the gaupalka. Her sister has moved away to her husband's village, now that he is back home from bidish, and she is still living in the same house with her mother. I don't think she wants to get married, or she probably would have had someone find her a guy. Will go out and forage on her day off because it brings her joy, but mostly lets her mother do that sort of thing while she brings income into the household.

EID Score: 4.85/7.00

Calendar Information:

Total # of Items in Calendar:	26
Total Plants:	20
Wild:	4
Domesticated:	16
Total Animals:	5
Wild:	2
Domesticated:	3
Total Fungi:	1

Figure 99. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P03

Participant P04

Ethnographic Observation:

P04 has had a very rough few years, discovering that her son has hearing loss and trying to find a special school for him so he can still have an education. Because of this she has to leave village every few weeks to go and see him at his school in Beni, which she doesn't like doing. She and her husband have increased the number of types of crops they have on their property, and tell me that the plants I have given them have done well, except for the kiwi which was killed in a hailstorm this year, but she is confident that kiwi will come back next year. Her home and land is a green paradise, and she loves gardening and keeps some plants simply because they are pretty or bring more tropical birds to the window. She is so knowledgeable especially about wild plants, but I didn't think to ask where she learned what she knows. She used to be Christian but tells me they have left the church since I got to know her five years ago. We left her house together and as we walked towards the village she pointed out several plants that were not included on the calendar that she uses for medicine, mainly blood pressure and liver issues. She also showed me how to roll one of the medicinal vines into a pair of fake glasses. She has always been a great counterpart, and we stopped at one of her neighbors, where she convinced her neighbor to take part in my study. Her neighbor had found a mushroom in her field and they spent some time telling me about this mushroom, where and when it could be found, and it's importance as a food during monsoon.

EID Score: 6.21/7.00

Calendar Information:

Total # of Items in Calendar:	64
Total Plants:	55
Wild:	12
Domesticated:	43
Total Animals:	6
Wild:	3
Domesticated:	3
Total Fungi:	3

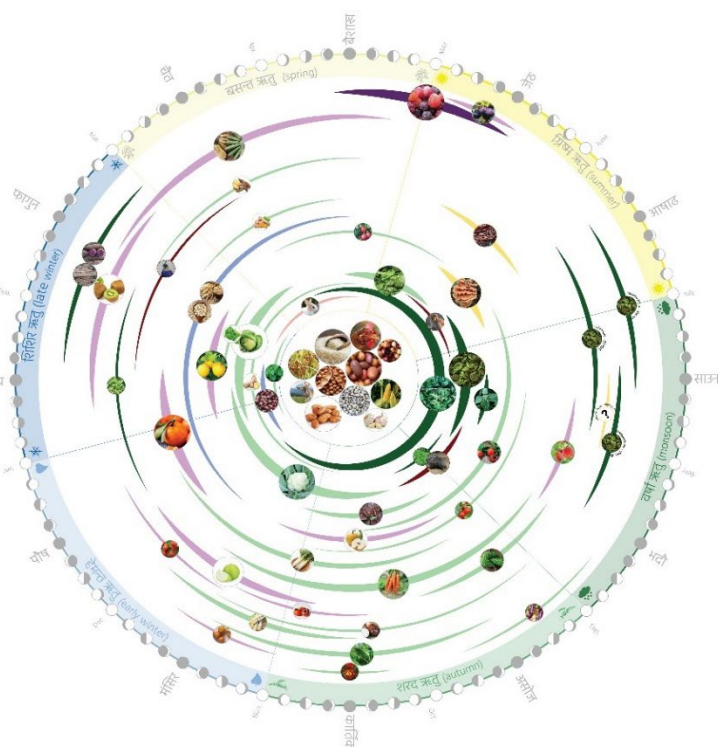
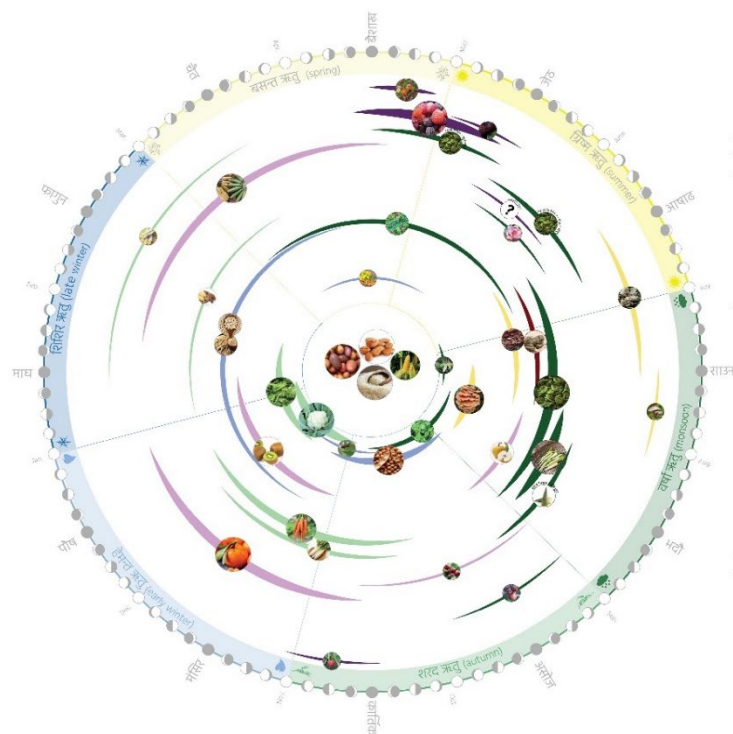


Figure 100. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P04



Participant P05

Ethnographic Observation:

P05 is normally very enthusiastic about the village and the natural spaces around it, and is very knowledgeable about the gathering of wild plants. He and his wife are educated and chose to teach in this village and raise their children here in the country rather than in the city. But he seemed very tired when I went to visit him and his wife this time around. He's very worried about how his son is going to make his way in the world. His son is currently studying in Pokhara, and doing better than average in school, but P05 wants his son to go for his bachelor degree in Australia, and he needs to have very high grades for that, so he and his wife are worried and stressed about that. He also seems very depressed about the state of his crops. He has the most kiwis of anyone in town, but half of them were destroyed in the hail storms that arrived in spring this year. His survived the most out of anyone due to him having installed hail nets, but he seems even more upset than anybody. This is not the mood I was expecting from him, he's usually very energetic and upbeat.

EID Score: 5.21/7.00

Calendar Information:

Total # of Items in Calendar:	41
Total Plants:	36
Wild:	15
Domesticated:	21
Total Animals:	1
Wild:	1
Domesticated:	0
Total Fungi:	4

Figure 101. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P05

Participant P06

Ethnographic Observation:

P06 hasn't changed much, although she was very happy to share that the family has purchased a refrigerator and a rice cooker since I last saw them. They are very happy because the refrigerator allows them to keep some food for longer. Their daughter is in year nine now, and will be graduating from the local school next year. They will send her to Pokhara just like their son, who currently has no plans to come back to the village. She didn't seem quite as tired as her husband, but she stayed quiet most of the time while I was talking with them. She let me know that for the intents of the calendar, her husband's knowledge is her knowledge. She informed me that they are hoping to leave village in 5 or 6 years once their children are well established elsewhere. Both of them are from the neighboring ward to the north of this village, and they are considering whether to move back there or whether to move into Pokhara to be closer to their children.

EID Score: 5.36/7.00

Calendar Information:

Total # of Items in Calendar:	41
Total Plants:	36
Wild:	15
Domesticated:	21
Total Animals:	1
Wild:	1
Domesticated:	0
Total Fungi:	4

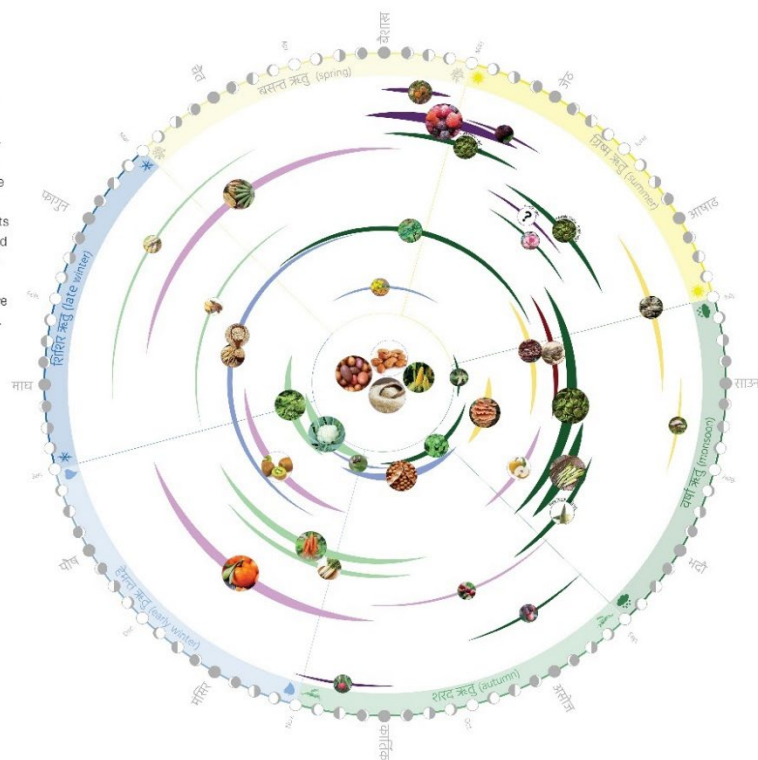


Figure 102. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P06

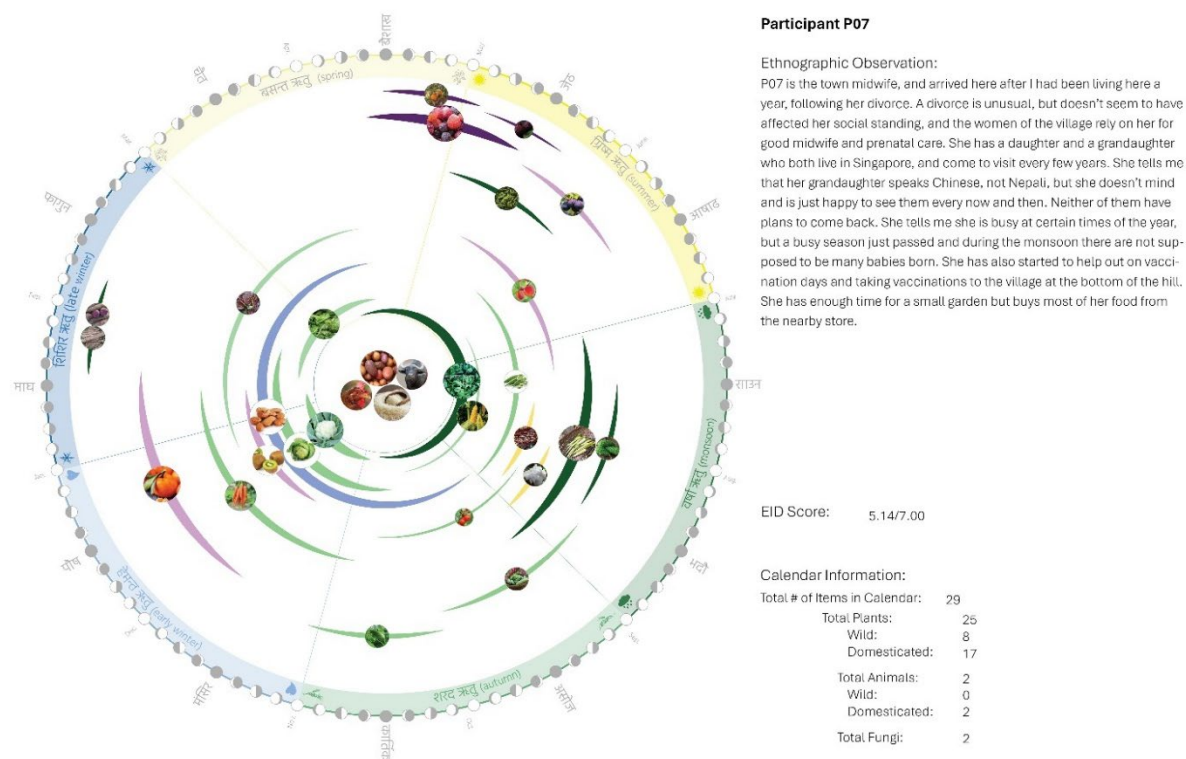


Figure 103. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P07

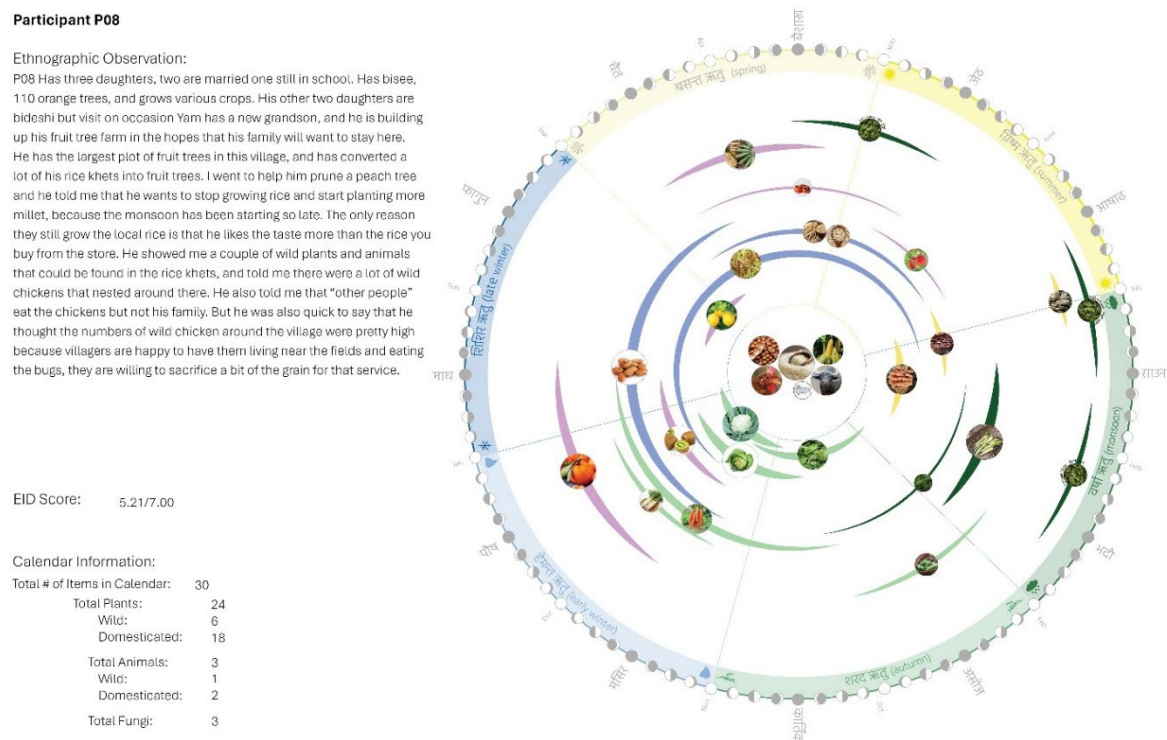
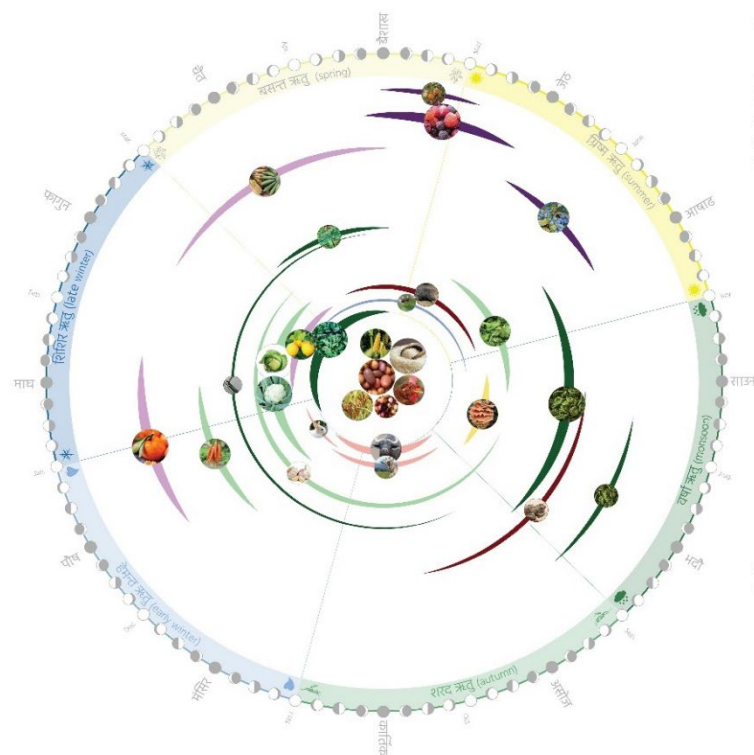


Figure 104. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P08



Participant P09

Ethnographic Observation:

P09 is doing ok. Her daughter Rekaa has returned from boarding school in Pokhara since the pandemic began, and has not gone back yet. She tells me that having her daughter closer is a comfort, and hopes that she will stay here in village to care for her as she ages, as she does not want to leave the area to live in a city.

EID Score: 5.29/7.00

Calendar Information:

Total # of Items in Calendar: 29

Total Plants:	22
Wild:	6
Domesticated:	16
Total Animals:	6
Wild:	2
Domesticated:	4
Total Fungi:	1

Figure 105. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P09

Participant P10

Ethnographic Observation:

I got to P10's house a little later than expected, but he made some time to sit down and talk to me and make the calendars. I was very happy he decided to speak with me, since he and I have not always gotten along. He was hesitant to say any of the things he picks specifically, due to not wanting others to know exactly what he picks from the jungle, so I let him say things like "winter fruits" instead of specific items. He is still very knowledgeable, and listed off things that no one else had told me. His house also has some unconventional animals around it, such as pigeons, cats, and a turkey. He enjoys keeping them around for both the novelty and for company. His specialty is in traditional medicine, but he told me he doesn't mind trying new things in agriculture, such as the turkey, every once in a while. He is still Magar, but with a different last name than the other villagers which place his origins in a district farther away from here. He tells me he enjoys living here, because this area is very sacred to the Magar community and he believes it connects him better to his work to be in a place so close to nature and many important landmarks for Hinduism.

EID Score: 5.57/7.00

Calendar Information:

Total # of Items in Calendar: 37

Total Plants:	27
Wild:	10
Domesticated:	17
Total Animals:	4
Wild:	2
Domesticated:	2
Total Fungi:	4

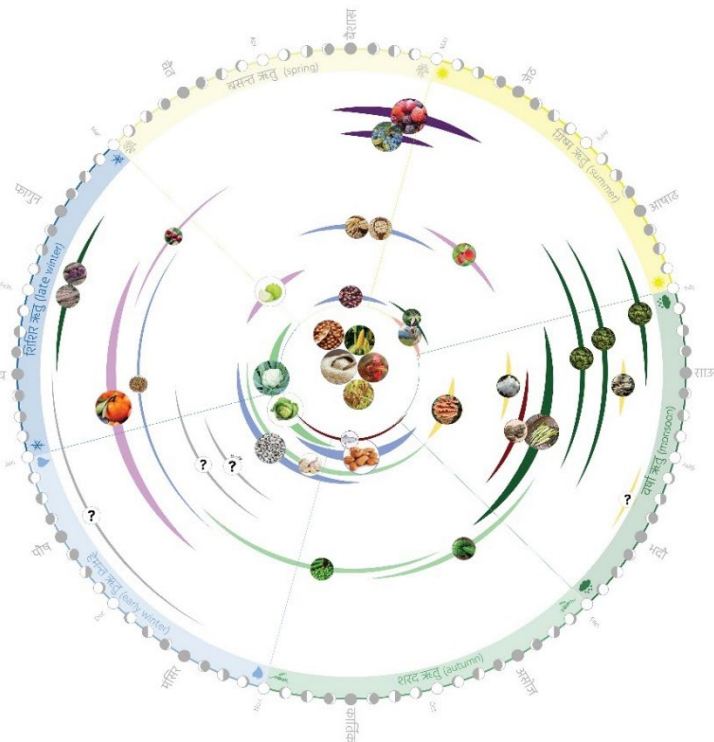
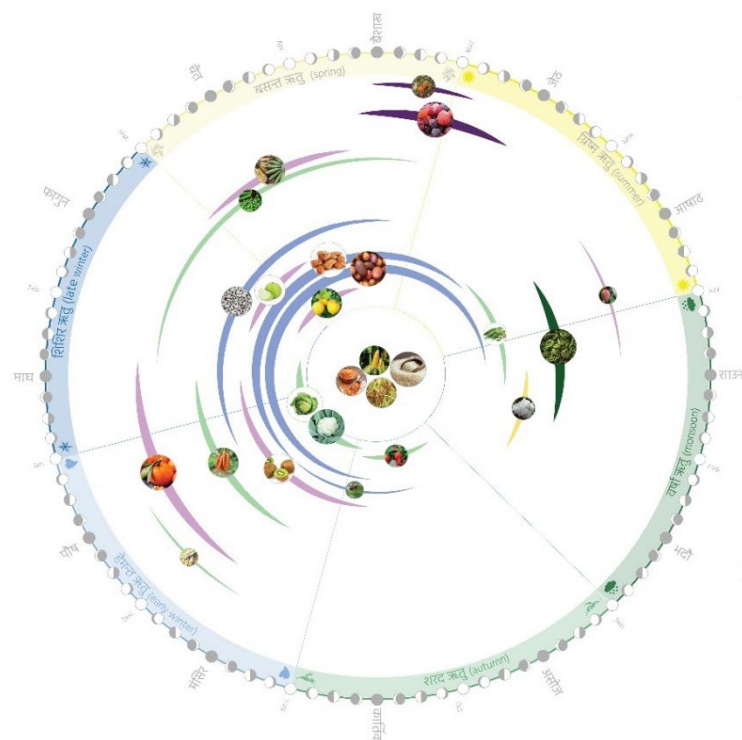


Figure 106. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P10



Participant P11

Ethnographic Observation:

P11 has married into P02's family, and she moved into this village from the Terai a few months ago. This is a very new environment for her, and she's not very familiar with the surrounding plants and animals, but she told me she would like to learn if she has free time. Her husband is working abroad, and comes home every year or so; he's a soldier and has annual leave.

EID Score: 4.71/7.00

Calendar Information:

Total # of Items in Calendar:	25
Total Plants:	24
Wild:	3
Domesticated:	21
Total Animals:	0
Wild:	0
Domesticated:	0
Total Fungi:	1

Figure 107. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P11

Participant P12

Ethnographic Observation:

P12 is a head mother's group leader, one of the Panchayat council that advises the ward government, and one of the cornerstone members of the community. She also has six children, three of whom are working bidesh right now. She told me she will not seek re election for the Panchayat council this year as she's getting too old for it, and wants her son to run instead. Several of her children reside in cities nearby, but she wishes to stay here for the rest of her life, even if she is not as involved as she was in the community. She's always been very enthusiastic about the new crops I wanted to introduce into the village, and still asked me for advice on her kiwis when I came to visit. They are some of the few true vegetarians in the village, and because of that they don't condone a lot of the meat eating, they own quite a few cows, are very religious, but not particularly interested in the foraging or hunting of plants or animals, choosing to grow a larger variety of vegetables than average on their land. They are also some of the few people who still grow and eat buckwheat, and say that along with it being important to their culture, it is good for the land and soil, and also tastier.

EID Score: 4.57/7.00

Calendar Information:

Total # of Items in Calendar:	27
Total Plants:	25
Wild:	3
Domesticated:	22
Total Animals:	1
Wild:	1
Domesticated:	0
Total Fungi:	1

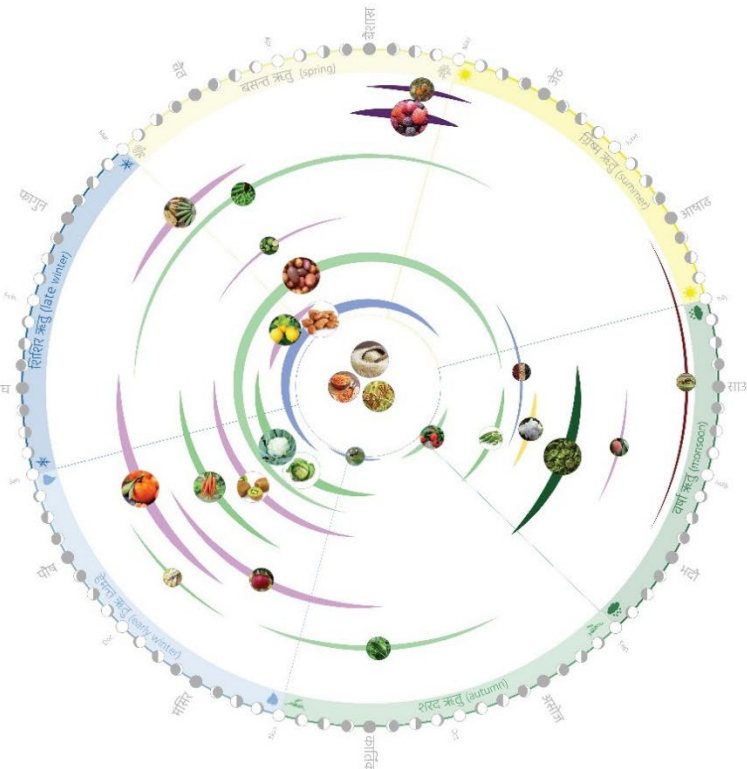
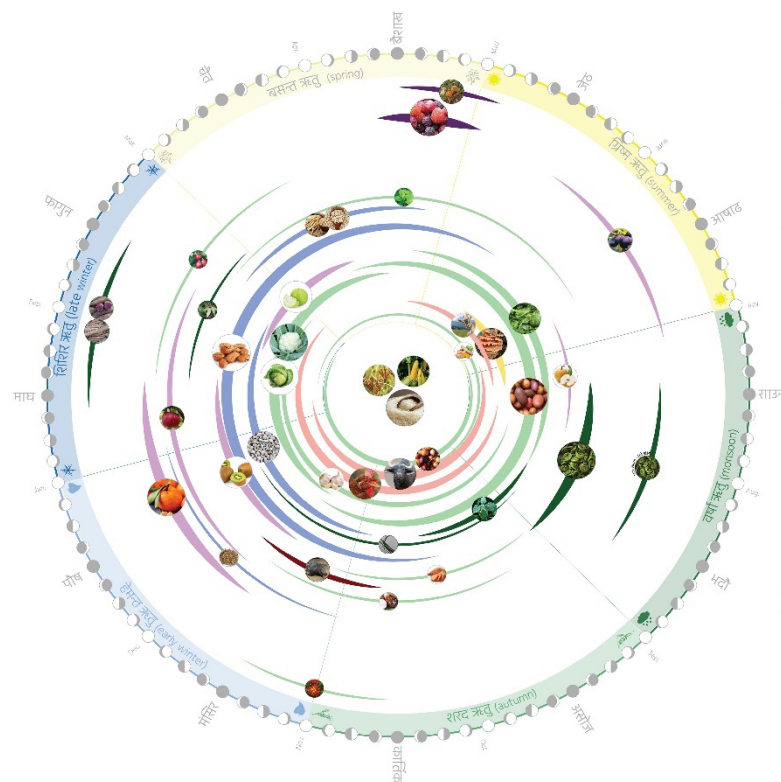


Figure 108. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P12



Participant P13

Ethnographic Observation:

P13 has two children who are both out of the village and a husband who is working abroad. She often works with P04 in the fields, as they are neighbors. Due to her home being a bit far out of village, she will often come into town to buy things and hang out with the other middle-aged women. Right next to her house is a small overhanging cave with a spring coming out of it. There is a small shrine to a village god there, and many people come to drink the water and perform pujas. She is very proud of being next to this landmark. She says it makes her feel closer to her land and she only has to go a short way to do puja.

EID Score: 5.23/7.00

Calendar Information:

Total # of Items in Calendar:	40
Total Plants:	35
Wild:	10
Domesticated:	25
Total Animals:	4
Wild:	1
Domesticated:	3
Total Fungi:	1

Figure 109. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P13

Participant P14

Ethnographic Observation:

P14 is still a very kind woman. Her daughter is now studying 12th grade in Beni, and comes home on the weekends. Her daughter is an equally sweet person. P14 mostly lives in the house alone, and doesn't need to grow as many things to feed just herself. As a result she tells me she doesn't grow very many things, and also that it can be a bit lonely as her house is further away from others. Despite living out in the solitude of nature she is not inclined towards spending time here. She will go into village every other day to buy supplies and also to socialize.

EID Score: 4.36/7.00

Calendar Information:

Total # of Items in Calendar:	19
Total Plants:	17
Wild:	3
Domesticated:	14
Total Animals:	1
Wild:	0
Domesticated:	1
Total Fungi:	1

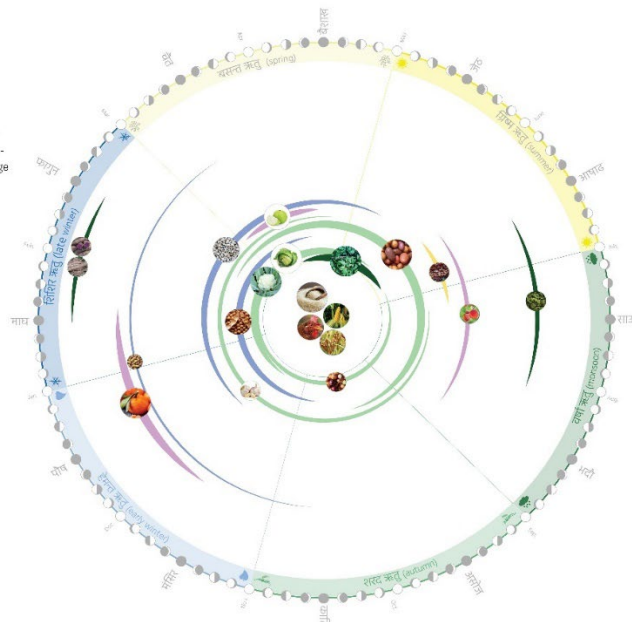
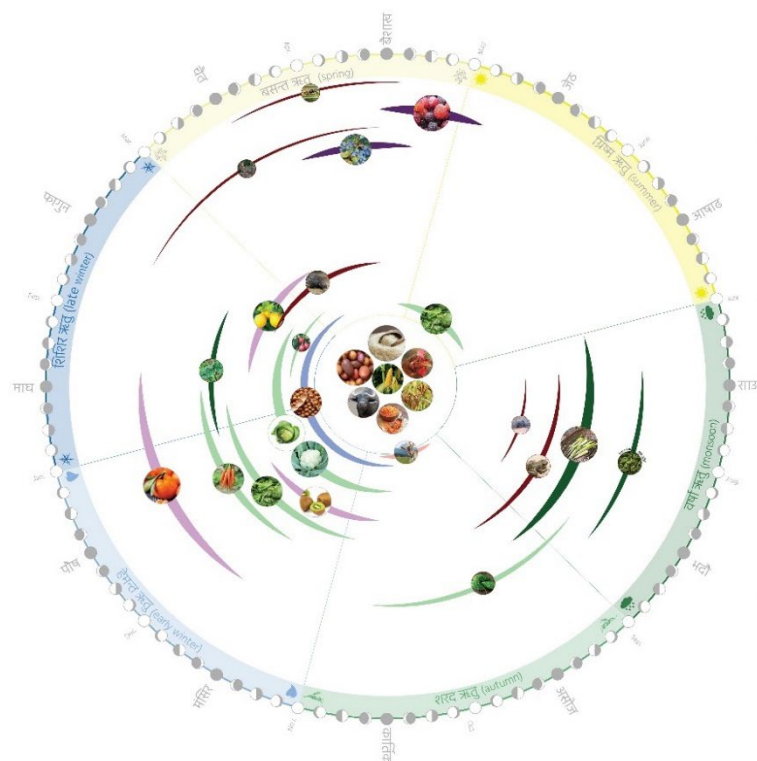


Figure 110. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P14



Participant P15

Ethnographic Observation:

P15 isn't married and lives right on the edge of town. He has a few herds of goats that he tends to, but due to the poor weather he decided to come down off the top of the hill for a few days to rest and resupply, which is when I spoke to him. For the most part he says he enjoys the peaceful hilltops and likes being up there, except for monsoon when leeches are everywhere. One of the younger men is watching his goats as a favor. Jabir never married so his profession keeps him away from the house and on top of the hill more often than not. He had brought his extended family members some mushrooms and bush meat, and when asked about them he was reluctant to speak on them. Eventually he told me that he had some traps for small bush cats and birds. He seemed very ashamed of this and I tried to comfort him by saying we also go hunting in the United States. He told me if not for the rules against it people would not feel so bad, since the goat herding opens up so much open land for these animals that they are plentiful, and he is also happy to have them there.

EID Score: 4.79/7.00

Calendar Information:

Total # of Items in Calendar:	29
Total Plants:	21
Wild:	5
Domesticated:	16
Total Animals:	8
Wild:	5
Domesticated:	3
Total Fungi:	0

Figure 111. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P15

Participant P16

Ethnographic Observation:

P16 is X's son, and he and his wife returned to village and had a baby girl about three years ago at the start of the pandemic. They both think it is important to teach their daughter about the village and the land around it. He is a carpenter, but also helps out with all the agricultural work on the side, or when he doesn't have carpentry work to do. He and his wife are both part of the christian church here, and so on saturday they have a sabbath of sorts, and take a family walk to picnic spots in the woods. He is also a gifted musician and plays both the guitar and the bamboo flute. He is educated but chose to come back and try and make a life in the village with his wife, simply because he likes it here.

EID Score: 5.50/7.00

Calendar Information:

Total # of Items in Calendar:	31
Total Plants:	25
Wild:	2
Domesticated:	23
Total Animals:	3
Wild:	1
Domesticated:	2
Total Fungi:	3

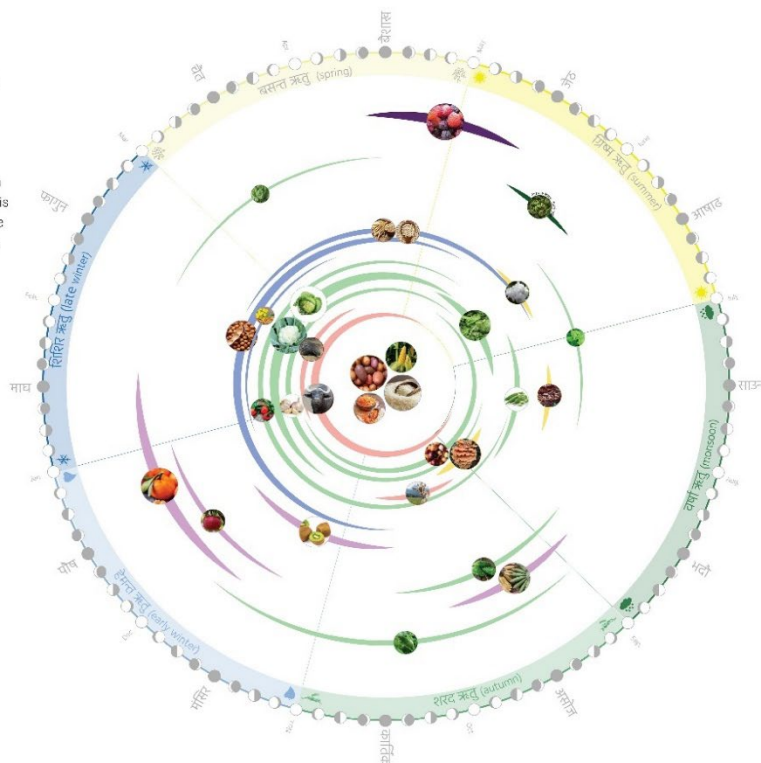


Figure 112. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P16

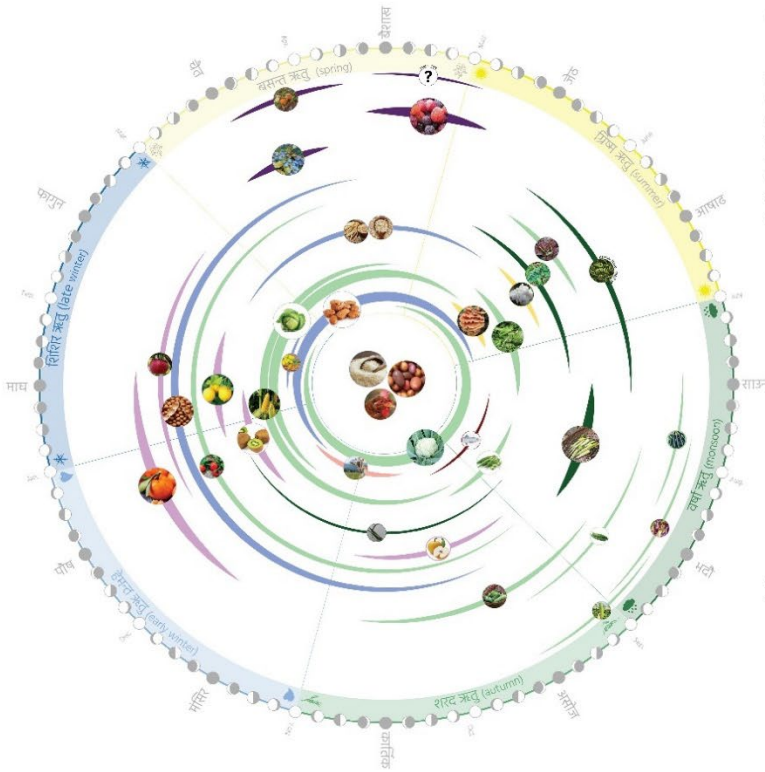


Figure 113. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P17

Participant P18

Ethnographic Observation:

P18 is older now and spends more time in the store than he does out cutting grass. He is a former labor migrant, and all six of their children are out of the village, with one living in the UK and another in the US, doing graduate school. They would move into the city, except that they have such a broad social network here, and the store is a good source of income. The family home also operates as sort of a base of operations when all of their children come home for major holidays. They say the village is a good countryside getaway for their family in the city, so they keep living here.

EID Score: 4.36/7.00

Calendar Information:

Total # of Items in Calendar: 47
Total Plants: 38
Wild: 12
Domesticated: 26
Total Animals: 4
Wild: 0
Domesticated: 4
Total Fungi: 5

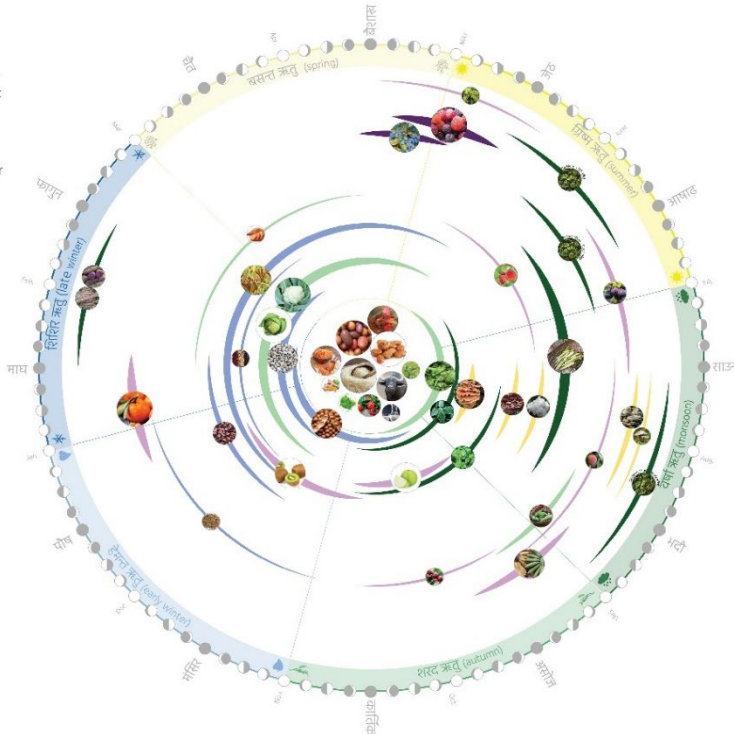
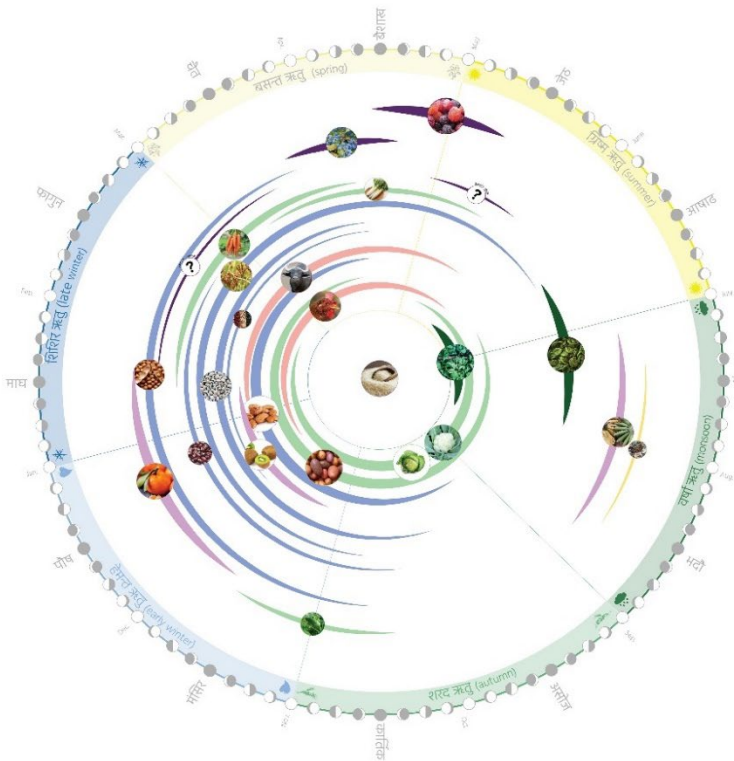


Figure 114. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P18



Participant P21

Ethnographic Observation:

P21 and his wife are still living right next to the large house he built with the money he earned from work abroad. They finished all the exterior detailing during the pandemic, but they use the lower level mostly for husking corn this time of year. They still abide mostly by an agrarian lifestyle, with chickens and a bisse, even though they are wealthy enough that they no longer have to. This includes the harder work of planting and harvesting crops. They tried to bring all their corn in by themselves this year but were unable to, so some neighbors pitched in to help them carry it all back to their house for husking. The day I came to talk to them they were all helping them husk it as well as they stopped in to say hello. They let me do some husking for a little while, and then told me to stop so I wouldn't be too tired. This is a common occurrence. His wife is very quiet, and I often see her walking by with a chicken stuffed into her bag. She tells me she likes keeping chickens around for company, and she thinks their antics are very entertaining.

EID Score: 3.86/7.00

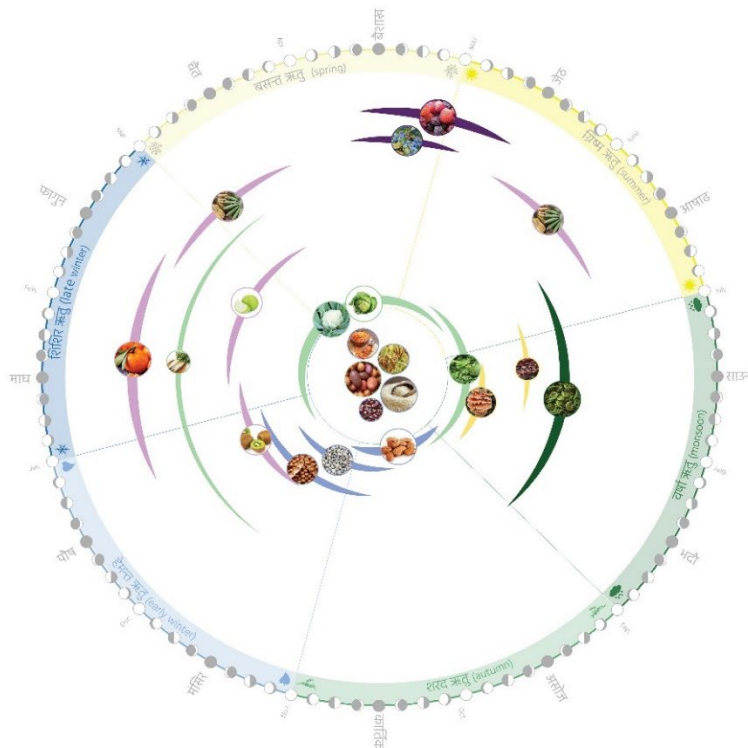
Calendar Information:

Total # of Items in Calendar:	25
Total Plants:	22
Wild:	4
Domesticated:	18
Total Animals:	2
Wild:	0
Domesticated:	2
Total Fungi:	1

Figure 117. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P21

Participant P22

Ethnographic Observation:

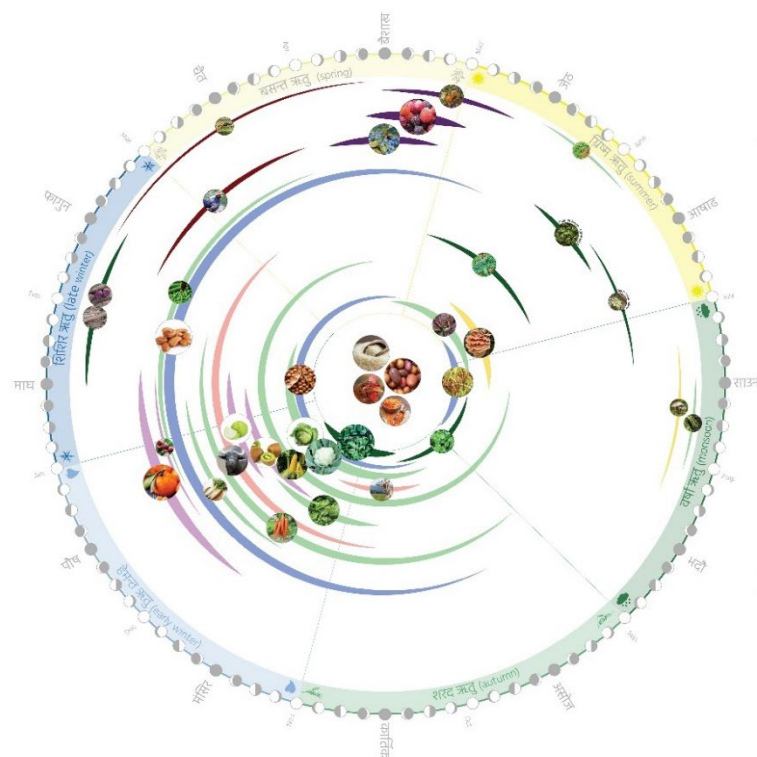


EID Score: 3.93/7.00

Calendar Information:

Total # of Items in Calendar:	20
Total Plants:	18
Wild:	3
Domesticated:	15
Total Animals:	0
Wild:	0
Domesticated:	0
Total Fungi:	2

Figure 118. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P22



Participant P23

Ethnographic Observation:

P23 was very helpful when I came by to ask her questions. She also gave me a life update. Her husband is back from abroad and she has had a child, a son. They're still living in the same house right in the middle of town, but since she has her office job and her husband is home, she doesn't have to do as much of the farm work, as he does that while she is at work. While I was conducting my fieldwork I did keep running into her out in the woods on her days off. During monsoon season all the mushrooms are in season and so many people like her spend their free time mushrooms as a "timepass game" (passing the time). Their daughter is now 8, but they don't think she's doing well at the government school and might try to transfer her to a private school in Beni.

EID Score: 6.43/7.00

Calendar Information:

Total # of Items in Calendar:	37
Total Plants:	30
Wild:	9
Domesticated:	21
Total Animals:	5
Wild:	2
Domesticated:	3
Total Fungi:	2

Figure 119. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P23

Participant P24

Ethnographic Observation:

P24 has had another baby since I last saw her, and has moved from her house in Baskot (far away from the bazaar) to her cousin's home (nearer the bazaar) so that her children don't have to walk so far to get to school, and so that she is less burdened when needed to carry things across the landslide area. Her husband left again just before I got here, and plans to come back in two years. I've never actually met him.

EID Score: 5.71/7.00

Calendar Information:

Total # of Items in Calendar:	35
Total Plants:	25
Wild:	7
Domesticated:	18
Total Animals:	9
Wild:	3
Domesticated:	6
Total Fungi:	1

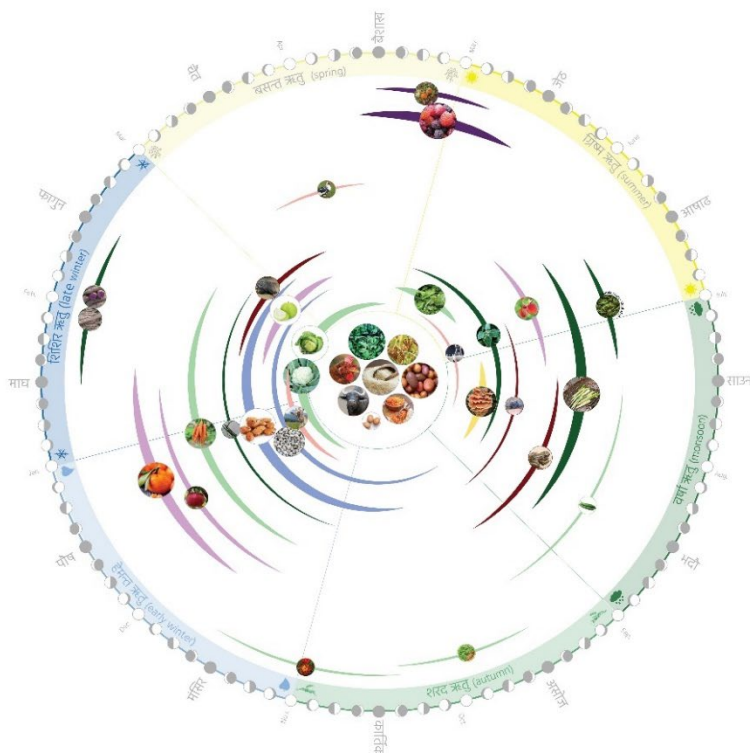
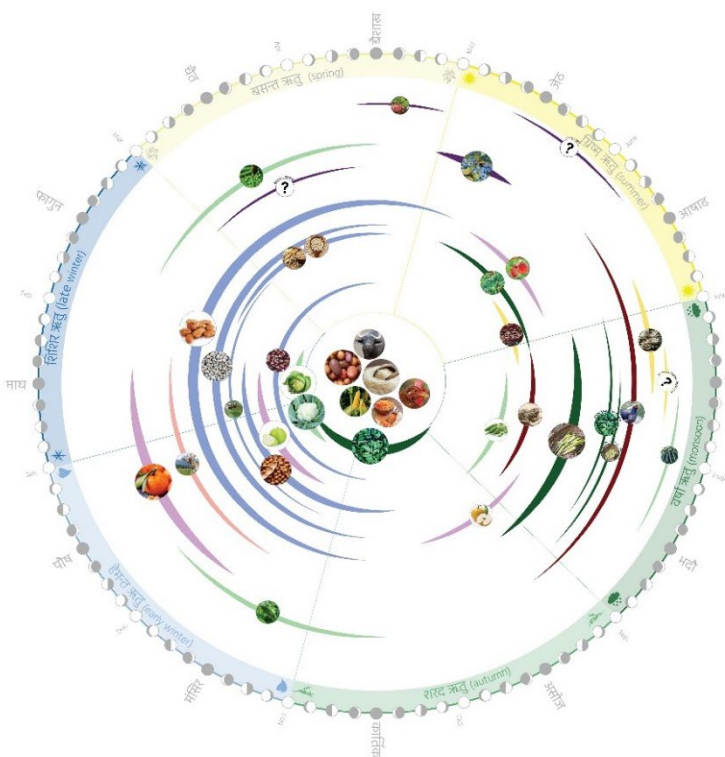


Figure 120. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P24



Participant P25

Ethnographic Observation:

P25 has been trying to go abroad again for the past 4 years, but keeps getting scammed by agencies offering him visas in places like Romania and Portugal. His parents are insistent that he not go to the middle east, and he had a bad experience in Malaysia his first time abroad, so his options are limited. He has a two year old daughter now, who is the only grandchild in the family currently. They have decided to educate her in Pokhara, so his wife and daughter are staying with family in Pokhara while he stays and works on the farm in the village. He tells me he enjoys farm life, and if he could he would want to stay and help his parents. He has a lot of ecological knowledge, and even forages for some of the more obscure plants like Dhakaiyo. His daughter is starting to learn English from the age of 2, and they don't currently have plans to bring her back to the village, although he hopes that when she is old enough his wife can return to the village to be with him.

EID Score: 3.93/7.00

Calendar Information:

Total # of Items in Calendar:	38
Total Plants:	30
Wild:	9
Domesticated:	21
Total Animals:	5
Wild:	2
Domesticated:	3
Total Fungi:	3

Figure 121. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P25

Participant P26

Ethnographic Observation:

Was very stressed about the state of the cornfields when I was there. The corn isn't quite ripe but it's been raining so much that some of it has started to rot. So they're bringing it in as fast as they can. My interview with her was conducted during one of the many days that month that she spent husking and hanging up corn to dry in their barn. She spends a lot of time worrying about her sons and discussing with her husband about the best crops to plant to deal with the unique weather on their part of the hill. She tells me that their land is just high enough to be too cold for some crops, but just low enough to get the worst of the hail and the wind in this area. Most of the time they grow corn in some khets with millet underneath. Lately they have been putting a lot of effort into their winter vegetables, and they have a reputation for having very good brassicas such as cauliflower and broccoli. Neither she nor her husband have any desire to leave the village. Her husband spent many years working as a labor migrant, and enjoys the peace and quiet of life in the village.

EID Score: 4.79/7.00

Calendar Information:

Total # of Items in Calendar:	33
Total Plants:	27
Wild:	5
Domesticated:	22
Total Animals:	4
Wild:	2
Domesticated:	2
Total Fungi:	2

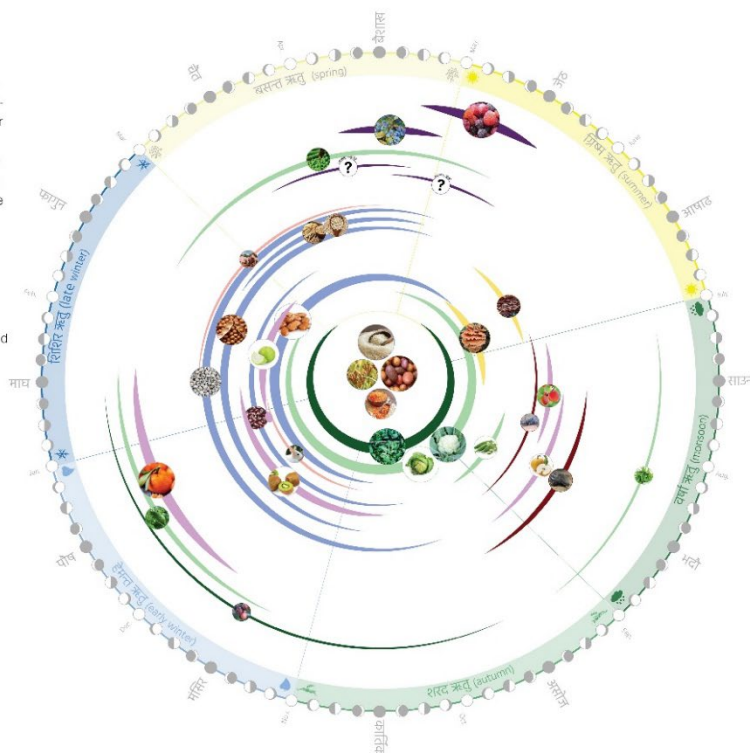
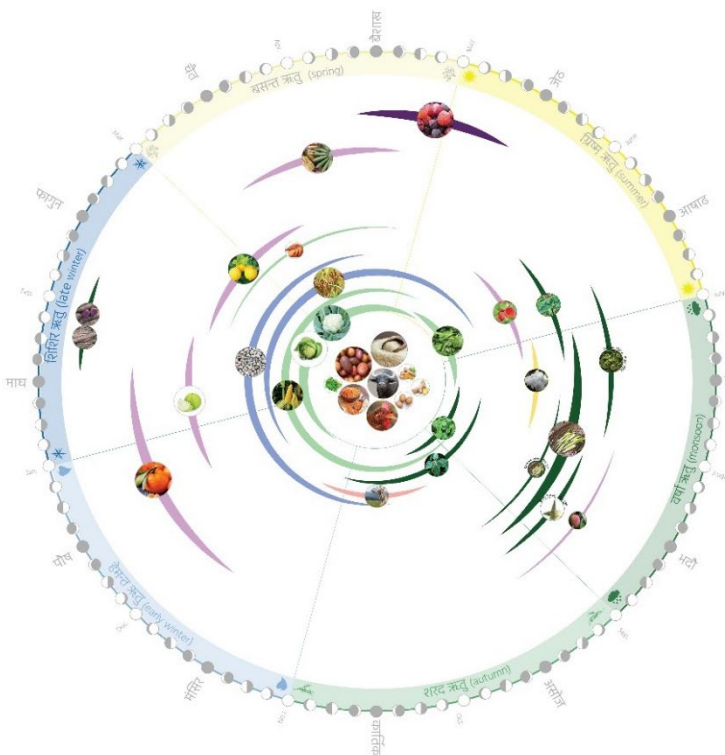


Figure 122. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P26



Participant P27

Ethnographic Observation:

Is extremely worried about his crops this year, as the arrangement is typically that they grow all their own food and his son in Japan sends them extra money for household expenses like electricity. But with the exceptionally heavy monsoon he worries there will not be enough corn to survive the rains and rot. Also unhappy that his granddaughter is in Pokhara for her education, but understands that that is the best option for her education. He is illiterate and believes education is very important, but tells me he failed in ensuring that all three of his sons made it through secondary school at least. Has given up on drinking alcohol in the last few years at the request of his family and seems happier and healthier for it. The family no longer owns a cat. He says in his older age that he very much enjoys spending time in his fields and going up to the lekh whenever he has free time.

EID Score: 3.93/7.00

Calendar Information:

Total # of Items in Calendar:	32
Total Plants:	27
Wild:	10
Domesticated:	17
Total Animals:	4
Wild:	0
Domesticated:	4
Total Fungi:	1

Figure 123. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P27

Participant P28

Ethnographic Observation:

P28's three children have since gone away to boarding school. The house is less messy now, and Kumari does not need to grow as much food since she is the only mouth to feed most of the time. Her husband sends her money once a month to pay for schooling. She still goes to church but I think something must have happened at the church because I have heard many people have left it. Her house is surrounded by various cacti and other succulents, or flowers in pots. She enjoys gardening and being surrounded by greenery. And she jokes with me that monsoon is her favorite season even with the leeches.

EID Score: 5.14/7.00

Calendar Information:

Total # of Items in Calendar:	32
Total Plants:	29
Wild:	9
Domesticated:	20
Total Animals:	1
Wild:	0
Domesticated:	1
Total Fungi:	2

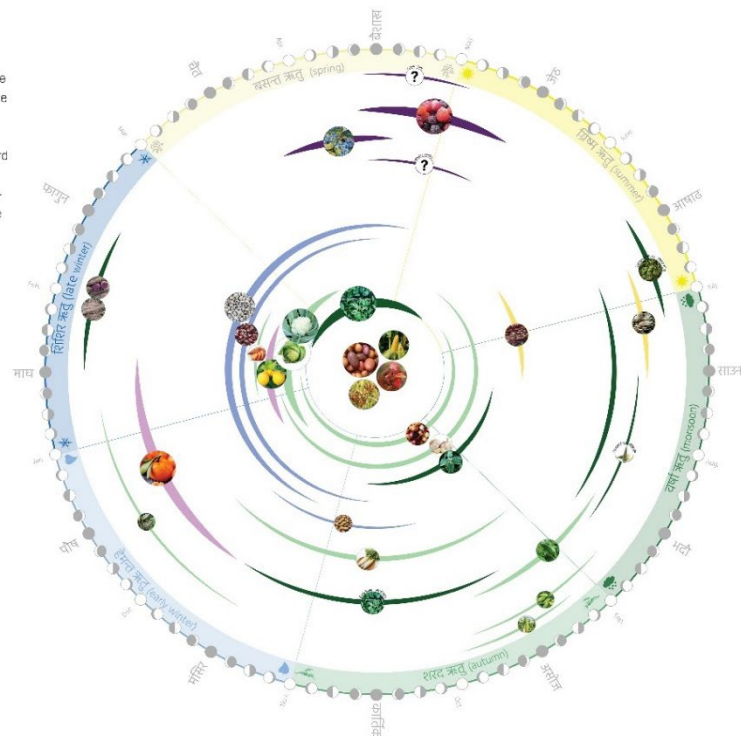


Figure 124. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P28

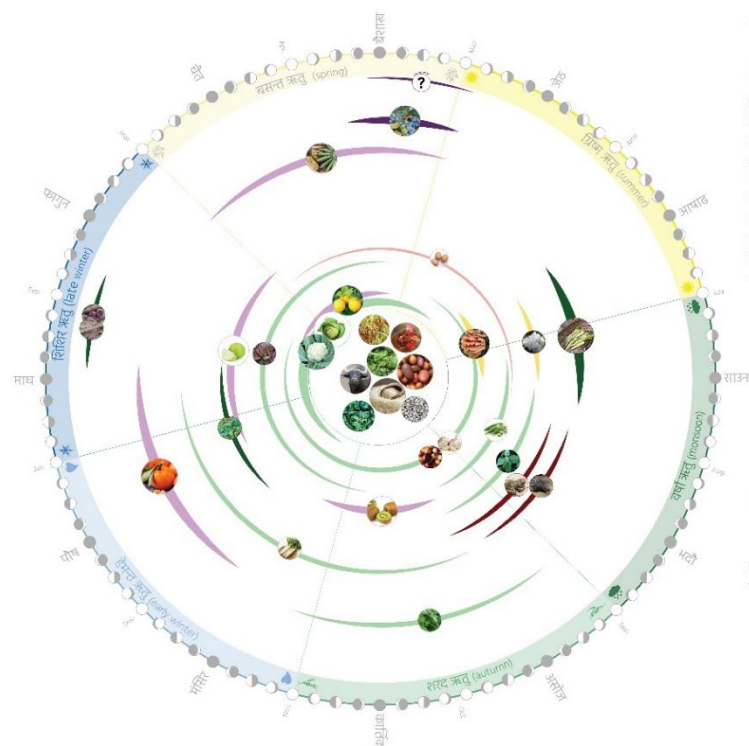


Figure 125. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P29

Participant P30

Ethnographic Observation:

P30 is still the ag technician, but is now not spending as much time at Begkhola as she is at the other ward, due to the population of the other ward growing and this one shrinking. The other ward also has reliable transportation to and from, while the roads to Begkhola can be dangerous at times, so she has started to avoid taking them unless she has to. She has a little boy that she brings with her, and he runs around here while she works. She does not worry about him here since it is so quiet. She distributes seeds of harder varieties and pesticides for plants that have been approved by the government, but also understands the need for wild vegetables, and is always happy when someone brings her foraged food.

EID Score: 5.29/7.00

Calendar Information:

Total # of Items in Calendar:	58
Total Plants:	50
Wild:	10
Domesticated:	40
Total Animals:	6
Wild:	1
Domesticated:	5
Total Fungi:	2

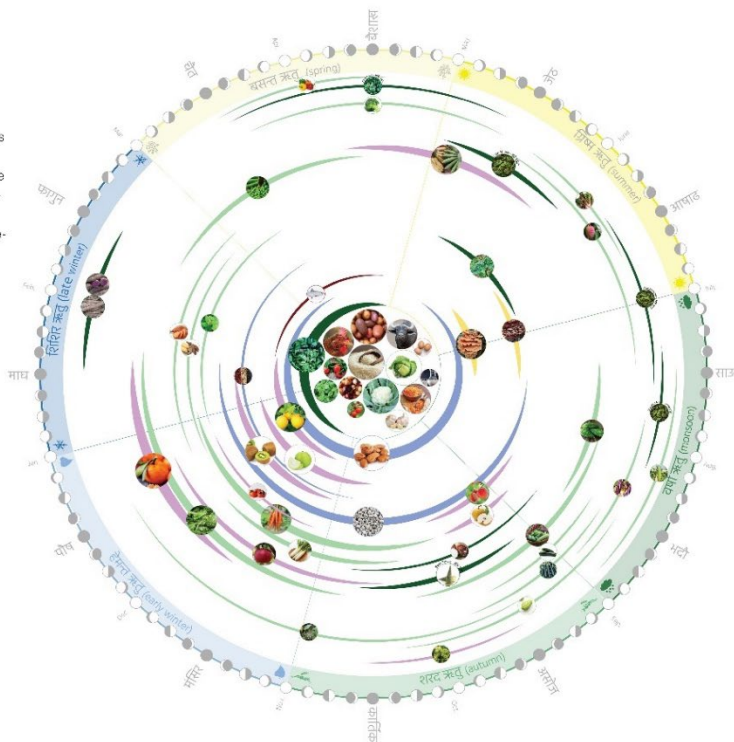
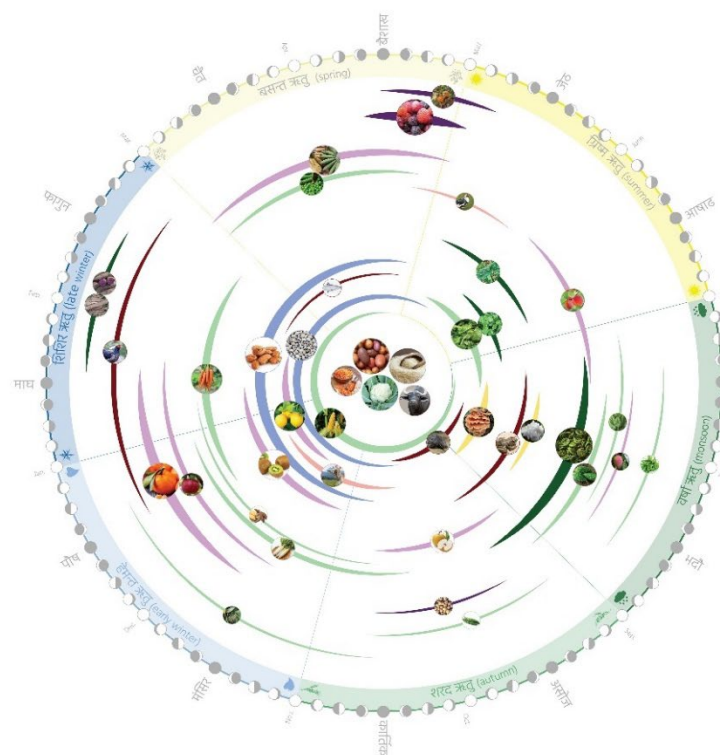


Figure 126. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P30



Participant P31

Ethnographic Observation:

This guy is the agVet technician now, which is why I didn't see much of him several years ago. His job is basically to hand out medicine for various animals. As a result he's pretty concerned with the status of agriculture in the village, and tells me that more people are selling their water buffaloes and goats these days, rather than holding onto them like they used to. A woman's husband passed away in a landslide while I was here, and he was telling me she is asking him to help sell their entire herd of goats, as she won't be able to care for them on her own. He would like people to be raising more cows, and was telling me about harder varieties. He's also actually worried that too much of the land is turning into forest and soon won't be suitable for grazing at all.

EID Score: 4.93/7.00

Calendar Information:

Total # of Items in Calendar:	41
Total Plants:	32
Wild:	8
Domesticated:	24
Total Animals:	7
Wild:	4
Domesticated:	3
Total Fungi:	2

Figure 127. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P31

Participant P32

Ethnographic Observation:

P32² is incredibly knowledgeable in wild plants and when I went to visit this house there was a large party going on for the day off, so I wasn't sure who I was going to talk to. But I told everyone about my project and they all pulled over to me. He was happy to spend a few minutes making the calendar with me. He told me about plants that only grew on the hills around their small village (part of the larger ward), and also told me about some more obscure uses for plants that I didn't think were edible such as using rhododendron to make a tea of sorts from the flower. He's very tied to this place, and even posts about the plants and mushrooms he finds on facebook. He has no plans to leave, although they're hoping that all of their sons can get an education in Beni or Pokhara

EID Score: 5/7.00

Calendar Information:

Total # of Items in Calendar:	52
Total Plants:	42
Wild:	19
Domesticated:	23
Total Animals:	4
Wild:	4
Domesticated:	0
Total Fungi:	6

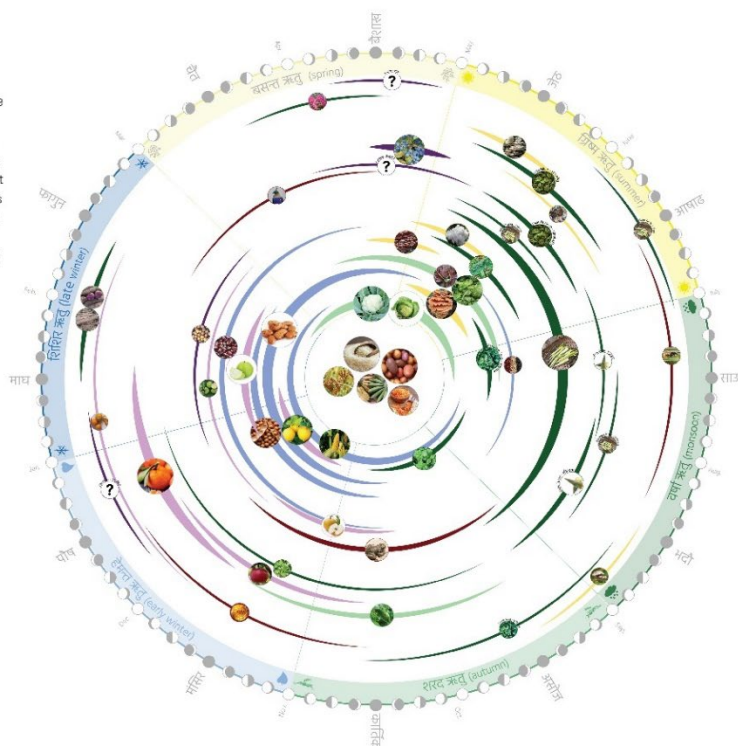


Figure 128. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P32

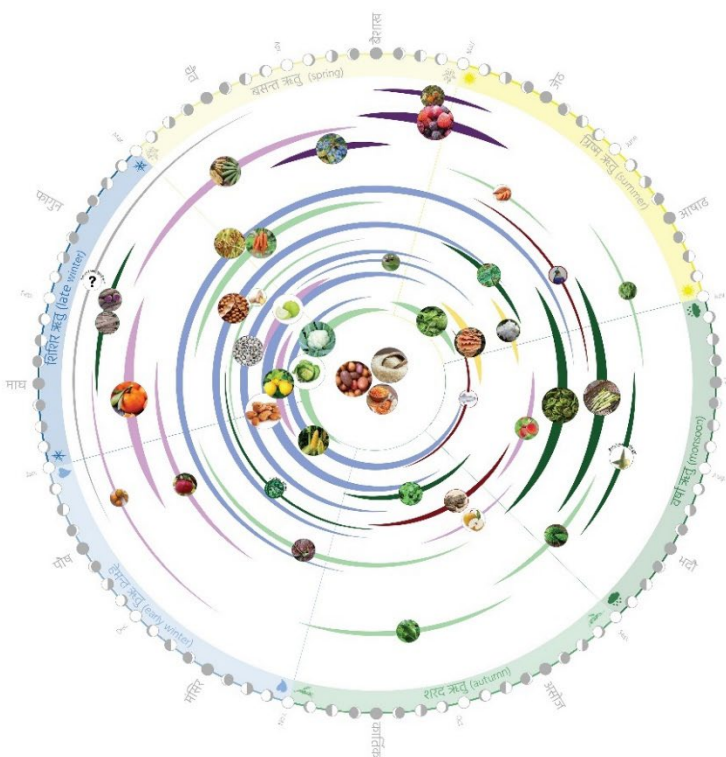


Figure 129. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P33

Participant P34

Ethnographic Observation:

This man was actually visiting from further down the hill, while I was at P32 and P33's home. He has a career as an office worker in the gaupalika, but also has a more traditional farm, and his wife grows more traditional crops.

EID Score: 4.93/7.00

Calendar Information:

Total # of Items in Calendar: 41
Total Plants: 35
Wild: 9
Domesticated: 26
Total Animals: 3
Wild: 2
Domesticated: 1
Total Fungi: 3

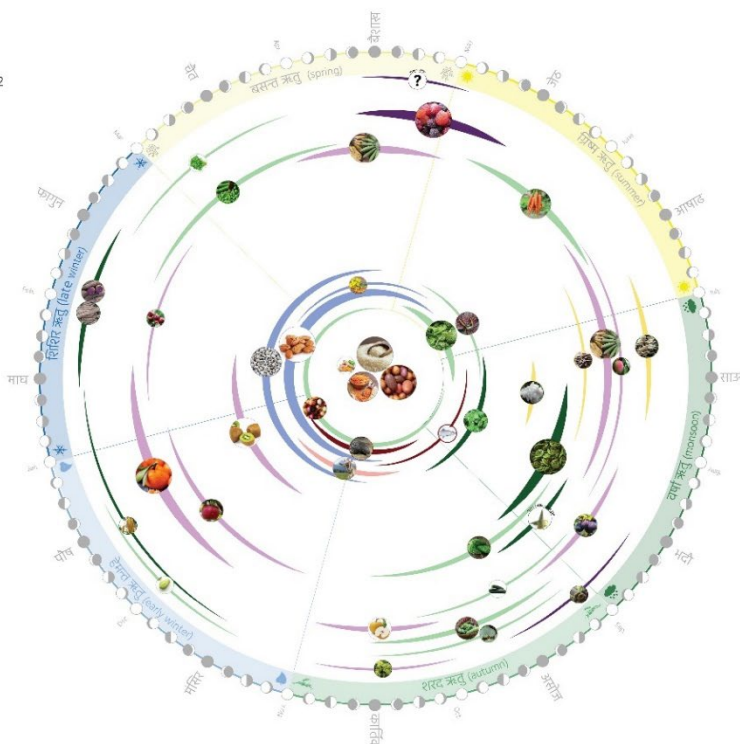


Figure 130. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P34

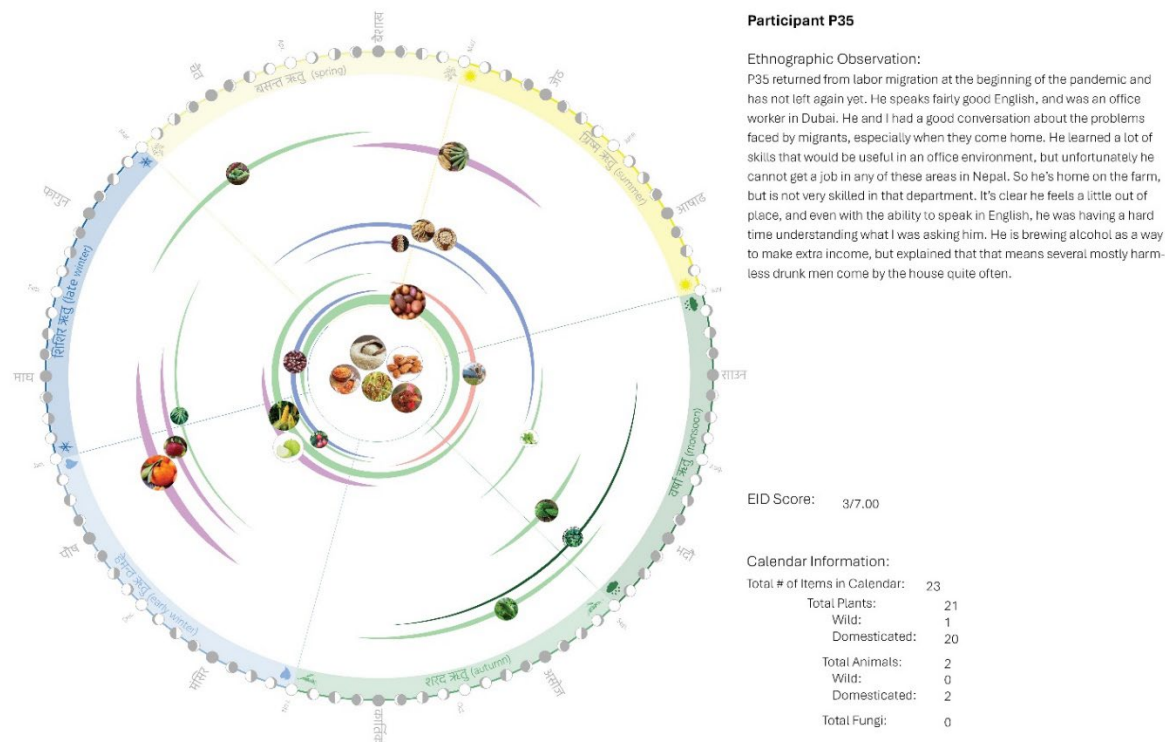


Figure 131. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P35

Participant P36

Ethnographic Observation:
P36 didi grew up on an organic farm outside of Kathmandu, and they decided to move into the hills and open a business because the road had just been built, and people of their caste seem to have an easier time coexisting with the Magars in my village, as the caste system is somewhat relaxed amongst the janajati. P36 enjoys the camaraderie of the village and is very kind and outgoing. While I was here she and her friends were trying to make a picnic trip to the top of the hill (a place called Ruise Point) but the weather didn't hold up enough for them to make it. They invited me but I was too busy to take a day off to wander. Despite being busy running the store, she and her husband try to make time to grow healthy or local foods, or to buy them from other villagers. They have also made a point of buying land, something that members of their caste were not allowed to do until recently. And they are very enthusiastic about tending it, they think it's very important to have land. They are some of the only people in gau who own ducks, something they are proud of

EID Score: 6.00/7.00

Calendar Information:
Total # of Items in Calendar: 50
Total Plants: 39
Wild: 11
Domesticated: 28
Total Animals: 7
Wild: 4
Domesticated: 3
Total Fungi: 3

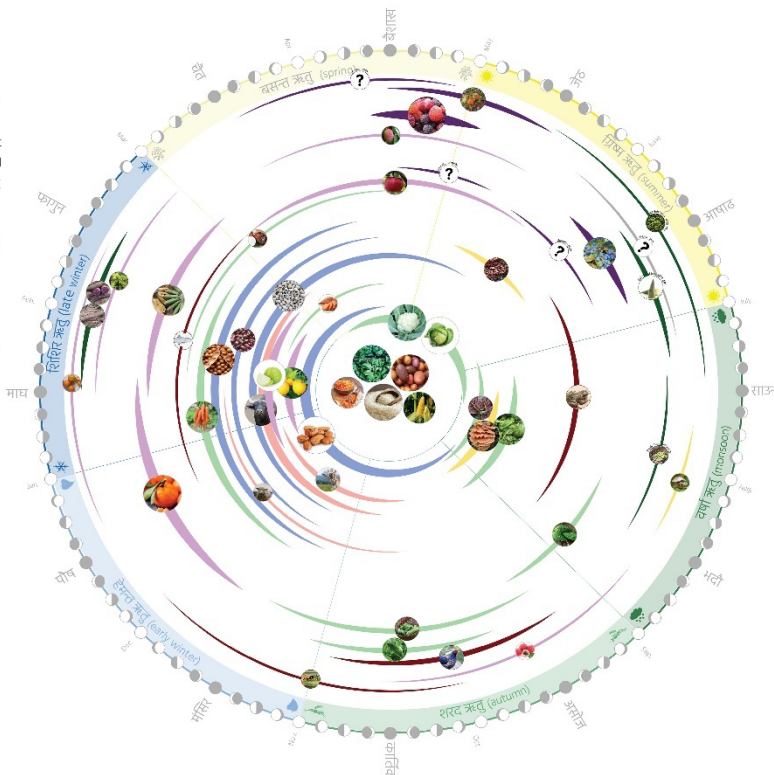
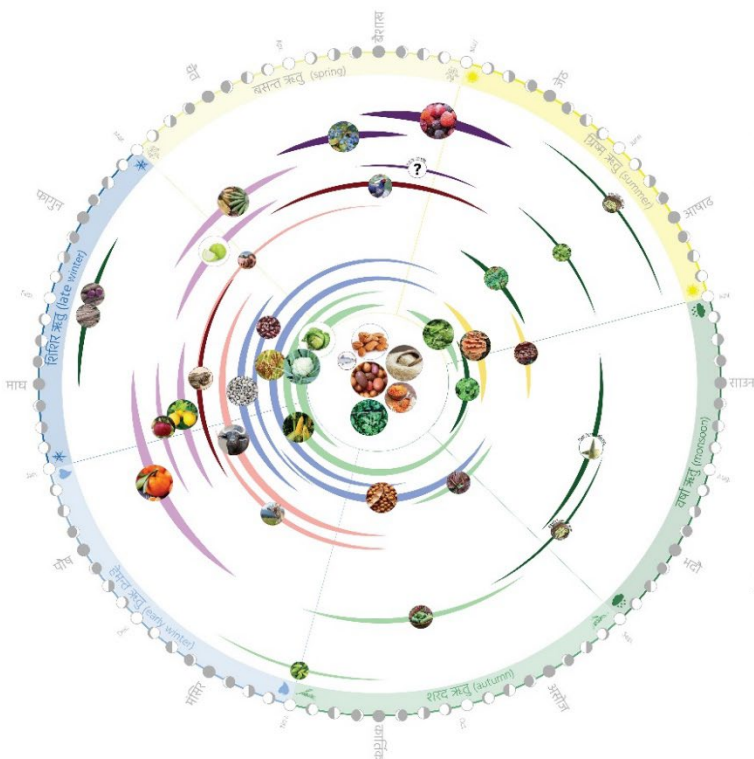


Figure 132. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P36



Participant P37

Ethnographic Observation:

P37 is an entrepreneurial farmer who has tried a lot of things, the most recent being a fish farm. He converted one of his rice khets into a large pit for a fish pond, and it worked out during monsoon, but had trouble during the dry season. His fish were never able to get to a large enough size, and kept getting poached by wild animals such as birds of prey, so he eventually gave up trying to sell them and just keeps them for his family. He also has a butcher, due to owning a fridge and a freezer and having a house next to the store. His wife does most of the agriculture work which frees him up to try income generating activities, some of which work, and some don't. He is a former labor migrant, and enjoys being back home in the village, due to it being quiet and peaceful in nature. He has no real desire to go work abroad again but also says he might have to if they decide to have another child.

EID Score: 4.64/7.00

Calendar Information:

Total # of Items in Calendar:	39
Total Plants:	31
Wild:	9
Domesticated:	22
Total Animals:	6
Wild:	3
Domesticated:	3
Total Fungi:	2

Figure 133. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P37

Participant P38

Ethnographic Observation:

P38 is an elderly leader in the village. She is illiterate but has one of the younger women take notes for her while she leads mothers' group meetings. The mothers group in her village is in charge of a lot of the cultural activities, and fundraises for things the community cares about, such as an addition to the primary school. Her son works abroad, and they've used the money to pay for her three granddaughters' educations as well as make some renovations on the family home. They are very proud of their large local breed chickens, and she showed them off to me when I came to visit. She also treated me to some homemade gundruk made from wild greens, stating that she would go herself to pick them but she is far too old so her daughter in law and granddaughter went out to pick them in the jungle a little further up the hill during the springtime.

EID Score: 5.36/7.00

Calendar Information:

Total # of Items in Calendar:	64
Total Plants:	54
Wild:	19
Domesticated:	35
Total Animals:	6
Wild:	4
Domesticated:	2
Total Fungi:	4

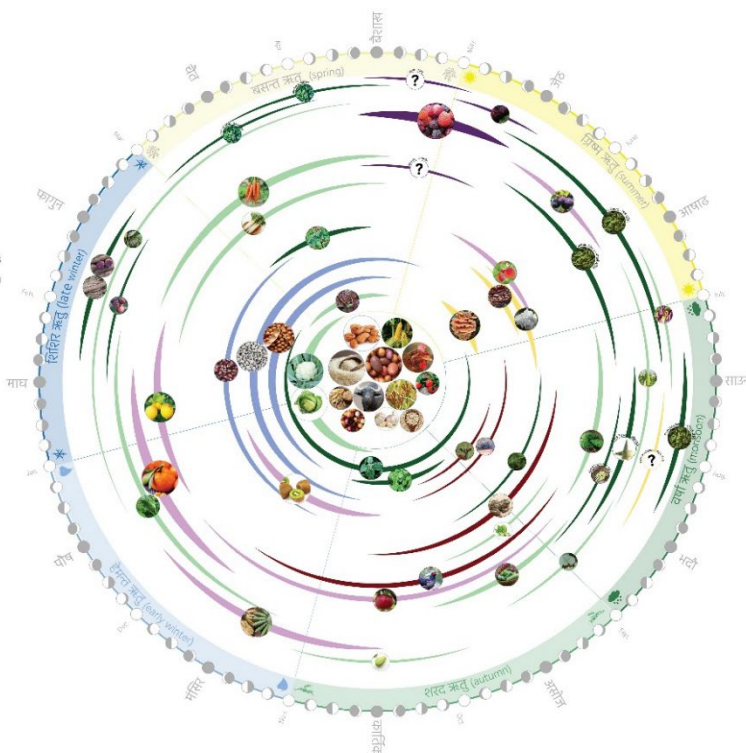
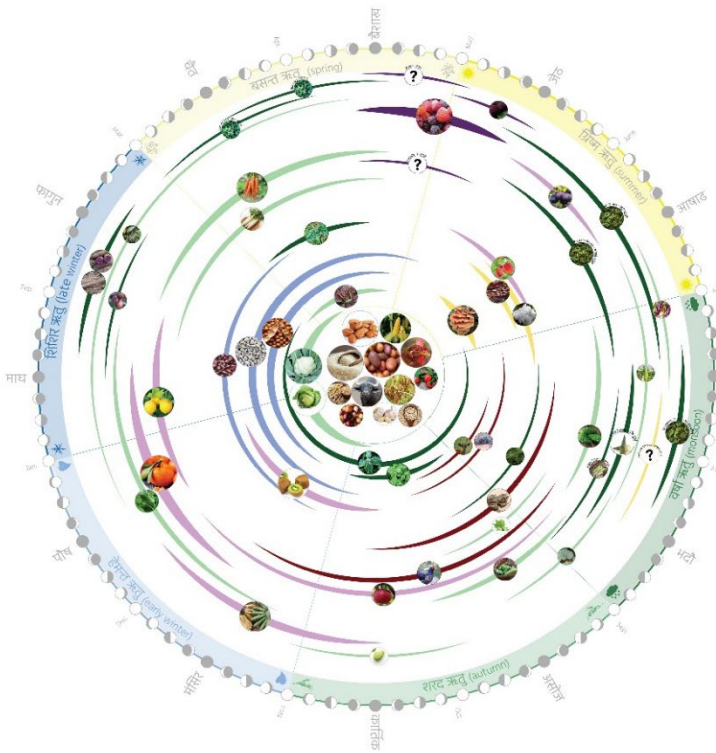


Figure 134. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P38



Participant P39

Ethnographic Observation:

P39 lives with P38, and has three daughters, all of whom do very well in school. Her husband works abroad, and her mother in law is a community leader, so she manages nearly all of the farm and housework. She has told me they aren't able to grow as much as they used to due to a lack of labor, so she buys a lot of goods from the store, such as rice, oil, and flour. She doesn't want to give up her chickens though. They're a local breed and she's very proud of how large they've gotten. In her free time she has a little corner bench near an herb garden where she loves to knit and look at her garden as well as watch her children, and occasionally hang out with her mother in law.

EID Score: 5.57/7.00

Calendar Information:

Total # of Items in Calendar: 64

Total Plants:	54
Wild:	19
Domesticated:	35
Total Animals:	6
Wild:	4
Domesticated:	2
Total Fungi:	4

Figure 135. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P39

Participant P40

Ethnographic Observation:

P40 comes from a military family which means that much of her family has been able to emigrate to the UK. She's very proud of this, and showed me pictures of her mother and father, and a picture of Queen Elizabeth that was given to her father for his service. It hangs on her wall between other family pictures. She splits time between here, and Pokhara, where she has a house and a small family store. These days she mostly just grows the large seasonal crops such as corn and rice, so that she only has to come back a few times a year. Were it not for the poor weather she would have already been done picking and putting up her corn crop before I came to visit her.

EID Score: 3.64/7.00

Calendar Information:

Total # of Items in Calendar: 26

Total Plants:	20
Wild:	5
Domesticated:	15
Total Animals:	4
Wild:	2
Domesticated:	2
Total Fungi:	2

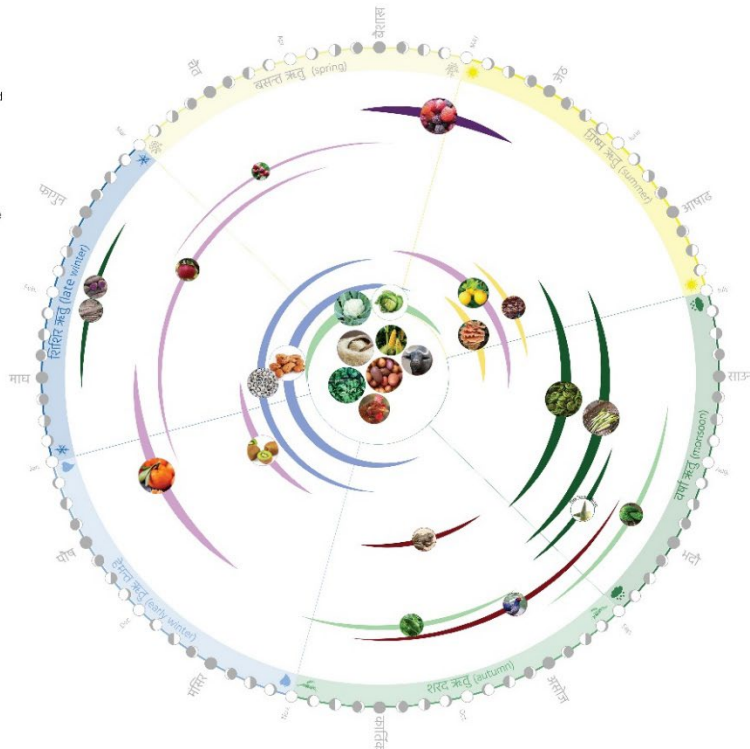
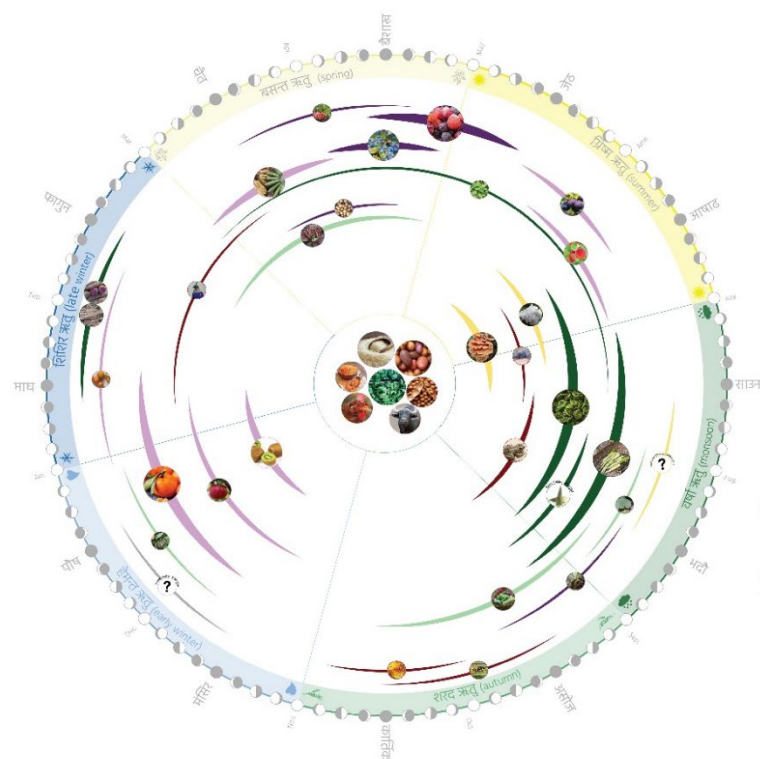


Figure 136. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P40



Participant P41

Ethnographic Observation:

P41 is a very shy young man. He only agreed to let me interview him after I asked him once already and he'd said no. I guess he reconsidered for some reason. He never went abroad to work due to his lack of education, and he prefers to spend time with his family's goat herds on the top of the hill, and normally just comes down the hill when winter approaches and it's time to drive the goat herds down to warmer more sheltered pastures. The family sends him up food every week such as potatoes and rice, but the rest he has to look for on his own, so he has gotten quite good at recognizing wild plants to eat.

EID Score: 5.36/7.00

Calendar Information:

Total # of Items in Calendar:	38
Total Plants:	26
Wild:	12
Domesticated:	14
Total Animals:	7
Wild:	5
Domesticated:	2
Total Fungi:	4

Figure 137. Individual Seasonal Round, included with SR quantitative counts, field observation notes, and Environmental Identity score: Participant P41

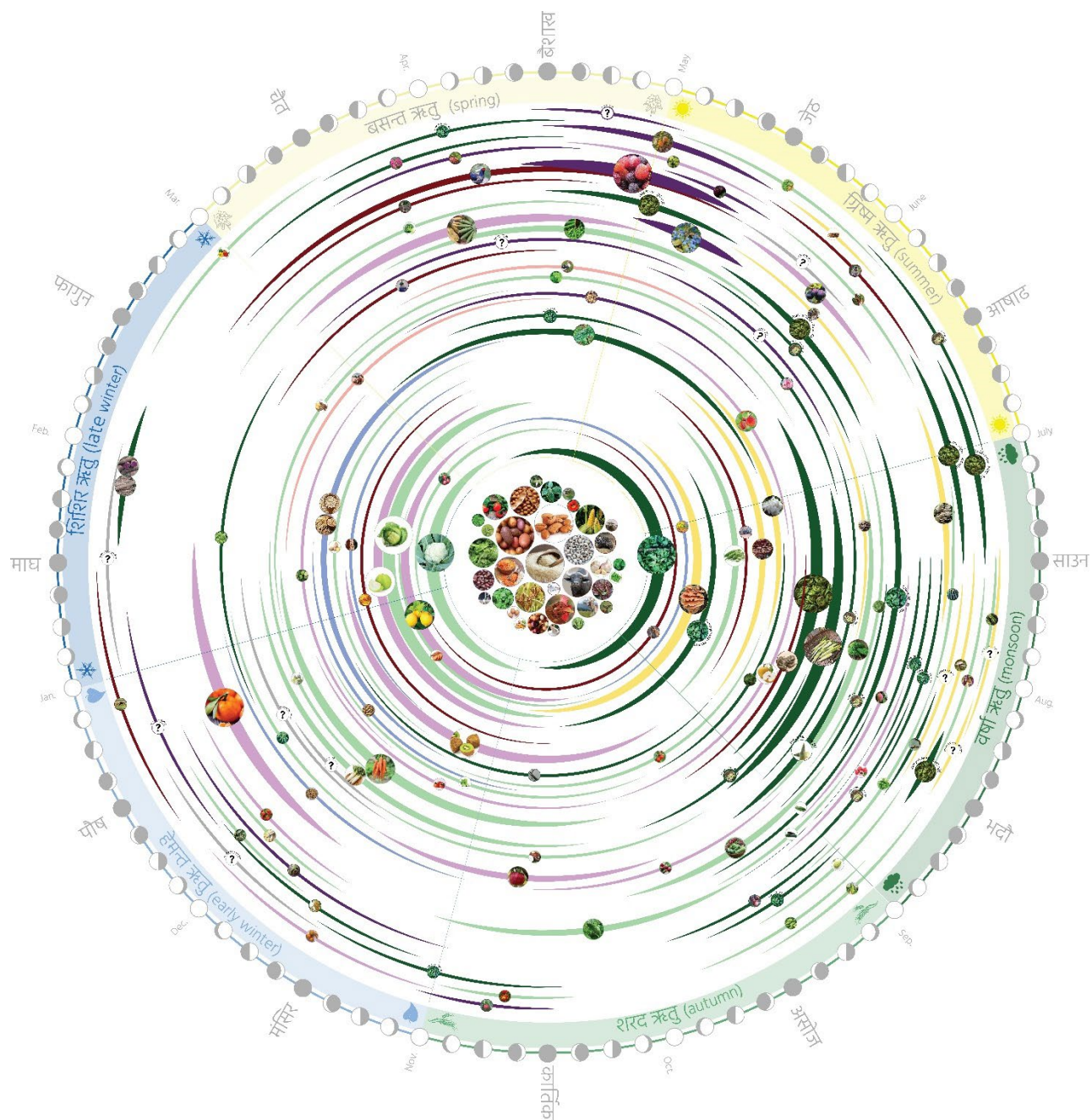


Figure 138. Cumulative Community Seasonal Round comprised of the information from every individual seasonal round

Index of Species

Wild Animals

 रतौ बहिर Aaringal Yellow Wasp var. species Rarely seen in this village due to prevalence of dogs. Consumed only as medicine.	 रतौ बाइर Raato Baader Rhesus Macaque macaca mulatta Rarely seen in this village due to prevalence of dogs. Consumed only as medicine.	 सेतो बाइर Seto Baader Nepal Gray Langur Saimopithecus schistaceus Rarely seen below high altitudes and heavily forested areas. Consumed only as medicine.
 बरा को बरौली Ban ko Brialo Jungle Cat felis chaus Commonly found in all habitats. Closely resembles the common village house cat. Rarely consumed, and only by chance.	 बरा कुखुरी (काली) Ban kukhura Kali Iophura leucomelanos Commonly found in forests, rice kharis, and field edges. Trapped or shot with slingshots. Eaten as common food.	 बाँने Darnphe Himalayan Monal Lophophorus impeianus National bird of Nepal, and a protected species. Conservation status is listed as "Of Least Concern." Commonly found at higher altitudes along field edges. Trapped or shot with slingshots and eaten occasionally.
 गीना Gongata River Crab Himalayapotamon atkinsonianum Found in seasonal and annual flowing streams and rivers, especially during the monsoon season. Harvested and eaten as common food.	 माछा Machha Fish var. species Found in lower elevation streams and rivers year round. Especially plentiful during monsoon season. Harvested and eaten as common food.	 मह Mana Wild Honey Commonly found on cliffsides. Harvested at specific times of the year using ropes and ladders. Is either consumed at the household level or sold locally.
 मह Paha Wild Frog var. species Found in seasonal and annual flowing streams and rivers, especially during the monsoon season. Harvested, smoked for several days, and eaten as common food.	 रतुवा (मृगा) Ratua (Mrga) Himalayan Musk Deer Moschus leucogaster Rarely seen in the area, and only in the higher altitude forests, due to its shyness. Is a threatened species due to the demand for its musk in perfumes and fragrances. Rarely consumed, and only by chance.	 मृगा Mrga Northern Red Muntjac Muntiacus vaghnaIs More commonly seen than the musk deer. Muntjacs are still quite shy but farms are occasionally found and cared for in this village. Eaten opportunistically, not hunted to the knowledge of the researcher.
 साँर Saara Indian Crested Porcupine Hystrix indica Commonly found in and around the village. Will often wander into village latrines to lick the salt off the walls. Killed during instances of accidental human contact. Meat is consumed and needles are used for sewing and decoration.		

 अण्डा Andaa Eggs Commonly consumed. Local chickens only lay at certain times of the year. Eggs are often brought up to the village from the regional capital for sale.	 भैसी Bhaisi Water Buffalo bubulis bubalis The most commonly raised species of livestock. Allowed to wander in and around the village during the cold months, and kept tied in covered sheds during the rainy and growing seasons. Multiple uses for meat, milk, colostrum, urine, and dung. Often used for sacrificial purposes.	 भैसी को दुध Bhaisi ko Dudh Water Buffalo Milk The milk of the Water Buffalo. Is often preferred for consumption due to its high fat content. Can be churned into ghu (ghee) and used for ceremonial and ritual purposes.
--	--	--

Domesticated Animals

Domesticated Animals

 भेडा Bheda Sheep Ovis aries Not as commonly raised as goats, but still present in some numbers in the village. Raised only for meat. Pastured at high elevations during the warm and rainy months and driven down to lower elevations for the cold months.	 सँगुर Sungsur Pig Sus scrofa domestica Not present in the village due to the temperatures at this elevation. Often purchased in the district capital and consumed in the village. Seen as an impure food in Hinduism, but tolerated for consumption in this community.	 हँस Haas Muscovy Duck Cairina moschata Not commonly raised in the village. Raised purely for meat, and not eggs.
---	---	---

Index of Species

 खरायो Kharaayo Rabbit Oryctolagus cuniculus Not commonly raised in the village. Raised purely for meat.	 खसी/बखरा Khasi/Bhakra Goat Capra aegagrus hircus Commonly raised in the village for both consumption and sale. Allowed to roam freely at high altitude pastures during the warm and rainy months, and driven down to lower contained paddocks in the colder months.	 कुखुरा Kukhura Chicken Gallus gallus domesticus Very commonly raised in the village for both meat and eggs. Contained in small chicken houses most of the time to protect from predators such as eagles, jungle cats, and jackals. Often used for sacrificial purposes.
---	---	---

Wild Fruits

 पुसुवा Apsyalu Golden Himalayan Raspberry Rubus ellipticus Very common. Found growing along field edges and in pastures. Picked as part of Nepali New Year festivities and outdoor picnics.	 बातुकिना Batiphani unknown unknown Not much known except that this fruit can be found at high elevations	 चुसुवा Chitro Barberry Berberis aristata Found growing at high elevations in wooded areas. Has a very short season and is gathered mostly for personal consumption
 देमुरा Dembera Himalayan Flowering Dogwood Cornus capitata Somewhat common. Found growing at lower elevations in wooded areas.	 घुमालो Ghughnaalo unknown unknown Not much known.	 गुलालो Gulaalo unknown unknown Not much known except that this fruit can be found at high elevations
 कालो कपना Kaalo Kaphna Black Bayberry Myrica esculenta Very common and economically important. Found growing in wooded areas at various elevations. Gathered both for personal consumption and local sale.	 सेतो कपना Seto Kaphna Red Bayberry Myrica esculenta Very common and economically important. Found growing in wooded areas at various elevations. Gathered both for personal consumption and local sale.	 फर्फिलो Trmilo Roxburgh Fig Ficus auriculata Found commonly in both wild and agroforestry settings. Primarily used as a fodder source for animals in winter, but the fruits are also consumed.
 लपसी Lapsi Nepalese Hogplum Choerospondias axillaris Very common and economically important. Found growing both wild and cultivated. Gathered both for personal consumption and local sale, and a common flavor in many Nepali candies.	 सालो कपना Kaphna Common Bayberry Myrica esculenta Very common and economically important. Found growing in wooded areas at various elevations. Gathered both for personal consumption and local sale.	 आमसिलो Aamsilo unknown unknown Not much known.

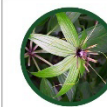
Index of Species

Domesticated Fruits

 अगुवा Aubergine Common Plum <i>prunus domestica</i> Often grown as a fodder tree, with the fruit eaten somewhat unripe before the insects get to it. Wild varieties are also available, but not eaten.	 अम्रा Aamra Red Guava <i>psidium</i> Cultivated at lower elevations and sold at higher elevations.	 आम्र Aam Mango <i>Mangifera</i> Cultivated at lower elevations and sold at higher elevations.
 आम्र Aam Common Peach <i>prunus persica</i> Often grown as a fodder tree, and the rootstock is sometimes used to graft less hardy varieties of stone fruits. Wild varieties are also available but not eaten.	 अम्र Angur Grapes <i>vitis vinifera</i> Cultivated less often than other vining fruits such as Kiwi.	 आम्र Aalu Common Potato <i>solanum tuberosum</i> Massively cultivated on a commercial scale. The fruit is sold for income, and the juice is pressed and kept for home use in teas and other beverages.
 अम्र Belauti Green Guava <i>psidium</i> Cultivated at lower elevations and sold at higher elevations.	 अम्र Haluwabel Persimmon <i>Diospyros kaki</i> Less cultivated than other fruit tree varieties, but very important for bringing as gifts to festival gatherings such as Dashain or Tihar.	
 अम्र Keraa Banana <i>Musa acuminata</i> Very commonly cultivated, with each house typically owning one banana tree.	 अम्र Kiwi Kiwi <i>Actinidia deliciosa</i> Has gained in popularity in the last 5-7 years. Cultivated on a commercial scale, the fruit is sold in the district capital for income, and any surplus is kept for consumption. Occasionally pressed into juice and fermented into alcohol.	 अम्र Lichi Lychee <i>Litchi chinensis</i> Less cultivated than other fruit tree varieties, but highly desired.
 अम्र Mausami Nepali Sweet Lime <i>Citrus limetta</i> Less cultivated than other fruit tree varieties, but desired as a local flavor in cooking and khajala (afternoon tea)	 अम्र Naspatti Asiatic Pear <i>Pyrus pyrifolia</i> Less cultivated than other fruit tree varieties. Wild varieties are also available but not often eaten.	 अम्र Straber Strawberry <i>Fragaria x ananassa</i> Has gained in popularity in the last 5-7 years. Produces berries twice a year in the Nepali climate, and families will typically keep a few runners in their kitchen garden.
 अम्र Suntalaa Mandarin Orange <i>Citrus reticulata</i> Massively cultivated on a commercial scale. The fruit is sold for income, and many families rely strongly on that income. Any surplus is kept for household consumption.	 अम्र Syauu Apple <i>Malus domestica</i> Recently introduced into the villages. Can be cultivated at the higher elevations. All fruit is kept for household consumption.	

Wild Plants

Index of Species

 बाँको सिङ्की Ban ko Sinki Mountain Ebony <i>Phanera variegata</i> Commonly found in high-altitude wooded areas. The flowers of this tree are picked, dried, and then fermented for storage, and eaten as a vegetable in soups and stews.	 धकाँ Dhakayo Griffith's Cobra Lily <i>Arisaema griffithii</i> Commonly found in high-altitude wooded areas. The leaves of this plant are inedible raw. They must be picked, beaten, fermented, then dried in the sun before they become edible.	 काँकली Kaarkalo (Phaulu) Taro <i>Colocasia esculenta</i> Commonly found in wetland areas, and also cultivated on occasion. Both the tubers and leaves are edible. The leaves must be beaten and cooked before becoming edible.
 लालिगुराँ Laliguranas <i>Rhododendron</i> Ericaceae rhododendron Commonly found in high-altitude wooded areas. This is the national flower of Nepal, and can be picked and made into a tea. Honey made from <i>Rhododendron</i> pollen is mildly poisonous, and can produce a hallucinogenic effect if consumed in small amounts.	 फाँटे Niyuro Fam Shoots (general) unknown Commonly found in wooded areas and around forest edges. Fiddlehead ferns can be picked from many different species of fern in Nepal. Each has their own characteristics and seasonality.	 डोँगे Niyuro (Dongare) Large Fern Shoots unknown Commonly found in wooded areas and around forest edges. Most often picked fresh and cooked into a vegetable curry to accompany rice and lentil soup.
 काँगे फाँटे Niyuro (Kaalo) Black Fern Shoots unknown Commonly found in wooded areas and around forest edges. Most often picked fresh and cooked into a vegetable curry to accompany rice and lentil soup.	 लूँगे फाँटे Niyuro (Lute) Climbing Fern Shoots unknown Commonly found in wooded areas and around forest edges. Most often picked fresh and cooked into a vegetable curry to accompany rice and lentil soup.	 माँगे फाँटे Niyuro (Maache) Small Fern Shoots unknown Commonly found in wooded areas and around forest edges. Most often picked fresh and cooked into a vegetable curry to accompany rice and lentils.
 पान्गे फाँटे Niyuro (Paatale) Thin Fern Shoots unknown Commonly found in wooded areas and around forest edges. Most often picked fresh and cooked into a vegetable curry to accompany rice and lentil soup.	 बाजी साँगा Saag (Baaji) Baaji Greens Unknown	 हाँलले बाँ साँगा Halale Saag Plantain Greens <i>rumex nepalensis</i> Available year round, commonly found alongside paths and roads. The leaves are picked and then stewed or picked for later consumption.
 जारे साँगा Jibre Saag Tongue Greens unknown	 खोले साँगा Khole Saag Watercress <i>Nasturtium officinale</i> Commonly found in wetlands. This is a staple green for many households. Leaves are picked, cleaned, and stewed to accompany rice and lentils.	 लेख बाँ साँगा Lekh Saag High-elevation Greens unknown
 मुस्तांगी साँगा Mustang Saag Greens from Mustang unknown	 पुंगे साँगा Parunge Saag Parunge Greens unknown	 पसाँगे साँगा Pasaayo Saag Pasaayo Greens unknown
 रातो साँगा Raato Saag Red Greens unknown	 राँगे साँगा Rite Saag Bitter Greens unknown	 पसुँगा Satuwaa Himalayan Paris <i>Paris polyphylla</i> Commonly found in deep wooded areas. The tubers of this plant are used as medicine and commonly gathered for sale in the district capital. Medicinal uses of this plant include alleviating snake bite, narcotic effects, and fever.

Index of Species

Wild Plants

 सलितमुर Silitmur Silitmur <i>Lindera neesiana</i> Commonly found in high-altitude wooded areas. This is a member of the spicebush family. The corns are picked, dried, and used in tea as medicine to alleviate headaches.	 संक्षिप्तली Singkauli Wild Cinnamon Tree <i>Cinnamomum zeylanicum</i> Commonly found in lightly wooded areas. The bark and leaves of this tree are collected annually and used as a reliable substitute for cultivated cinnamon.	 संक्षि Sisnu Himalayan Nettle <i>Urtica ardens</i> Commonly found on garden edges, roadsides, and in lightly wooded areas. The sting of this nettle will numb the affected area for up to an hour. Picked with long's, beaten, and cooked into a nutritious stew.
 सोत यम Sato Yam White Greater Yam <i>Dioscorea alata</i> Commonly found in forested areas. This yam is dug up and consumed during Waghe Sagar, a major winter festival. Yam are boiled, then peeled of their hard skins and consumed without seasoning.	 संक्षि Timur Szachuan Pepper <i>Zanthoxylum piperitum</i> Commonly found on hillsides and in lightly wooded areas. It is possible to cultivate Timur, but famously hard to do so. Residents in this village rely on wild growth for their supply of peppercorns, which are dried and then ground into a widely used spice.	 संक्षि Titipatti Mugwort <i>Artemisia vulgaris</i> Commonly found by roadsides and in fields. When picked the leaves produce a very pleasant aroma. Branches can be hung in doorways to repel insects, and the leaves can be boiled into a nutritious herbal tea.
 तुसा Tusaa Bamboo Shoots (generic) unknown Commonly found in wooded areas at various elevations. Bamboo shoots are an important staple food during the monsoon season, and there are multiple species and varieties available depending on the time of year and location.	 असु तुसा Tusaa (Arsu) Swed Bamboo Shoots unknown Commonly found in wooded areas. The shoots are cut at the base, peeled into matchsticks, and then sautéed with spices, turmeric and ginger to accompany rice and lentils.	 बोत तुसा Tusaa (Bars) Large Bamboo Shoots unknown Commonly found in wooded areas. The shoots are cut at the base, peeled into matchsticks, and then sautéed with spices, turmeric and ginger to accompany rice and lentils.
 ठोत तुसा Tusaa (Dongare) Thick Bamboo Shoots unknown Commonly found in wooded areas. The shoots are cut at the base, peeled into matchsticks, and then sautéed with spices, turmeric and ginger to accompany rice and lentils.	 गुरे तुसा Tusaa (Gure) Gure Bamboo Shoots unknown Commonly found in wooded areas. The shoots are cut at the base, peeled into matchsticks, and then sautéed with spices, turmeric and ginger to accompany rice and lentils.	 जबोत तुसा Tusaa (Jabito) Jabito Bamboo Shoots unknown Commonly found in wooded areas. The shoots are cut at the base, peeled into matchsticks, and then sautéed with spices, turmeric and ginger to accompany rice and lentils.
 सली तुसा Tusaa (Malingo) Thin Bamboo Shoots unknown Commonly found in wooded areas. The shoots are cut at the base, peeled into matchsticks, and then sautéed with spices, turmeric and ginger to accompany rice and lentils.	 नली तुसा Tusaa (Nigalaa) Little Bamboo Shoots unknown Commonly found in wooded areas. The shoots are cut at the base, peeled into matchsticks, and then sautéed with spices, turmeric and ginger to accompany rice and lentils.	

Domesticated Plants

 अतु Aatu Common Potato <i>solanum tuberosum</i> Widely cultivated in the cold season.	 अदु Aduwa Ginger Root <i>zingiber officinale</i>	 दंगुन बली Baigun Biml Purple Eggplant <i>solanum melongena</i> The most commonly cultivated eggplant.
--	--	--

Domesticated Plants		Index of Species	
	बंदग Bandaa Cabbage Brassica oleracea		बगुला Bantaa Black Eggplant solanum melongena A specially eggplant that is not often cultivated here.
	बेसार Bessaar Turmeric curcuma longa Gathered and processed both for consumption and sale.		भा को बी Bhangko Bhu Hemp Seeds Cannabis sativa The seeds of the hemp plant are ground into a powder and used in achairs and burnes.
	ब्रकली Brakauli Broccoli Brassica oleracea var. italica		बुद स्याउ Bu Syaau Ground Apple Smalanthus sonchifolius Grown both for it's fruit and it's flowers.
	चाँ Chia Tea Bush Camella sinensis		चाँकि Chichinda Snake Gourd Trichosanthes cucumerina
	गाजर Gaajar Carrot Daucus carota The cultural norm is to consume carrots raw. Community residents have begun to cook them as well.		घुँला, घुँलाई Ghiraaula, Ghimlaai Sponges Gourd Luffa Consumed as a vegetable, and a spare few are dried out and used as sponges the remainder of the year.
	गोलगोला Goluheda Tomato Solanum lycopersicum		घुँला Ikus Chayote Sechium edule
	कांगकुंग Kangkung Thai Water Spinach Ipomoea aquatica Grown to supplement a lack of domesticated greens during the monsoon season.		काउली Kauli Cauliflower Brassica oleracea
			बेत Baretlaa Balsam Apple Momordica balsamina Picked and eaten before they ripen, to avoid the toxins which develop later on.
			बिनी Binti Okra Abelmoschus esculentus
			चाँलाई Charlaai Slipper Gourd Cylanthera pedata Picked and typically dried for later use.
			दाँया Daanya Cilantro Coriandrum sativum
			घुँलाई Ghikumari Aloe Vera aloe vera Consumed as medicine for the digestive tract and applied to the skin to soothe burns.
			काको Kaako Cucumber Cucumis sativus
			केरा Kerau Green Peas Pisum sativum

Index of Species

Domesticated Plants

 खोसनी Khorsani Hot Pepper Capsicum annuum Khorsani is available in many varieties. The local variety (Dale Khorsani) can be compared to a ghost pepper in capsaicin strength.	 खुरली Kurli Ash Gourd Benincasa hispida	 खुरली Kurli Asparagus Asparagus officinalis
 खसखसुन Khasicun Bell Pepper Capsicum annuum	 खसु Lasun Garlic Allium sativum Cultivated both for sale and personal consumption	 खीसा Lauka Zucchini Squash Cucurbita pepo L. Typically picked and consumed when very small, to avoid pumpkin fly infestation.
 खसुली फूल Laxmi Phul Nasturtium Tropaeolum Grown for aesthetics, as well as for ritual and ceremonial purposes. The flowers can be consumed and have a peppery flavor.	 मकई Makai Corn Zea mays A staple grain which is grown both for sale and personal consumption.	 मुला Mula Daikon Radish Raphanus sativus Can be eaten fresh, cut and dried, made into ghundruk, or cooked as a vegetable curry to accompany rice and lentils.
 खड़ू Ooku Sugarcane Saccharum officinarum	 पासुली Paalungu Spinach Spinacia oleracea	 फारली Phasi Pumpkin Cucurbita
 पुदीना Pudinaa Mint Mentha Typically used for medicinal purposes.	 प्याज Pyaj Onion Allium cepa	 खुन मोलयेवा Rukh Golbheda Tamarillo Solanum betaceum
 खसुली खस Saag (Lasuni) Garlic Chives Allium tuberosum Is both cultivated and grow wild.	 पासुली Paugsai Saag Bok Choy Brassica rapa subsp. chinensis	 फार खो खस Phataparko Saag Buckwheat sprouts Fagopyrum esculentum Consumed early in the growing season, making use of leftover seed stored for planting Buckwheat.
 फारली खो खस Pharsiko Saag Pumpkin Leaves Cucurbita The young leaves of the pumpkin plant are picked, de-stringed, and cooked into vegetable curries to accompany rice and lentils.	 खो खो खस Paayoko Saag Curly Mustard Greens Brassica juncea	 खोली खो खस Toriko Saag Red Mustard Greens Brassica nigra

Domesticated Plants

Index of Species

 सक्रकण्डा Sakrakanda Orange Fresh Sweet Potato Ipomoea batatas	 सयपत्री Sayapatri Marigold Tagetes Used for ritual and ceremonial purposes, strung into welcoming and farewell garlands, and soaked in hot water to make a medicinal tea.	 सल्लिम Shilim Shiso Perilla frutescens var. crispa The seeds are ground and used both for cooking and for making achaars.
 तीने करला Tite Karala Bitter Melon Momordica charantia One of the reliable monsoon vegetables. High in vitamins and favored by the Nepalese for its astringent taste.	 रानी तरुल Raato Tarul Red Greater Yam Dioscorea alata	 सोती Tori Mustard Brassica juncea

Grains & Pulses

 बदाम Badaam Peanut Arachis hypogaea Not widely cultivated, but sold by several farmers	 सबनाम Barmaas Soybean Glycine max Widely cultivated as a source of protein.	 बोली Bodi Blackeye Pea Vigna unguiculata
 धान Dhaan Rice Oryza sativa Widely cultivated as a major staple grain.	 डाल Dhal Red Lentils Lens culinaris Participants may also be referring to Black Lentils when they mention "Dhal" as a food.	 गाभात Gaabaat Horse gram Lentils Macrotyloma uniflorum Lam Regarded as healthier than other varieties of lentils such as Red or Black lentils.
 गी Gai Common Wheat Triticum aestivum Cultivated on the higher-altitude farms as a staple grain, and sold to those down below.	 जी Jai Barley Hordeum vulgare Cultivated alongside and sometimes in maslins with wheat.	 कोदो Kodo Finger Millet Eleusine coracana Widely cultivated both for it's grain and as a source of fermentation for locally produced alcohol.
 फापर Phaapar Buckwheat Fagopyrum esculentum This Himalayan variety of pink-flowered buckwheat was traditionally much more widely cultivated. Rice has eclipsed most of the role of buck-wheat in feeding the people, and the few who cultivate it now do so for reasons of taste and health.	 सल्लिङ्ग, सबना Silung Ricebean Vigna umbellata Not commonly found or cultivated outside of the Himalayas.	 सोती, सैरागुली Simi, Gerdaigudi Beans (various) Phaseolus vulgaris Many different varieties of beans are sowed during the monsoon season. These are mostly mixed together during consumption, with some very colorful hybrids resulting from this process.

Index of Species

Fungi

 बुडे च्याउ Bude Chyauu Nepal More Typically foraged for in springtime, in higher altitude forests where goats have been grazing.	 चामरे च्याउ Chamare Chyauu Chamare Mushroom	 चिप्ले च्याउ Chiple Chyauu Slippery Mushroom
 धोरे च्याउ Dongare Chyauu Large Mushroom	 कचुम च्याउ Kachuma Chyauu Field Mushroom Typically found growing in cultivated fields where Water Buffalo dung-based compost has been spread.	 पादोचे च्याउ Paadoche Chyauu Paadoche Mushroom
 रौमो च्याउ Raato Chyauu Red Mushroom Analogous to Chicken of the Woods in North America.	 सेलो च्याउ Selo Chyauu White Mushroom	 थंकारे च्याउ Thankare Chyauu Thankare Mushroom
 वास्सगुम्बा Vassagumba Caterpillar Fungus <i>Optiocoryceps sinensis</i> Coryceps mushroom. This is sought out and used as medicine, or sold for a very high price.		

True Unknowns

 होपाल Hopal Could have been a mispronunciation of "apple"	 गुलाबी पानी Gulaabi Paani Sweetwater?	
 पचथगे Pachthagate Could have been a mispronunciation of the date "the fifth of the month" (panch gite).		 काालो बुस्के Kaalio Buske



Figure 139. Photo: a child examines the seasonal rounds template



Figure 140. Photo: a child examines the seasonal rounds template



Figure 141. An example of a wild Himalayan Fig, or bedu, edible



Figure 142. An example of a wild Himalayan Fern, niuro, edible



Figure 143. The route to an interview site



Figure 144. An example of a typical meal in rural Nepal