

Muohttaga jávohis giella

Sámi árbevirolaš máhttu muohttaga birra
dálkkádatrivedanáiggis

The Silent Language of Snow

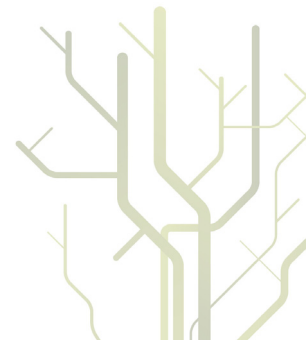
Sámi traditional knowledge of snow in times of climate
change



Inger Marie Gaup Eira

Čálus grádii/A dissertation for the degree of
Philosophiae Doctor

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ČÁLLOSA SISDOALLU/THE CONTENT OF THE THESIS

| | |
|---|-----|
| Čállosa struktuvra/The structure of the thesis | 5 |
| Giitosat/Acknowledgement | 6 |
| Oppalaš geahčestat artihkaliin/Overview of the articles | 9 |
| Láidehus, dr grádačállosa, vuosttaš oassi | 11 |
| The introduction, translated from Sámi language, Part 1 | 85 |
| Referánsat/Referances | 163 |
| Artihkalat/The articles, nubbi oassi/Part 2 | 171 |

Mildosat/The Appendix

ČÁLLOSA STRUKTUVRA

Dán čállošis leat guokte oasi, vuosttaš oassi lea láidehus ja nubbi oassi lea artihkkalčoakkáldat. Láidehusoassi lea čállon sámegillii ovddidan dihte sámegiela diedalašgiela. Dát lea de jorgaluvvon eŋgelasgillii viiddidit lohkkiid beali danne go boazodoalloealáhus lea riikkaidgaskasaš ealáhus sirkumpolára davvin. Das maŋŋil čuvvot artihkkalat, main originálagiela veršuvdna boahtá ovddabeallái jorgaluvvon veršuvnna. Vuosttaš ja nubbi artihkal lea čállon sámegillii ja de jorgaluvvon eŋgelasgillii ja golmmat ja njealját artihkal lea čállon eŋgelasgillii ja jorgaluvvon sámegillii. Dasto lea mielddus 1 sámegillii ja mielddus 2 ja 3 leat čállon sámegillii ja de jorgaluvvon eŋgelasgillii.

THE STRUCTURE OF THE THESIS

This thesis consists of two parts; An introduction and four articles. The introduction is written in Sámi language to contribute to the development of the Sámi language as a scientific language. The introduction has been translated into English, to broaden the readership, because reindeer herding is an international industry in the circumpolar North. Furthermore the articles are organized by the original language version followed by the translations. Articles 1 and 2 were written in Sámi and then translated into English, while Articles 3 and 4 were written in English, then translated into Sámi. Finally the Appendix 1 is in Sámi language, while Appendix 2, and 3 were written in Sámi and translated into English.

GIITOSAT

Leat hui ollu olbmot ja ášahusat geaid háliidan giitit danne go leat dorjon doavttergrádabarggu ollášuhttima ja válbmemma. Vuosttažettiin ja eanemus giitosat gullet mu bagadalliguoktái, prof. Ole Henrik Maggai ja prof. Svein D. Mathiesenii, geat leaba njeallje jagi movttiidahttán, hobehan, dorjon mu, čilgen munnje nu ahte buorebut ipmirdan movt čoavdit hástalusaid mat ain čuožželit.

Dát dutkan lea leamaš oassin Ealát-prošeavttas, maid Norgga dutkanráđdi (doarjjanummar 176078/S30), leat ruhtadan ja maid Sámi allaskuvla ja Riikkaid gaskasaš boazodoalloguovddáš leaba jodihan. Dáidda ášahusaide ollu giitosat. Maiddái Sámi allaskuvlla ovdeš rektor, Mai Britt Utsi ja direktora, Anders J.H. Eira oazžuba ánsu dainna go Sámi allaskuvla válddii EALÁT-prošeavtta iežas háldui.

Boazosápmelaččat viđa dálvesiiddas Oarje-Finnmárkkus leat leamaš mielde prošeavttas ja addán munnje earenoamáš dieđuid sin beaivválaš boazobarggus. Ollu giitu sidjiide. Dáidda lassín lean giitevaš go lean beassan ovttasbargat ja oahppat Ealát-prošeavtta bargiiguin. Earenoamážit háliidan giitit dr. Nancy G. Maynard (NASA), gii álgu rájes lea beroštan mu barggus ja ollu veahkehan mu. Dasto háliidan giitit Ealát prošeavtta nevvodeddjiid, nugo Dr. Robert W. Corell gii lea veahkehan mu ipmirdit árktalaš guovllu dálkkádatrievdamiid birra, Christian Jaedicke, gii lea muohtametamorfose oahpahan munnje, dr. Dagrunn Vikhamar-Schuler ja dr. Inger Hanssen-Bauer geat leaba čilgen ja oahpahan dálke- ja dálkkádatrievdama dieđalahkoneami. Giitu Dr. Peter Wasilewski ja Allen Lunsford:ii NASA Goodard Flight space Centre, geat fuomášuhtiiga mu termokrona teknologija,

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Inger Marie Gaup Eira
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OPPALAŠGEAHČESTAT ARTIHKKALIIN/OVERVIEW OF THE ARTICLES

Dát dr.grádačálus lea dáid artihkaliid vuodul čállon. Artihkkalat leat almmuhuvvon, manuskripta sáddejuvvon sisa ja ráhkkanahhton manuskripta.

The thesis is based on following publications, published articles, submitted manuscript and manuscript in preparation.

1. artihkal/Article 1:

Eira, Inger Marie, Magga, Ole Henrik & Eira, Nils Isak, 2010.

Muohtatearpmaid sisdoallu ja geavahus. Sámi diedalaš áigečála. 2/2010. s. 3-24.

Translated to English: Sámi Snow Terminology - Meaning and Usage

2. artihkal/Article 2:

Eira, Inger Marie & Mathiesen, Svein D.

Odda siida-vudot gozihanvuogádat observeret dálveguhtuneatnamiin dálkkádatvariabiltehta váikkuhusaid sámi boazodoalus.

Translated to English: A novel siida-based monitoring system to observe effects of climate variability on winter pastures in Sámi Reindeer herding. Manuscript in preparation.

3. artihkal/Article 3:

Eira, Inger Marie, Jaedicke, Cristian, Magga, Ole Henrik, Maynard, Nancy, Vikhamer-Schuler, Dagrún & Mathiesen, Svein D., 2011.

Traditional Sámi snow terminology and physical snow classification - Two ways of knowing. The English manuscript submitted to journal: Cold Regions Science and Technology, September 27, 2011

Jorgaluvvon sámegillii: Árbevirolaš sámi muohtaterminologijja ja muohttaga fysihkalaš iešvuodaidda čilgen - guokte diehtovuogi.

4. artihkal/Article 4:

Maynard, Nancy G., Oskal, Anders, Turi, Johan M., Mathiesen, Svein D., Eira, Inger Marie G., Yurchak, Boris, Etylin, Vladimir & Gebelein, Jennifer, 2010.

Impacts of Arctic Climate and Land Use Changes on Reindeer Pastoralism: Indigenous Knowledge and Remote Sensing. Chapter 8. Eurasian Arctic Land Cover and Land Use in a Changing Climate. Springer Science + Business Media B.V.

Jorgaluvvon sámegillii: Árkatalaš dálkkádaga ja eanangeavaheami rievdamiid váikkuhusat boazodollui: Eamiálbmot máhttu ja gáiddusmihtideapmi.

LÁIDEHUS,

DOAVTTERGRÁDA ČÁLLOSA VUOSTTAŠ OASSI

SISDOALLU

| | |
|--|-----------|
| GOVVOSAT JA TABEALLAT | 13 |
| OKTIIGEASSU | 15 |
| 1. ÁLGGAHUS | 17 |
| 1.1 DUTKAMA ULBMIL | 19 |
| 1.2 BOAZODOALLU JA DAN VUOĐDOEAVTTUT | 20 |
| 1.3 EAMIÁLB MOTMÁHTTU JA DIEĐALAŠ MÁHTTU | 22 |
| 1.3.1 Eamiálbmotmáhttu definišuvdna, hápmi ja iešvuohta | 22 |
| 1.3.2 Árbevirolaš máhttu ja dieđalaš máhttu | 24 |
| 1.4. OVDDEŠ JA BOAHTTE ÁIGGI DÁLKKÁDAGAT GUOVDAGEAINNU BOAZODOALLOGUOVLLUS. | 25 |
| 1.4.1 Ovdalaš áiggi dálkkádagat Guovdageainnu boazodoalloguovllus. | 25 |
| 1.4.2 Einnostuvvon boahtteáiggi dálkkádagat Guovdageidnui. | 28 |
| 2. TEOREHTALAŠ LAHKONANVUOGIT | 29 |
| 2.1 LINGVISTTALAŠ TEOREHTALAŠ LAHKONANVUOGIT | 29 |
| 2.1.1 Sáme giela terminologijja vuodđu | 30 |
| 2.1.2 Giela ja terminologijja doaibma | 31 |
| 2.1.3 Doahpagat | 35 |
| 2.1.4 Doabaanaliisa ja kategoriseren | 36 |
| 2.2 DIEĐALAŠ LAHKONEAPMI MUOHTTAGA JA BOAZODOALU EKTUI | 39 |
| 2.2.1 Muohta ja dan dovdomearkkat ja dan meakkašupmi dálveekologijji | 39 |
| 2.2.2 Muohttaga nuppástuvvan | 40 |
| 2.2.3 Muohttaga klassifiseren | 43 |
| 3. METODOLOGIJA | 44 |
| 3.1 DUTKANGUOVLU | 45 |
| 3.2 DÁTAID ČILGEHUS | 45 |
| 3.3 INFORMÁNTTAT | 47 |
| 3.5 MUOHTAFYSIHKKA JA TEMPERATUVRRAMIHTIDEAMIT | 49 |
| 4. DAVVISÁMEGIELA MUOHTADOAHPAGAT, DAID SISDOALLU JA GEAVAHEAPMI | 50 |
| 4.1 ARTIHKKALIID ČOAHKKÁIGEASSU | 50 |
| 4.2 MUOHTADOAHPAGIID DOVDOMEARKKAT | 54 |
| 4.3 SÁMEGIELA MUOHTADOAHPAGIID KATEGORISEREN JA KLASSIFISEREN | 56 |
| 4.4 GUOHTUN JA BOAZODOALU VUOĐDOMUOHTADOAHPAGAT | 59 |
| 4.4.1 Guohtun | 60 |
| 4.4.2 Oppas ja čiegar | 64 |
| 4.4.3 Fieski | 67 |
| 4.4.4 Ritni | 68 |
| 4.4.5 Goavvi | 69 |
| 4.5 ÁRBEVIROLAŠ MÁHTTU MUOHTTAGA, HEIVEHEAMI JA RESILIEANSAJURDDAŠEAMI BIRRA | 73 |
| 5. LOAHPPAJURDAGAT | 80 |

Govvosat ja tabeallat

| | |
|--|----|
| <i>Govus 1: Gaskamearálaš dálve- (juovlamánu, ođđajagimánu, guovvamánu) (a) ja giđđa -(njukčamánu, cuoŋománu, miessemánu) (b) áibmotemperatuvrrat mihtiduvvon Guovdageainnus 1889 rájes (Vikhamar-Schuler et al., 2010).</i> | 26 |
| <i>Govus 2: Gaskamearálaš dálve- (juovlamánu, ođđajagimánu, guovvamánu) (a) ja giđđa -(njukčamánu, cuoŋománu, miessemánu) arvi/muohta mihtiduvvon Guovdageainnus 1889 rájes (Vikhamar-Schuler et al., 2010).</i> | 27 |
| <i>Govus 3: Molsašuvvat ja rievdamat das man galle beaivvi lei muohta eatnama nalde Guovdageainnus 1955 rájes. A) goas bođii vuosttaš muohta ja B) goas lei maŋemus beaivvi muohta (Vikhamar-Schuler et al., 2010).</i> | 27 |
| <i>Govus 4: Rievdan das galle beaivvi lei áibmotempatuvra < -15 oC Guovdageainnus 1955 rájes ja B) variašuvdna das man ollu muohta lei Guovdageainnus 1995 rájes (Vikhamar-Schuler et al., 2010).</i> | 28 |
| <i>Govus 5: Jahkásaš ja jagiáiggi gaskamearálaš temperatuvrrat 1961-1990 mihtiduvvon Sis-Finnmárkku (Kárášjogas) dálveorohagain ja mearariikkas (Ráissas) Finnmárkku geasseorohagain, (olles linját) ja seammá gaskamearálaš temperatuvrrat rehkenaston 50 vulosskalerejuvvin dálkkádatmodeallain jagi 2085 (stábat linjá) (Magga et al., 2011a).</i> | 29 |
| <i>Govus 6: Oarje-Finnmárkku boazodoalloguovlu, dálveorohagat, juhkkon golbman johtolahkan.</i> | 45 |
| <i>Govus 7: Temperatuvrra mihtidanrusttegat.</i> | 49 |
| <i>Govus 8: Sámegeiela muohtadoabavuogádat čájehuvvon gráfalaš doabakárttain, mii lea ráhkaduvvon muohta- ja jieknadoahpágiid oktavuođain/gaskavuođain ja daid ovtálagánvuođain/erohusain dan ektui masa dát gullet. Fiskes rieggá siste leat muohtatearpmat, čuvges alit riekkis čájeha jagi áiggi áššiid, čuvges ruoná čájeha stratigráfalaš gaskavuođaid ja čuvges ruoksát čájeha guođoheami/guohtuma áššiid. Teaksta mii ii leat rieggáid siste, čilge fysihkalaš diliid ja muohtametamorfosa. Njuolat čujuhit proseassaide ja rievddadeaddji syklusiiida. Doabavuogádat lea ráhkaduvvon prográmmain Cmap Tools (Novak & Cañas, 2008).</i> | 57 |
| <i>Govus 9: Oppas-variánttat dásiid mielde, buoremus dásis heajumus dássái.</i> | 65 |
| <i>Govus 10: Čiegar-doaba juhkkon čieža vuolledoaban.</i> | 67 |
| <i>Govus 11: Fieski-doaba vuolledoahpágiiguin.</i> | 68 |
| <i>Govus 12: Rinádat bisttii 45 beaivvi 2008 skábman. Gráfas: SD čájeha man gassa muohta lei ja TAN lea maximuma temperatuvra.</i> | 69 |
| <i>Govus 13: Goavvi-doaba vuolle-doahpágiiguin.</i> | 70 |
| <i>Govus 14: Geavahettiin temperatuvra-, arve/muohta- ja muohta gassodagadátmaid mat Kárášjogas leat mihtiduvvon 1917-1918 sáhttet navdit ja čilget Guovdageainnu dálkediliid (Hansen-Bauer, 2010).</i> | 72 |
| <i>Govus 15: Oarje-Finnmárkku boazolohku 1945 rájes dálá áigái. Alit linjá čájeha boazologu, rukses stoalpu čájeha goavvejagiid ja ruoná fas goavvegiđaid. (Almmolaš dátat Boazodoallohálldahusas, Norggas).</i> | 76 |
| <i>Govus 16: NAO-indeavssa variašuvnnat čavččaid (1873–2000) ovttas runta čuoggáiguin mat merkejit historjjálaš goavvejagiid 1917, 1967 ja 1996 Guovdageainnu boazodoalloguovllus ja mat heivejit otkii negatiiva čakča NAO-fásaiguin (Ráhkaduvvon Jianping, 2003 mielde).</i> | 77 |

| | |
|---|-----------|
| <i>Tabealla 1: Dutkanmetodaidd geavaheami oppalašgeahčestat.....</i> | <i>45</i> |
| <i>Tabealla 2: Gávcci muohtadoahpaga analiisa dovdomearkkaid mielde.....</i> | <i>54</i> |
| <i>Tabealla 3: Sámegiela muohtadoahpapiid klassifikašuvdna ráhkaduvvon Fiertz et al., 2009, Jernsletten, 1994; Svonni, 1981; Ruong, 1964 vuodul.</i> | <i>58</i> |
| <i>Tabealla 4: Ovdamearka movt muohtasátnelistu lea huksejuvvon.</i> | <i>59</i> |
| <i>Tabealla 5: Muohtašlájat mat sáhttet dagahit heajos dahje buori guohtuma.</i> | <i>61</i> |
| <i>Tabealla 6: Guohtumadiliid vuollevariánttat</i> | <i>62</i> |
| <i>Tabealla 7: lešguđet goavvi –áigodagat, mas nealgedálvi 1917/18 lea merkejuvvon fiskadiin, 1967/68 ja 68/69 merkejuvvon ruoksadiin leat goavvejagat, ja 1958-1961 ja 1997 merkejuvvon ruonáin leat goavvegiđat.</i> | <i>71</i> |
| <i>Tabealla 8: Heivehanstrategijat goavvá.....</i> | <i>78</i> |

OKTIIGEASSU

Dát doavttergrádabargu lea gielladutkan fágaidrasttideaddji perspektiivvas, man ulbmil lei guorahallat sáme giela muohtadoahpagiid sisdoalu ja geavahusa dálveguohtundiliid birra sámi boazodoalus, Guovdageainnus, Norggas. Doabaanaliisavuodđun lean geavahan informántadieđuid, gielalaš ja muohtafysihkalaš beliid ja boazodoallomáhtu ja nu ovttastahtán árbevirolaš eamiálbmotmáhtu fysihkkamihtidemiiguin. Dáidda lassin lean ráhkadan siida-vuđot gozihanvuogádaga, man vuodđun lea boazodoalu fágagiella, mas viđa siidda boazovázzit geavahedje guođohanbeaivegirjji gozihit beaivválaččat muohtadiliid, biekká, arvvi/muohttaga, ealu láhttema relaterejuvvon duovdagiidda. 318 muohtaguoskevaš doahpaga, mat guovllus geavahuvvojit, sisdoallet eavttuid mat sihke duddjojit bohcco ceavzimii ja ahtanuššamii, ja maiddái olbmo bargovejolašvuodaide. Doahpagiid dovdomearkačoahkit gullet sihke boazodollui ja muohtafysihkkii ja daid máŋggadimenšunála sisdoallu čájeha muhtomiin čielga muohtafysihkkadovdomearkkaid nugo riikkaidgaskasaš muohtaklassifikašuvnnain leat ja earát fas gullet guođohanstrategiijaide. Kompleaksa kategoriija muohtadoahpagat sisttisoallet oktanaga ollu fáktoraidda nu go dieđuid muohttaga, muohtadiliid, muohtafysihka, dálkki, temperatuvrra, báikki, áiggi ja bohcco/olbmo váikkuhusaid birra. Muohtadoahpagat leat dehálaččat beaivválaš boazobarggus, mat leat dehálaš oasit boazodoalu árbevirolaš máhtus. Boazovázzit observerejit ja hálddašit muohttaga guovtti perspektiivvas, muohtafysihka mielde ja ealu ekologijja mielde dálveguohtoneatnamiin, mii mearkkaša ahte sis lea ollislaš muohtamáhttu ja –oaidnu. Goziheami bohtosat čájehit ahte dálveguohtoneatnamiid geavaheapmi lea strategalaš ja systemáhtalaš báikki ja áiggi dáfus ja ahte leat stuora erohusat Oarje-Finnmárkku siiddaid muohtadilliin jagiid ja báikkiid ektui, mii váttisin dahká buohtastahttit nuppi siidda dili nuppiin ja generaliseret dilliid. Doabageavaheapmi speadjalastá boazovázziid árbevirolaš máhtu hálddašit kompleaksa vuogádagaid ja barget ealuin dálvemáilmmis. Dát sáhtta váikkuhan boazodoalu seailumii doloža rájes dássáži. Muohtadoabaanaliissat čájehit ahte lea dehálaš geavahit boazodoalu fágagiella ja -fágaterminologijja boazodoalu hálddašeamis ja hálldahusas. Riikka heivehanstrategiijaide oktavuodas ferte boazodoalu árbevirolaš máhtu váldot vuhtii, ja dálkkádatrivdamiid dustema heivehanstrategiijaide fertejit boazodoalu kultur- ja giellavuogátvuodát váldot mielde. Dát gáibida iešguđetlágan máhtu, ja dan dihte ferte ovttastahttit sihke eamiálbmot boazodoalloárbevirolaš máhtu ja oarjemáilmmi dieđalaš máhtu.

Čoavddasámit: *sáme giella, muohtadoahpagat, guohtun, boazodoalu fágagiella, árbevirolaš máhttu, muohtafysihkka, dálkkádat.*

1. ÁLGGAHUS

“Go ealu dárbbuid lea duhtadan, de boazosápmelaččas lea muoſet ja buot lea buorre, vaikko makkár stuora bárttit ja barggut ovdal ležžet leamaš. Muhto nuppe dáfus de son vuorrástuvvá ja váivahuvvá go eallu ii beasa guohtut, danne go lea heajos guohtun go eanan lea skárton.” (Smith 1938:311)¹

Dát bargu guorahallá sámegeiela muohtadoahpágiid systema ja muohtaga mearkkašumi sámi boazodollui, Guovdageainnus, Norggas. Doahpágiid analiisavuodđun lean geavahan sihke gielalaš, muohtafysihkalaš ja boazodoalu beliid. Dát lea vuosttažettiin geahččaleapmi oažžut ipmárdusa movt dálkedilit váikkuhit báikkálaš muohtadiliide ja nu fas boazodoalu guohtondiliide. Bargu lei oassin Riikkaidgaskasaš Polárajagi (IPY) prošeavttas EALÁT–boazodoalu raššivuoda fierpmádatdutkan, mii lea *Arctic Climate Impact Assessment* (ACIA) raportta čuovvoleapmi (ACIA, 2004). IPY lea stuora dutkanprográmma, maid Riikkaidgaskasaš dutkanráđđi (International Council for Science) ja Máilmmi meteorologalaš organisašuvdna (World Meteorological Organization) organiserejedje, ja dát lei njealját polára jahki. Dás leat leamaš sullii 50000 oassálasti 60 riikkas, geat čadahedje 200 prošeavtta, fysihkas, biologijjas ja servodatdutkamiin. Guovdageaidnu lea okta dain moatti IPY dutkanguovlluin gos lei prošeakta 2007-2009 (Orheim & Ulstein, 2011) ja maiddái 1882-1883 (Tromholt, 1885).

1995 rájes lea árkálaš guovlluid dutkamiin leamaš paradigmalonuheapmi go dutkamiin dál leat váldigoahtán mielde holisttalaš ja fágaidrasttideaddji perspektiivva, mas leat maiddái mielde olmmošlaš bealit, eamiálbmotmáhttu ja ipmárdus árkálaš guovlluid sadji máilmmis (Bowden *et al.*, 2005).

¹Jorgalus dás: “Når hjorden har sitt behov tilfredsstilt, er fjellappenens sinn rolig og alt er bra, hvor store strabaser og anstrengelser han enn har hatt. På den annen side gripes han av håpløs uro og fortvilelse, når hjorden, som stundom hends, ikke finner beite fordi isskorpe har lagt seg på laven” (Smith 1938:311)

Nu lea ge IPY EALÁT-prošeakta kultuvrraid- ja fágaidrasttideaddji raššivuodadutkan, mas leat komponeanttat iešgudet surggiin, nugo giella-, servodat- ja luonddudiehtagat ovttahttojuvvon boazodoallomáhtuin. Prošeakta lea suokkardallan movt boahtteáiggi hástalusat váikkuhit boazodollui ja daid báikegottiide, movt dát buoremusat sáhtáše dáidda hástalusaide heivehallat ja movt ovddidit sihkarastin dihte boazodoalu ceavzima boahttevaš buolvvaide (Magga *et al.*, 2011a; Mathiesen & Magga, 2011). Prošeavttas leat ásahan odđa metodalaš lahkonanvuogi dohkkehemiin ahte boazodoalu návccaid vuodđu heivehit rievdamiidda lea árbevirolaš máhttu, masa gullet giella, guođohanvuogit ja ovttaskas boazovázzi barggut (McCarthy *et al.*, 2005; Tyler *et al.*, 2007).

Boahttevaš 30-50 jagiin einnostuvvojit dálkkádatrievdama váikkuhusat máilmmis eanemusat čuohcat árkttalaš guovlluide ja nu váikkuhit boazodoalu guohtunguovlluide. Dán barggus geavahan doahpaga *dálkkádatrievdan* dilliid birra, masa gullet globála liegganeapmi, temperatuvrariievdan, muohta- ja arvedálkkiidrievdan, areálageavaheami rievdamat, 10-jagi skáladálkkádat ja dálkevariábilitehta ja luonddu ja servodatlaš vuogádagaid váikkuhusa. Einnostuvvo ahte dálkkádatrievdamiid váikkuhusat Norggas čuhcet eanemusat Sis-Finnmárkui, mii lea sámi boazodoalu deháleamos dálveguohtuneatnamiid guovlu (McCarthy *et al.*, 2005; Tyler *et al.*, 2007; Oskal *et al.*, 2009). Dálkkádatrievdamat dagahit iešgudetlágan raššivuodaid árkttalaš guovlluid eamiálbmogiidda ja báikegottiide (Henriksen, 2007). Dálkkádat ja sosioekonomalaš rievdamat dovdojit dál miehtá árkttalaš guovlluin ja earenoamážit boazodoalu kultuvrras ja boazodoalu árbevirolaš guovlluin (Magga *et al.*, 2011a,b,c). Árkttalaš guovlluid eamiálbmogat leat buolaš- ja ekstrema fysihkalaš diliid mielde heivehan iežaset eallima, kultuvrra ja árbevirolaš máhtu ja dakkár dilid leat sin eallima eaktun. Inuihta sirkumpolára konferánssa dála jodiheaddji Sheila Watt-Cloutier dajai ahte árkttalaš guovlluid eamiálbmogiid kultuvra dárbbasa buollaša. Sin kultuvrra ii sáhte váldit eret sin fysihkalaš birrasis (Baer, 2010).

Muohta lea álo leamaš dehálaš sámiid birgejumái ja ealáhusaide (Ruong, 1964; Svonni, 1981; Eira, 1984; 1994, Jernsletten, 1994; Magga, 2006), nugo biepmu riibamii, vuohttimii, vánddardeapmái (Ruong, 1982: 76-77; Krupnik *et al.*, 2010:41) ja dieđusge dasa movt boazu beassá guohtut (Saijets & Helander-Renvall, 2009). Go davviguovlluide einnostit jođánis, sihke biraslaš ja servodatlaš rievdamiid (Magga *et al.*, 2011a), de lea dehálaš ráhkkanit dáidda rievdamiidda unnidan dihte riskaváikkuhusaid boazodoalloservodagaide.

Olbmot geavahit iešguđege bargguin ja fágasurggiin earenoamáš sániid ja dajaldagaid mat eai leat árgabeaivválaš gielas oassin. Johns (2010: :411-13), gii lea gielaláččat čilgen inuihta gielaid muohta- ja jiekŋatearpmaid, oaivvilda ahte máhttu mii lea sániid duogábealde, mii geavahuvvo refereret ja čilget mearrajeŋa, lea dehálaš sihke eamiálbmogiidda ja earáide. Boazosápmelaččaid vásáhusat eallit luonddus ja das maid luondu addá lea ovdánahttan giela, ja nu leat gielas ollu sánit mat gullet luonddu dáhpáhusaide (Jernsletten, 1997:234). Boazoálbmogiid ipmárdusa vuodđun leat buolvvaid vásáhusat maid vuodđun lea dološ bivdoservodagaid vásáhusat, mat leat čohkkejuvvon ja vurkejuvvon sin fágagielaide ja boazobargguide sihke ovttaskas olbmo ja siidda dásis. (Joks *et al.*, 2006; Turi, 2009).

1.1 Dutkama ulbmil

Dutkama váldoulbmil lea iskat movt guovddáš sáme giela muohtadoahpagat adnojuvvojit beaivválaš boazodoalus dálkkádaga ja guođohandoaimmaid mielde dálvet Guovdageainnus. Dása lassin lea ulbmil ipmirdit doahpágiid mat adnojuvvojit gaskaoapmin árvvoštallat guohtundilálašvuodaid dálvemáilmmis. Dutkamis geavahan gielalaš ja fágaidrastideaddji lahkonanvugiid fuomášan dihte odđa dieđuid ja systematihka sáme giela muohtadoahpágiid geavaheamis. Ja lean loahpas digaštallan sáhtášii go sáme giela muohtadoabavuogádat leat ávkin boahhteáiggi hálddašanstrategiijaide dálkkádatmolsašumiid ja –rievdamiid oktavuodas.

Barggus deattuhuvvo:

1. Identifiseret muohtatearpmaid ja daidda gullii doahpágiid sisdoalu mat geavahuvvojit sámi boazodoalus dálvet ja guorahallat girjjálašvuoda sáme giela muohtaterminologii ja birra ja movt doahpagat báikkálaččat ipmirduvvojit ja geavahuvvojit Guovdageainnus. (1. artihkal)
2. Suokkardallat movt guhtege doaba adno beaivválaš boazobarggus áicat ja gozihit muohtaga variabelitehta ja riev dama ja movt geavahuvvojit ságastallamis geavtlaš boazobarggus, oážžut vuodu ráhkadit sáme giela muohtadoabavuogádaga. Ulbmil lei ovdánahttit metoda kártet doahpágiid sisdoalu ja geavahusa. (2. ja 4. artihkal)
3. Iskat movt sáhtá ovttahttit ja buohtastahttit iešguđetlágan máhtu muohtaga birra. Analyseret sáme giela muohtadoahpágiid gielalaš-, muohtafysihkalaš- ja boazodoallofágalaš beliid mielde. Boazodoalu guovddáš muohtadoahpágiid buohtastahttit riikkagaskasaš klassifikašuvnnaid muohtašlájain. (2. ja 3. artihkal)
4. Loahpalaččat digaštalan máhtu geavaheami relevánssa, mii lea oassin boazovázziid terminologii, resilieansa jurddašeami ja heivehannávccaid perspektiivvas boahte áiggi hálddašeamis.

1.2 Boazodoallu ja dan vuoddoeavttut

Sullii 2,5 miljovna bohcco (Rangifer tarandus) guhtot ja guodohuvvojit duoddariin ja taigaguovlluin (Turi, 1999; Turi, 2002; Oskal *et al.*, 2009; Maynard *et al.*, 2010). Boazodoallu lea árbevirolaš ealáhus Eurasias, ja lea eambo go 20 iešguđetlágan čearddalaš eamiálbmoga ealáhusvuodđun ja eallinvugiid vuodđun Norggas, Ruotas, Suomas, Ruoššas, Mongolias, Kiinás, ja dása gullet sullii 100 000 boazovázzii (Oskal *et al.*, 2009; Magga *et al.*, 2011,a).

Lagabui 3000 sápmelačča Norggas eaiggáduššet bohccuid (Boazodoallohálddahas, 2011). Boazodoalus lea stuora kultuvrralaš ja ekonomalaš mearkkašupmi davvi Eurásia eamiálbmogiidda ja eará álbmogiidda.

Boazodoalu ekologalaš vuodđoeavttut pastorála ealáhusláhkin leat jagi áiggiid molsašumit ja bohcco oahppan johtalit ja orrut seammahat guovlluin jagi iešguđet áiggiin (Sara, 2001:81). Dálki ja bieggá leat guovddážis pastorála eallimis. Jagi áiggi gollamis leat dihto geardduhusat seammás go leat maid áššit maid olmmoš ovdagihtii ii máhte árvidit (Sara, 2007:9). Boazodoalus leat golbma vuodđokomponentta: boazu, olmmoš ja ekologijja. Oktavuohta dáid gaskkas lea dynámalaš ja lea ge johttiálbmoga eallinvuogi dovdomearka (Hågvar, 2006:132). Boazodoallu lea olmmoš-ekovuogádatčanastat ovdamearka (Turi, 2008; Oskal *et al.*, 2009). Boazodoalu ekologalaš vuodđomearis leat guovttelágan rievddadeamit, nubbi guoská dálkkádahkii, nappo jagi áiggiid rievddademiide mat váikkuhit resurssa oažžumii ja -geavaheapmái ja nubbi guoská olbmo bargomeari rievddademiide (Sara, 2001).

Sámi boazodoallu vuodđu lea nomadisma, man dovdomearka lea johttit stuora guovlluid ja johtolagaid gaskka (Sara, 2001; Joks *et al.*, 2006:93). Sámi boazodoallu lea Norggas, Suomas, Ruotas ja Ruoššas. Norggas ja Ruotas gullá boazodoallu lágalaččat sámi álbmogii, mii máksá ahte leat dušše sápmelaččat geat besset eaiggáduššat bohccuid. Sámi álbmot lea eamiálbmotjoavku mii gullá sámi guovlluide, mat leat seammá go sáme giela guovllut.

Dát dutkan lea čađahuvvon Oarje-Finnmárkkus, gos 2011 ledje 53 dálvesiidda, oktiibuot sullii 10787 km² dálveguohtuneananareálas (govus 1). Dálvesiiddat leat juhkon golbman johtolahkan (sona), nuorta-, guovda- ja oarjejohtolat. Oarje-Finnmárkkus ledje 2008-2009 doaibmajagis oktiibuot 93603 bohcco mat gullet 1717 olbmui, mat fas gullet 217 siidii (www.reindrift.no).

1.3 Eamiálbmotmáhttu ja diedalaš máhttu

1.3.1 Eamiálbmotmáhttu definišuvdna, hápmi ja iešvuohta

Eamiálbmot servodagain lea álo leamaš alddiineaset máhttu, mii lea leamaš ávkin sidjiide beaivválaš diliin ja mii lea veahkehan birget ja ceavzit árktaš guovlluin duháhiid jagiid čađa ja eará sajiin máilmmis gos eamiálbmogat orrot (Magga *et al.*, 2011a). Árbevirolaš máhttu lea eamiálbmogiid- ja báikegottiid čuđiid jagiid čohkkejuvvon árbevirolaš eallinvugiid ja sin ássanguovlluid resurssaid geavaheami ja suodjaleami oktavuodas (Henriksen, 2002:175-76; Turi, 2009). Árbevirolaš ja báikkálaš máhttu ja –diehtu leat dagahan ahte dát servodagat ja kultuvrrat leat doalahan eallinvugiideaset.

“Eamitálbmotmáhttu”, “árbevirolaš máhttu”, ja ”árbevirolaš ekologalaš máhttu” (eng: Indigenous knowledge (IK) ‘traditional knowledge’ (TK), ‘traditional ecological knowledge’ (TEK)) doahpágiid sisdoalus lea ovtastupmi masa čatnasit máhttu ja máhttovuogádagat, nu go Fikret Berkes definere árbevirolaš máhttu²: árbevirolaš máhttu lea máhttočoakkáldat masa gullet vásáhusat, dábit ja osku, barggut- ja bargovuogit guhkes áigge čađa ovdánahtton ja fievrreduvvon kultuvrralaččat buolvvas bulvii (Berkes, 2008:7).

Eamiálbmogiid máhttu lea dynámalaš, danne go 1) máhttu heivehuvvo biraslaš rievdamiid mielde, ja juohke buolva ieš lasiha dasa iežas vásihan máhttu dahje áicamiid ja go 2) das leat sosiálaproseassat nugo servodagaid resurssaávkástallamat mat varierejit servodagas servodahkii (Peloquin & Berkes, 2009:534). Erohus gaskkal eamiálbmotmáhttu ja árbevirolaš máhttu lea ahte eamiálbmotmáhttu eamitálbmotperspektiivvas sisttisoallá historjjálaš, sosiála ja kultuvrralaš oktavuoda dimenšuvnna, mii lea buolvvaidd

²Jorgaluvvon engelasgielas: “TK is a cumulative body of knowledge, practice and belief, evolving by adaptive processes and handed down through generations by cultural transmission” (Berkes, 2008:7)

čáđa fievrreduvvon, ja mas leat vásihan stáda ja unnitlogu gaskavuodaid (Keskitalo, 1993; Jannok-Nutti, 2007).

Krupnik ja earát ákkastallet ahte eamiálbmogiid vuohki diehtit ja máhttit lei árbevirolaččat vuodđuduvvon dan nala ahte dárkilit guldalit dan maid vuorrasit olbmot ja rávis olbmot muitaledje. Mánát ja nuorat čuvodišgohte mánnán juo oahppanolbmuid ja báikkálašcheppiid áican ja oahppan dihte movt čoavdit áššiid bargguid čáđa. Sin beaivválaš guldaleapmi movt bargat ja čoavdit sihke beaivválaš áššiid ja várálašvuodaid, oahpaha sin movt dovdat omd. várálaš jienjaid ja movt dáid garvit, seammás go ohppe movt dárkilit čilget ja bagadallat dáid diliid birra (Krupnik *et al.*, 2010:351-52).

Muhtun surggiin, nugo omd. ekologiijas, mii lea oalle odđa biologiijafágasuorgi, leat beroštišgohtán árbevirolašmáhtus. Ferte lasihit ahte dákkár mállat máhtu geavahit diedusge maiddái eará álbmogat, vaikko oarjemáilmmi servodagain dát orru leamen láhppon mángga dáfus, nugo almmolaš dásis ja diedalašvuoda norpmain. Sámi birrasiin leat gáibidišgohtán ahte galget deattuhit árbevirolašmáhtu omd. biologalaš resurssaid hálddašeamis (Joks *et al.*, 2006).

Boazodoallomáhtu sáhtta čilget máhttun ávkki atnit bohccos ja doallat sierra siiddaid jagi čáđa. Dát mearkkaša máhtu hálddašit guđege bohcco valljodahkan ja diehtit ealu ja luonddubirrasa gaskavuodaid (Sara, 2001). Boazovázzi luonddumáhttu ja luonddudovdu lea earenoamáš, eará lágan go bođu olbmo, danne go boazovázzi lea šaddan dovddiidit luonddubirrasa luođu ealli eaktudemiin. Bohccuid čuvodeami oktavuodas šaddá boazovázzi meahcedilis vásihit iešguđetlágan diliid, sihke garra dálkkiid ja maid návddašit fierttu (Sara, 2003:94).

Go veardida boazodoallomáhtu sisdoalu eamiálbmot- ja árbevirolaš máhtu sisdoaluiguin, de heive dat bures árbevirolaš máhtu čilgehusaide ja dan sáhtta karakteriseret sihke eamiálbmot- ja árbevirolaš máhttun. Luonddumáhttu

lea vuđolaš árvun boazovázzái, go das lea sihke árbi ja su iešvuodadovdu (Sara, 2003:94).

1.3.2 Árbevirolaš máhttu ja dieđalaš máhttu

Borgos (1993) oaivvilda ahte dieđalaš máhttu ja árbevirolaš máhttu leat guokte paradigma diehtagis, mii lea Kuhn čilgehusa mielde (Kuhn, 1996). Dán guovtti máhttomálle gaskkas ii leat jearaldat goappá vällje (Borgos, 1993:8f.). Go ovttahtá dieđalaš- ja eamiálbmotmáhttu, omd. odasmahtti resurssaid ovttahtá dieđalaš- ja eamiálbmotmáhttu, de ovttahtá dan buoremusa guovtti máilmmioainnus (Nakashima, 2000). Boazodoalloplánema máhttovuođu oktavuoda ákkastallamiin, čanai Kalstad árbevirolaš máhttu boazodoalu oktavuhtii (Kalstad, 1993:40f.). Dákkár máhttomálla-vuogádagain leat muhtun dovdomearkkat mat earuhit árbevirolaš máhttu oarje-máilmmi máhttovuogádagain, muhto ii leat álki sirret dán guokte málla guovtti oassái nu go Borgos maid oaivvildii.

Go buohtastahtá árbevirolaš máhttu dieđalaš máhttuin, de oaidnit árbevirolaš máhttu mihtilmasvuodaid mat earuhit dán dieđalaš máhttu, dat ahte árbevirolaš máhttu oaidná ekologalaš vuogádagain ollislažžan (Berkes, 2008; Peloquin & Berkes, 2009). Dát máhttu čatnasa báikkálaš diliide ja nu ii sáhte beare generaliserejuvvot. Máhttu leat olbmot iskan dahje duodaštan iežaset vásáhusaid bokte árgabeaivedilliin (Jernsletten, 1997; Berkes, 2008; Krupnik *et al.*, 2010). Máhttu sáhtá sihke hámi ja viidodaga dáfus rievdat olbmos olbmui, servodagas servodahkii (Peloquin & Berkes, 2009). Dat rievdá ja ovdána ovttatládje ja mearkkaša ahte olbmot ohppet áššiid barggu bokte, geahččaladdamiiguin ja gelbbolašvuodahukseamiin (Berkes, 2008). Máhttu eai deattuhuvvo kvantifiserejuvvon aspeavttat, muhto dattege dat ii mearkkaš ahte máhttu ii leat dárkil (Magga, 2010). Giella speadjalastá máhttu, servodatorganiserema, norpmaid, árvvuid, oainnuid, ásáhusaid ja njuolggadusaid. Máhttu lea dan hámis mii árbevirolaš máhttoguđdiin lea. Danne lea dehálaš muitit ahte máhttu šaddá doppe gos dat lea ráhkaduvvon ja

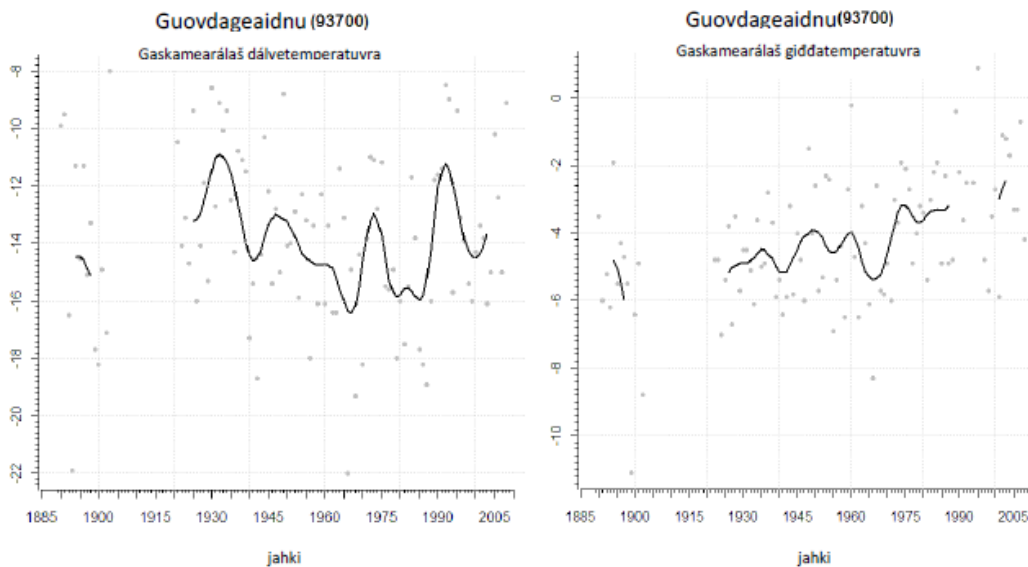
geavahuvvon (Turi, 2009). Oppalaččat sáhtta dadjat ahte árbevirolaš máhttu lea earálágan go dieđalaš máhttu sihke struktuvrra, doaimma, vuolggasaji, vuodu ja agi dáfus (Borgos, 1993; Helander, 1993; Jernsletten 1997; Joks, 2006; Berkes, 2008; Peloquin & Berkes, 2009). Robert Corell, gii jodihii Árkatalaš rádi barggu "Arctic Climate Impact Assessment", lea hui čielgasit deattuhan árvvu das ahte váldit mielde eamiálbmogiid jienaid ja máhtu dálkkádatdutkanmiidda (Rapp, 2006). ACIA raporta lei okta dain vuosttaš bargguin mas ovttastahte árbevirolaš máhtu ja oarjemáilmmi dieđalaš máhtu. Eamiálbmogiid máhttu ja diehtu leat maiddá dehálaččat ja mávssolaččat go galgá ipmirdit dan mii luonddus dáhpáhuvvá.

1.4. Ovddeš ja boahte áiggi dálkkádagat Guovdageainnu boazodoalloguovllus.

Vai buorebut sáhtta ipmirdit boazosápmelaččaid fágagiela muohtaga ja muohtanuppástuhttima birra, de áiggun dán oasis čilget historjjálaš ja boahteáiggi dálvedálkkádagaid Guovdageainnus, gos dát giella lea ovdánan ja geavahuvvon.

1.4.1 Ovdalaš áiggi dálkkádagat Guovdageainnu boazodoalloguovllus.

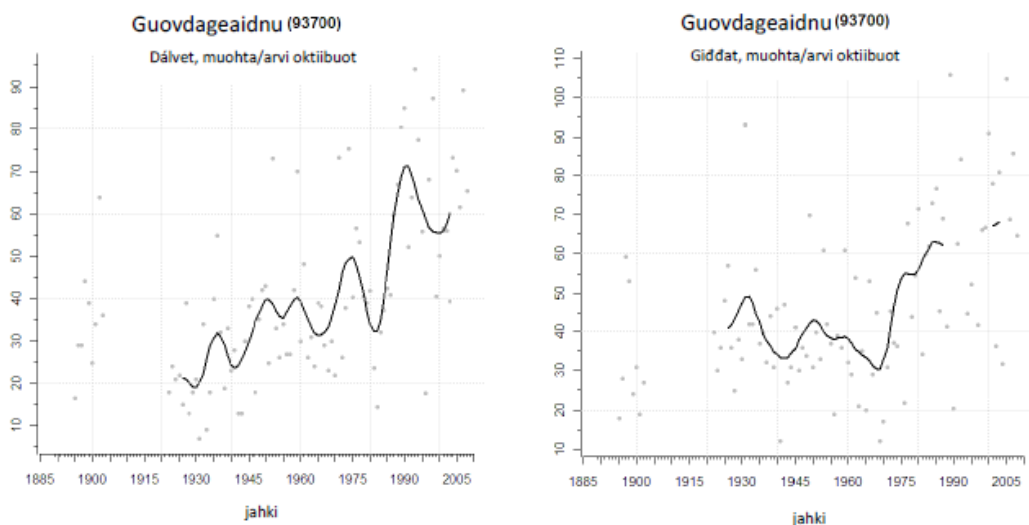
Vuodđodálkkádatpáramehterat, nu go temperatuvra ja arvi/muohta leat mihtiduvvon 1889 rájes Guovdageainnu badjegeažis, ja leat addán earenoamáš dátačoakkáldaga maiguin sáhtta čilget historjjálaš dálkkádatdiliid (Schuler *et al.*, 2010). Sámi boazodoallu Guovdageainnus lea šaddan relatiiva dásseidis dálkkádagas. Gaskamearálaš dálvetemperatuvrrat (juovlamánnu-odđajagimánnu-guovvamánnu) leat varieren gaskkal sullii -8 ja -22 °C (govus 1 a) ja leat dagahan galbma ja goike dálvviid Sis-Finnmárkku boazodollui (Vikhamar-Schuler *et al.*, 2010).



Govus 1: Gaskamearálaš dálve- (juovlamánu, odđajagimánu, guovvamánu) (a) ja gidđa - (njukčamánu, cuoŋománu, miessemánu) (b) áibmotemperatuvrrat mihtiduvvon Guovdageainnus 1889 rájes (Vikhamar-Schuler *et al.*, 2010).

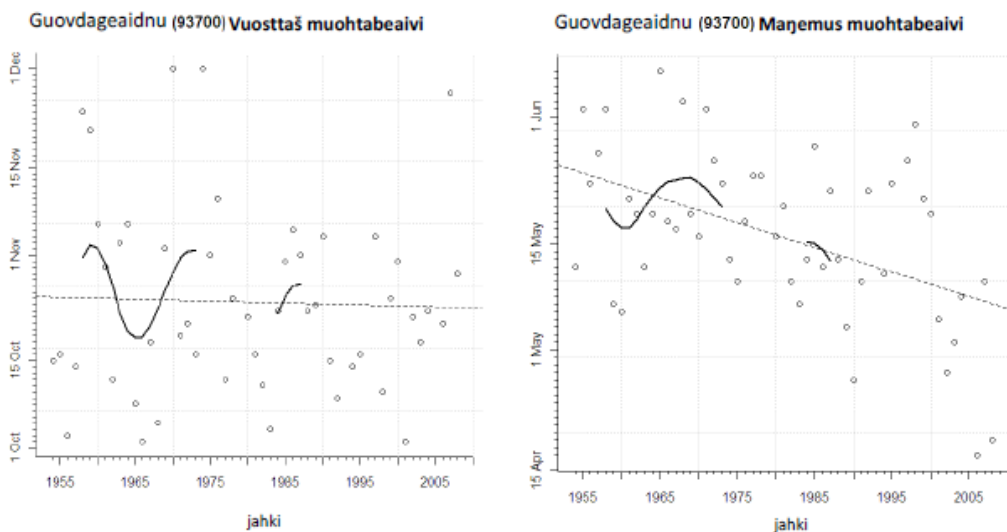
Galbmaseamos jahkásaš gaskatemperatuvra $-5.1\text{ }^{\circ}\text{C}$ mii lea Norggas mihtiduvvon, mihtiduvvui Guovdageainnus 1893 ja 1985. Galbmaseamos áibmotemperatuvra mihtiduvvon Guovdageainnus lei $-57\text{ }^{\circ}\text{C}$ (ii leat almmolaš olaheapmi) odđajagimánus 1999. Eanemus ja unnimus muohta mihtiduvvui 110 cm 1936:as ja 34 cm 1972:is.

Guhkitáiggi dálkeguorahallamat Guovdageainnus čájehit ahte 20. jahkečuodi dálve- ja gidđatemperatuvrrain lea stuora variabilitehta jagiid gaskka ja 10-jagiid gaskka (Govus 1a,b) (Vikhamar-Schuler *et al.*, 2010). Gidđa lea áidna jagiáigi goas guhkesáiggi áibmotemperatuvrrat leat statistihkalaččat mearkkašahttit. Guovdageainnus gidđatemperatuvrrat leat loktanan $1.5\text{ }^{\circ}\text{C}$ 1900 rájes gitta 2000 rádjái (Hanssen- Bauer, 2010). Gaskamearálaš dálvetemperatuvrrat Guovdageainnus duodaštit ahte siseatnama dálvetemperatuvra lea sullii $10\text{ }^{\circ}\text{C}$ vuollelis go mearariikkas (*ibid.*).

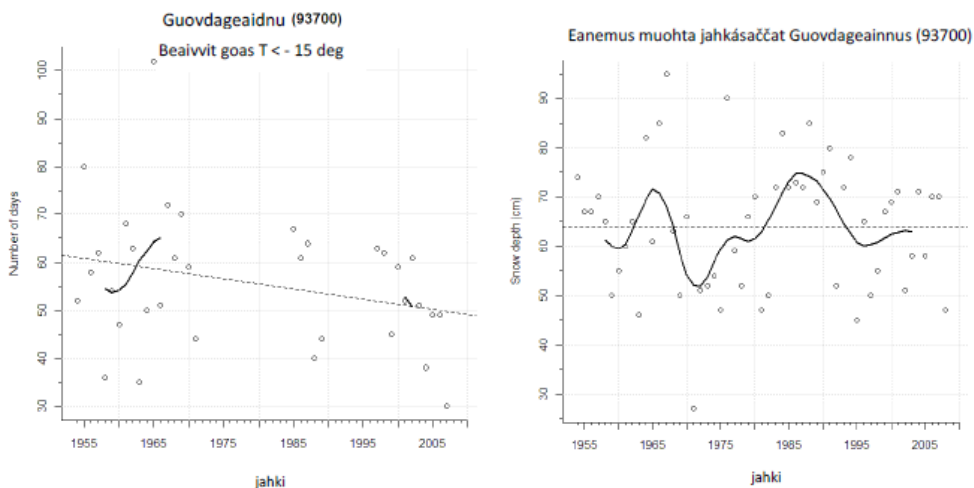


Govus 2: Gaskamearálaš dálve- (juovlamánu, ođđajagimánu, guovvamánu) (a) ja gidđa- (njukčamánu, cuoŋománu, miessemánu) arvi/muohta mihtiduvvon Guovdageainnus 1889 rájes (Vikhamar-Schuler et al., 2010).

Jahkásaččat leat gaskamearálaččat 228 beaivvi goas lea muohta boazodoalloguohtoneatnamiin. Muohtaáigodaga (nu guhká go muohta lea eatnama nalde) sáhttá juohkit golmma váldoáigodahkan (Vikhamar-Schuler et al., 2010). Vuosttaš áigodagas, 1900:s gitta 1940 rádjái muohtaáigodat oatnu measta ovttain mánuin. Nuppi áigodagas, 1950:as gitta 1970 rádjái guhkui muohtaáigodat ja goalmát áigodagas, 1970 rájes molsašuvai muohtaáigodat, guhkimus áigodat lei sullii 1995:as ja dan maŋŋil oanui fas. Muohtaáigodat Guovdageainnus oanui eanas dan dihte go áibmotemperatuvra loktanii gidđat 1955 rájes, čavččaid eai lean dakkár trendat observerejuvvon (ibid.).



Govus 3: Molsašuvvat ja rievdamat das man galle beaivvi lei muohta eatnama nalde Guovdageainnus 1955 rájes. A) goas bođii vuosttaš muohta ja B) goas lei maŋemus beaivi muohta (Vikhamar-Schuler et al., 2010).

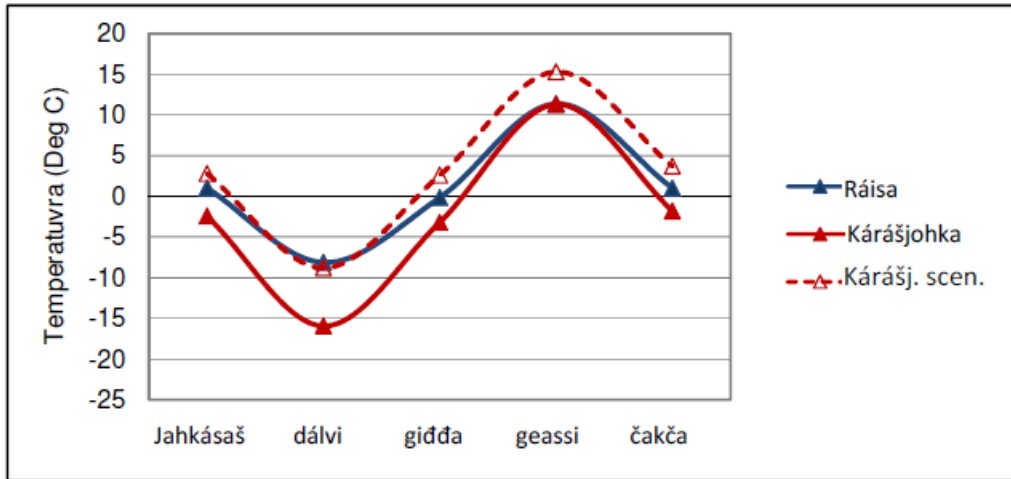


Govus 4: Rievdan das galle beaivvi lei áibmotempatuvra < -15 °C Guovdageainnus 1955 rájes ja B) variašuvdna das man ollu muohta lei Guovdageainnus 1995 rájes (Vikhamar-Schuler et al., 2010).

Čájehuvvo ahte lea negatiiva trenda das man galle beaivvi lei temperatuvra galbmasit go $-15\text{ }^{\circ}\text{C}$ dain mañemus 50 jagi, muhto ii leat čielga positiiva iige negatiiva trenda galbma áigodaga guhkkodagas (galle beaivvi lea temperatuvra vuollet $-15\text{ }^{\circ}\text{C}$) dan mañemus 100 jagis (Vikhamar-Schuler, *et al.*, 2010). Áibmotemperatuvra Guovdageainnus lea loktanán vuosttažettiin gidđat, seammás go arvi/muohta orru lassánan buot jagi áiggi (*ibid.*).

1.4.2 Einnostuvvon boahhteáiggi dálkkádagat Guovdageidnui.

Guovdageidnui lea einnostuvvon ahte dálvetemperatuvrrat boahhteáiggis (juovlamánu-odđajagimánu-guovvamánu) sáhttet loktanit eanet go $7\text{ }^{\circ}\text{C}$ jahkečuodi loahpaguvlui. Boahhteáiggi dálvetemperatuvrrat Guovdageainnus sáhttet šaddat seammá dássái go dálá temperatuvrrat leat mearariikkas (Ráissas) (Govus 5). Dálkkádatscenerijjat geažuhit dan guvlui ahte dálvetemperatuvrrat Guovdageainnus sáhttet loktanit $7 - 8\text{ }^{\circ}\text{C}$ (Benestad, 2011, almmuhuvvame) ja jahkásaš arvi/muohta-dilit sáhttet lassánit 5%, seammás go muohtaáigodat sáhttá oatnut ovttain mánuin (Engen-Skaugen, 2007).



Govus 5: Jahkásaš ja jagiáiggi gaskamearálaš temperaturvrrat 1961-1990 mihtiduvvon Sis-Finnmárkku (Kárášjogas) dálveorohagain ja mearariikkas (Ráissas) Finnmarkku geasseorohagain, (olles linját) ja seammá gaskamearálaš temperaturvrrat rehkenaston 50 vulosskalerejuvvin dálkkádatmodeallain jagi 2085 (stábat linjá) (Magga et al., 2011a).

2. TEOREHTALAŠ LAHKONANVUOGIT

2.1 Lingvisttalaš teorehtalaš lahkonañvuogit

Dutkama fágaidrasttideaddji fáddá eamiálbmotperspektiivvas duddjo eavttuid teorehtalaš lahkonañvuogiide. Vuolggasadji lea boazodoalu fágagiella bohcco ja muohttaga birra, ja movt muohtaterminologiiija geavahuvvo guođohettiin, movt boazovázzit gulahallet dáid birra ja movt jurddašit ja oidnet daid bohcco ja ealu ceavzima oktavuodas. Teorehtalaš lahkonañvuogit galggaše čilget fágagiella sániid birra, gielladiedalaččat, sániid kognitiivva beali birra ja sániid geavaheami birra boazodoallobirrasis. Dutkamis ovttastahtán gielalaš lahkonañvuogiid terminologiiija teoriija ja kultuvrralašlingvistihka ja dán vuodul analyseren dátaid. Mun deattuhan terminologiiija *terminologiiijaoahpa* mearkkašumiin mii lea oahppa movt sáhtta iešguđet fágasuorggi doahpagiid ja terminologiiijaid struktureret, ráhkadit, ovdánahttit, geavahit ja giedahallat (Myking, 2009). Gielalaš lahkonañvuogit sáhttet doarjut nubbi nuppi addin dihte minstariid ja ollislašvuodaid mat fas sáhttet ovdanbuktit dutkanfáttá

mihtilmasvuodaid. Dán oasis buvttán ovdan teorehtalaš lahkonanvugiid mat sáhttet čilget sámegiela muohtaterminologijja ja muohtadoahpagiid analiisa.

2.1.1 Sámeigiela terminologijja vuodđu

Nu go eará gielain ja kultuvrrain ge lea, de lea sámegiela ja sámii kultuvrra gaskkas nanu oktavuoha ja maiddái ealáhusaid ja sámegiela gaskkas leat nanu čanastaga go sámegiella lea sámii vuoddoealáhusain bargo- ja fágagiella (Helander, 1997:22). Kulturdoaba lea viiddis doaba mii ee. sisdoallá servodagaid daguid ja ipmárdusaid ja maiddái árvvuid ja árvvoštallamiid iežaset eallindilis mat čuožžilit olbmo eallimis. Kultuvra mii gullá muhtun fágasuorgái lea oassin kulturbirrasa árbbis ja daguin (Laurén *et al.*, 1997:15). Sámit leat dássážiin nagodan doalahit iežaset duhátjagiid boares árbevieruid meahcástemiin ja bivdoálbmogin mat leat dagahan ahte árbevirolaš máhttu dálkki ja dálkkádaga birra, luonddu ja elliid birra lea seilon otnážiin (Jernsletten, 1997).

Muohtaterminologijja geavahuvvo beaivválaččat dálvet, goitge luondduealáhusain, nugo boazodoalus (Eira *et al.*, 2011, sáddej. sisa). Sámeigiela muohta- ja jieknaterminologijja čilgehus addá systemáhtalaš dieđuid das makkárat muohta- ja jieknadilálašvuoddat leat. Sámeigiela muohtaterminologijjas muhtun muohta- ja jieknasámit daddjojot leat lihka boarrásat go sámegiella ja dáid geavaheapmi lea čuvvon buolvvas buolvii gitta dán áiggi rádjái (Roung, 1964; Jernsletten, 1997:234-36). Dat leat nie dološ tearpmat, maid ii leat vuogas njuolggut buohtastahttit ođđa ráhkaduvvon tearpmaiguin ođđa áššiid ja diŋggaid namahusaid váras.

Tearpmat ja frásat dahket fágagiela iešguđet fágasurggiin. Fágagiella lea giellahápmi mii gullá dihto fágii dahje máhttosuorgái ja maid fágageavaheaddjit geavahit (Store Norske leksikon) ja mat eai leat árgabeaivválaš gielas oassin. Sátnečoakkáldagat mat gullet dihto fágagillii definerejuvvojot terminologijjan (Sager, 1990; Laurén *et al.*, 1997:47). Fágagiela ovdánahttin lea terminologijja diedasuorggi vuolggasadji, ja tearpmat ovddastit

earenoamáš fágasuorggi doabavuogádaga (ISO, 1990). Danne go tearpmat leat dárkileappot sisdoalu dáfus go árgabeaivesánit, leat fágagiela gulahallamis stuorit gáibádusat go dábálaš giela gulahallamis. Jernslettena (1997:235) čilgehusa mielde leat sámiin máŋgga suorggi fágagielain spesialiserejuvvon tearpmat ja dajaldagat mat maiddái sisttisdoallet kulturárbevieru ja –dieđu sámiid ipmárdusas iežaset eallinbirrasis.

2.1.2 Giela ja terminologijja doaibma

Giella lea gaskaoapmi mainna olmmoš govvida iežas birrasa, daguid, biergasiid ja dáhpáhusaid jna. ja daidda ferte geavahit doahpágiid ja tearpmaid vai sáhtta mitalit nubbái maid oaivvilda (Eira *et al.*, 2010).

Terminologijjas lea gielalaš ja semantihkalaš vuoddu (Sager, 1990:1-2) ja maiddái mearkaoahppa nu movt maiddái lingvistihkas, semantihkas ja semiotihkas lea (Rey, 1995:25). Terminologijja lea vuosttažettiin leamaš reaidun eará surggiin, nu go ovdamearkka dihte fágalaš gulahallamis ja dokumentašuvnnas, jorgaleamis jna. Terminologijja teorijja ovdáneapmái leat máŋga diedasuorggi váikkuhan, nu go omd. lingvistihkka, logihkka, ontologijja, filosofijja, dieđa- ja informatihkkateorijja (Laurén *et al.*, 1997:26).

Gielas lea kognitiiva doaibma, seammás go das lea teakstagullelaš doaibma ja gulahallandoaibma (Temmerman, 2000:61). Kognitiivva bealis deattuhit deskriptiivalaš lingvistihka, namalassii čilget ja válddáhallat máhtu (ibid.), maiddái fágagielas (terminologijjas) lohket kognitiiva, lingvisttalaš ja sosiála beali (Rey, 1995:116). Myking (1996:115) ákkastallá ahte terminologijja lea gielladieđalaš suorgi mii organisere kognitiiva- ja kommunikatiivamáhtu.

Terminologijja njunuš dutkit Davviriikkain ee. Picht, Myking, Laurèn (Laurèn *et al.*, 1997) ákkastallet ahte terminologijja vuoddu lea geavahuvvon Aristoteles filosofijja ja semánttalaš ja struktuvrralaš fealtateorijja. Dán suorggis deattuhit disjunkšuvvna dahje earuheami ja doabarealisašuvvna synkrona dásis (ibid.). Palmer gis ovttahtta lingvisttalaš antropologalaš

teorijaid ja bidjá dasa kognitiiva lingvistihka osiid ráhkadit kultuvrralaš lingvistihkkateoriija. Son oaivvilda ahte earenoamáš dilálašvuodat oidnosiin dahket giela kognitiivamálliid. Dát dilálašvuodat čájehit ahte máilmmi oaidnu váikkuha vuoddomodeallaide dan ektui makkár gielat máilmmis leat minsttarin. (Palmer, 1996). Sihke kognitiiva- ja kultuvrralaš lingvistihkka geavahit mentála modeallaid, mat leat muittu jurdagat, dan birra movt áššit doibmet ja movt leat oktii čadnon čájehan dihte movt kognitiiva proseassat ráhkadit minstariid das maid jurddaša ja ipmirda. Mentála modeallain lea guovddáš doaibma ovddastit objeavttaid ja fenomenaid, čilget ášši ja namuhit dáhpáhusaid čájehan dihte movt máilbmi ipmirduvvo (Palmer, 1996). Mentála modeallat leat jurdaga muittut ja huksehusat das movt áššit doibmet ja movt gullet oktii. Kognitiiva dutkit leat dutkan mentála modeallaid ipmirdan dihte movt olmmoš diehtá, dovdá, mearrida ja láhtte iešguđet birrasiin. Dat sisttisdollet olbmo ipmárdusa áššiin ja váikkuhit dasa ahte olmmoš sáhtá einnostit bohtosiid iežas daguiguin. Dát leat ovttagardáneappot go dat duohtavuolta maid dinggat ja doahpagat ovddastit (Palmer, 1996:55-56). Berkes & Berkes (2009) ákkastallaba ahte eamiálbmogiid oktavuodas mentála modeallaráhkadeapmi čuovvu olbmuid hupmangiela minstariid, gielalaš ráhkaduvvon tearpmaid ja doahpágiid, ja dat sisttisoallá mentála proseassa, diehtočoakkáldagas doahpaga ráhkadeamis vurkema rádjái. Soai buktiba ovdamearkkaid inuihta servodaga mentála modeallain movt sii árvvoštallet elliid dearvvašvuoda ja kvalitehta, omd. dan mielde man buoidi/guoirras njuorju lea. Dáin árvvoštallamiin geavahit dávjjit gielalaš čilgehusaid go loguid dárkilisvuoda. Sii háreve ráhkadit lineáraoktavuodaid váikkuhusa ja šlájá gaskka, nu go oarjemáilmmi diehtagis dábálaččat dahket. Sii baicca empiralaččat gehččet birasrievdamiid ja dáidda gulli áicamiid. Inuihta máilmmigova mielde lea mánnálašvuolta ja jurdilkeahtesvuolta mii dahká ahte geavahit ovttagardánis ja generaliserejuvvon čilgehusaid kompleksa fenomenaide (ibid.). Jus visot holisttalaččat huksejuvvon doabarelašuvnnat galget spesifiserejuvvot, de olles jurddašeapmi šaddá ášši mii lea veadjemeahtun hálddašit. Orru leamen oktasaš gaskavuolta gaskkal vuogádaga

kompleksitehta ja definišuvnna dárkilisvuoda, mas sáhtta leat jierpmálaš čilgehus (Berkes & Berkes, 2009:7-8). Mađi eanet geahčada gielaid, dađi čielgaseappot oaidná man olu biras, dilli ja dárbu váikkuha doahpagaidd ásaheapmái (Magga, 2004), mii lei maidđái Sapir ja Whorf oaidnu, geat ráhkadeigga hypotesa mii lea čadnon lingvisttalaš realismii. Soai oaivvildeigga ahte giella lea jurdaga eaktun ja ahte olbmot oidnet máilmmi iešguđet ládje dan mielde makkár giella sii hupmet, danne go sii mearridit ja klassifiserejit máilmmi daid kategoriijaid mielde mat leat iežaset gielas (Sapir, 1968).

Mentála modeallaid čilgemis eamiálbmotperspektiivvas namuhuvvo sulaid meroštallan ipmárdus (eng:fuzzy logic) mii lei álggus introduserejuvvon matematihka lahkonemiin, man ulbmil lei dahkat vejolažžan nagodit giedahallat kompleksa vuogádagaid (Berkes, 2008; Berkes & Berkes 2009). Sulaid meroštallan ipmárdusa oktavuodas eai dárbbas áššit leat dárkilit definerejuvvon dahje kvantifiserejuvvon ovdal go sáhtta daid gohčodit matematihka áššin. Dieđut leat klassifiserejuvvon viiddis kategorisašuvdnačoahkkin dahje joavkun, mat sáhttet govvidit movt olbmo jierbmi doaibmá. Vuodđun lea ahte deháleamos elemeanttat olbmo jurddašeamis eai leat logut, muhto gilkorat, main leat sulaid meroštallančoahkit (Zadeh, 1973:28; Berkes & Berkes, 2009:7-12). Sulaid meroštallan ipmárdusas leat golbma dovdomearkka: 1) geavahit gielalaš variábeliid ovdalii lohkovariábeliid, 2) karakteriseret dahje defineret eaŋkilis variábeloktavuodaid sulaid meroštallamiin, ja 3) karakteriseret kompleksa oktavuodaid sulaid meroštallan algoritmmaiguin. Ovdamearkka dihte leat ”buidi, guoirras, ruoinnas” gielalaš variábelárvvut das man buoidi juoga lea (Berkes & Berkes, 2009:9). Dát dovdomearkkat leat maid boazodoalu muhtakarakteriseremis, mas omd. geavahit dajaldagaid *assás geardni* dan sadjái go dárkilis mihtidemiin, ahte lea omd. *10 cm geardni* (Eira *et al.*, 2011, sisa sáddejuvvon).

Berkes & Berkes (2009) oaivvildeaba ahte nu go olbmo jierbmi dahká, sulaid meroštallan ipmárdus maid čohkke oktii kategoriijaid mielde

relaterejuvvon objeavttaid nu ahte unnida kompleksitehta go áššiid galgá árvoštallat. Sulaid meroštallan ipmárdus lea veahkkin go galgá klassifiseret dieđuid hui viiddis ja mánggabealat kategoriijaide dahje joavkkuide. Maiddái Halfpenny & Ozanne (1989:38) namuheaba movt eamiálbmogat (indiánat ja inuihtat) geavahit giela dárkilit čilget muohtadiliid mat sáhttet leat sidjiide várálažžan. Soai čálliba ahte eamiálbmogat eai geavahan loguid čilgedettiin, muhto sin rikkis doabačoakkáldat attii vejolašvuoda čilget, sihke odđa ja nuppástuvvon muohtašlájaid ja muohtadiliid. Seammá dilli lea boazovázziin, go sii han gozihit ollu variábeliid go guođohettiin ealu fertejit oktanaga geahččat ja gozihit omd. movt eallu láhtte, makkárat bohccot leat, makkár temperatuvra lea, man lávttas olgun lea, guđe guovllus bieggá bossu jna. Dát lea oassi sin mentála modeallas, mas váldonjuolggadus lea iskat ealu ravddaid ja man garas muohta lea (Eira *et al.*, 2011, sisa sáddejuvvon).

Terminologiiijas lea dehálaš doaibma gulahallama oktavuodas. Gulahallan earenoamáš fága sisdoalus, gáibida ahte ságastallit dovdet fága gullelaš doahpagiid ja dása dárbbahuvvojit terminologiiija ja tearpmat. Olbmuide geaidda fágasánit ja -dajaldagat eai leat oahppásat, sáhtta leat váttis ipmirdit ságastallama sisdoalu. Nils Isak Eira (1994:23) čállá ahte boazodoallu lea huksejuvvon nu ahte siiddas fertejit siidaguimmežagat gulahallat ja hutkat ráddálagaid vai siidadoallu lihkestuvvá, ja nu lea ge ipmirdeapmi, gulahallan ja máhttin nu dehálaš. Guođohanbarggus leat boazosáгат hui guovddážat (Sara, 1990:92) ja dain ságain geavahuvvojit boazodoalu fágatearpmat gulahallet ealu, guohtuma, bohccuid ja eatnamiid birra. Dása maid gullá dárkilit čilget ja bagadallat sihke bohcco, eatnamiid- ja luonddudiliide mat ain čuožžilit. Oahppan boazosápmelaš sáhtta mottiin sániin čilget hui dárkilit nubbái omd. guohtundilálašvuodaid birra, mihtilmas bohcco birra jna. ja maid eará áššiid oktavuodas (Eira, 1994). Eira oaivvilda ahte mávssoleamos lea dieđuid sisdoallu, ii ge nu ollu diehtohivvodat, son dadjá “ii leat sáhka man ollu sániid ja čilgehusaid dahje bagadusaid buktá nubbái, muhto man ollu diehtu čujuhusain lea” (*ibid.*).

2.1.3 Doahpagat

Doahpagat leat mentála dahje logalaš duohtavuoda ovddasteamit, mat ráhkadit vuogádaga olbmo jurdagii man vuodul sáhtta klassifiseret ja ipmirdit dan maid jierbmi áicá (Antia, 1999).

Iešguđet suorggi lingvisttat leat ollu digaštallan movt sáhtta čilget doahpaga sisdoalu ja movt dan sáhtta iskat. Dás lea sáhka sis geat čuvvot árbevirolaš terminologiija diehtaga vugiid ja nuppe bealis sis geat deattuhit giela kognitiiva ja kultuvrralaš beali. Temmerman (2000), gii lea dutkan biologiijasuorggi teavsttaid, oaivvilda ahte árbevirolaš terminologiija (eng: Traditional terminology) prinsihpat ja metodat eai váldde vuhtii dan ahte terminologiijas lea dehálaš doaimma kommunikatiiva ja kognitiiva dilálašvuodain. Su oaivila mielde árbevirolaš terminologiijain gáibida metodaidd maiguin sáhtta guorahallat ja čilget buot beliid mat leat dehálaččat fágagiela ipmirdeami proseassas (Temmermann, 2000:220-221).

Terminologalaččat definerejuvvon doahpaga sáhtta buohtastahttit semánttalaš struktuvrrain, mas semánttalaš dovdomearkkat leat seamma go doahpaga sisdoallu (Laurén *et al.*, 1997:76). Dutkit definerejit *doaba*-doahpaga mángga ládje, muhto guovddáš dáin definišuvnnain lea ahte doaba unnimusat guoskkaha sáni čilgema kognitiiva beali. Magga (2007) dadjá ahte doaba lea juoga maid olmmoš govvida jurdagiin ja man olmmoš navdá gullat oktii dainna lágiin ahte dasa dárbbáša ja heive bidjat namahusa. Terminologiija riikkaidgaskasaš standárdis daddjo ahte doaba lea jurdaga ovttadat mii lea ráhkaduvvon objeavtta dahje objeavttaid klássa dovdomearkkaid iešvuodaiguin (ISO, 1990). Dan sáhtta karakteriseret fenomenan (duohtamáilmmi oassi maid áigu čilget), ipmárdussan dahje jurddan. Temmerman (2000:42) gohčoda doahpaga ipmárdusa ovttadahkan (eng: unit of understanding). Doahpágiin leat dovdomearkkat (eng: characteristic) (Suonuuti, 2008), mii mearkkaša ahte doahpaga dovdomearkkat dat dahket doahpaga. Dovdomearkkat leat vuodđun definišuvnna ráhkadeamis (Picht & Draskau, 1985).

2.1.4 Doabaanaliisa ja kategoriseren

Doahpaga sisdoalu sáhttá čilget definišuvnnain (Laurén *et al.*, 1997:107). Doahpaga njálmmálaš ja/dahje čálalaš definišuvdna lea veahkkin ráddjeme nuppi doahpaga nuppi lagas doahpagis (Suonuuti, 2008:15). Go galgá defineret leksikála ovttadaga mearkkašumi, dárbbášuvvo definišuvdna mii addá gáržžimus ja deháleamos dieđuid doahpaga birra (Temmerman, 2000:83). Definišuvnna doaibma lea čájehit gokko doahpaga sadji lea doabavuogádagas. Dan dahká go bidjá doahpaga bajit dásái nuppi doahpaga ektui ja dasa leat biddjon dárbbalaš ja doarvái dovdomearkkat mat čuldet ja earuhit doahpaga eará doahpagiin doabavuogádaga horisontála dásis (*ibid.*). Definišuvdna veahkeha čájehit doahpaga oktavuodaid ja čanastagaid eará doahpagiidda.

Fágadoahpagiid sáhttá omd. analyseret terminologalaš metodaiguin ja mearridit doahpaga dovdomearkka ja guorahallat dan relašuvnnaid ja oktiigullelašvuodaid seammá fágasuorggi doahpagiiguin. Nuopponen (1994:30; 1996:171) oaivvilda ahte juohke doahpaga galgá sáhttit bidjat doabavuogádahkii nu ahte buorebut sáhttá struktureret fágasuorggi, ja dakkár vuogádatjurdda lea strukturalisttalaš (saussuralaš ja wüsterlaš) vuoiŋgas (Laurén *et al.*, 1997:113-14).

Terminologiiija bealis galgá doahpagis leat tearbma dahje namahus man mearkkašupmi lea dárkil, ja buoremus livččii ahte definišuvdna mearrida tearpma mearkkašumi nu ahte dainna sáhttá identifiseret ja ipmirdit (Wüster, 1985:7), muhto Temmerman (2000:81) gis oaivvilda ahte ii soaitte vejolaš addit čielga, ovttageardánis doabastruktuvrra ja mas lea definišuvdna mii fátmasta daid dárbbášlaš ja viidosaš dovdomearkkaid mat earuhit doahpaga eará doahpagiin. Doabavuogádat lea vuogádat mas doahpagat ráhkadit ollislašvuoda. Terminologiiija teorijja vuoddojuordaga mielde ii sáhte ovttaskas doahpaga guorahallat sierra ovttadahkan, muhto dat ferte leat iežas doabaoktavuodas ovttas eará doahpagiiguin (Picht & Draskau, 1985:62; Laurén *et al.*, 1997). Doahpagat

sáhttet leat iešguđet doabavuogádagain dan mielde makkár oktavuodát leat doahpagiid gaskkas (Nuopponen, 1994:237).

Go lea hubmu kategoriseret ovttaláganvuoda oktavuodaid, de kultuvrralaš lingvistihkas geavahit doahpaga *viiddideapmi* (eng: extension) (Palmer 1996:78). Terminologijja diehtagis maid geavahit dán seammá tearpma seammá sisdoaluin, namalassii *doahpaga viidodaga*, mii namuha buot dovdomearkkaid mat gullet doahpagii, dávjá čájehuvvon listun (Laurèn *et al.*, 1997:115; Suonuuti, 2008). Vuostetearbma dása lea *čiekjudeapmi* (eng: elaboration), mii čujuha kategoriseremii mii lea ollislaččat nannejuvvon bajitdási šemáhta mielde (Palmer, 1996:92). Terminologijjas gohčodit vuostetearpma *doahpaga sisdoallun* (eng: intention), mas earuhit doahpaga mihtilmasvuoda ja earuheaddji dovdomearkkaid eará doahpagiid ektui (Laurèn *et al.*, 1997:116; Suonuuti, 2008:23). Terminologijja oktavuodas geavahuvvojit dát doahpagat definišuvnna ráhkadeami oktavuodas.

Máhtu sáhtta kategorijjavuogádagaiguin organiseret (Davidson, 1984:182). Nuopponen ákkastallá ahte jus áigu ovdan buktit olbmo máhtu, mii dihto fágasuorggis lea ráhkaduvvon ja ovdánahtton, de ferte defineret suorggi doahpagiid ja doahpagiid oktavuodaid, maid gohčoda doabavuogádahkan. Hierárkkalaš doabaanaliisa veahkeha fievrredit jurdagiid nubbái, gulahallat earáiguin iežas jurdagiid birra (1994:36). Doabavuogádagat dahje -ortnegat leat dego kárttat mat čájehit mas “máilbmi” lea ráhkaduvvon ja movt dat heivejit oktii.

Terminologalaš árbevierus heivehit doahpaga doabastruktuvrii, mii mearkkaša sullii seamma go kategoriseret. Dát doabastruktuvra lea logalašvuđot struktuvra, mii čájeha ahte x lea muhtunlágan šládja y :as dahje ontologalaš klassifikašuvdna (x lea oassi y :s). Sosiokognitiiva terminologijja mielde lea ipmárdus mii hukse kategoriija ja juohke kategoriija ipmárdus lea kognitiiva modealla siste (Temmerman, 2000:224). Doahpagat dahket kategoriserema vejolažžan ja ráhkadit dieđuid ovttaskas kategoriija guoski máhttoovttadagaid

birra (Cruse, 2004:127). Temmerman (2000:65) oaivvilda ahte kategoriijat leat mentála ipmárdusa ovttagat ja ahte ipmárdus lea vásáhusvuđot ášši huksejuvvon ovdalaš máhtu nala.

Klassifiseremiin gis sáhtta ásaht systemáhtalaš oppalašgeahčestaga mii čájeha iskojuvvon ášši ovttalágan- ja mánggaláganvuđaid (Nuopponen, 1994:33). Eamiálbmogiin muohta- ja jiekŋaterminologijat leat iešguđetláganat klassifikašuvnna ja kategoriijaid dáfus. Omd. Northwest Territory Slave indiánat geavahit jiekŋataksonomiija árvoštallat vánddardandiliid. Sis leat 13 kategoriija juhkkujuvvon golmma jovkui: nanu jiekŋa, jiekŋa mii suddá ja ráhkan jiekŋa. Dát 13 doahpaga eai eat sierra sánit, muhto deriverejuvvon eaŋkil ruohttasit (Silver *et al.*, 1997:72-73). Muhtin jiekŋašlájat leat buorit vánddardeapmái iešguđet vánddardandiliin, ja muhtun jiekŋašlájaid dahket ahte ii oba sáhte ge vánddardit ja muhtun šlájain sáhtta vánddardit. Sin ipmárdusa mielde leat 39 dakkár dilálašvuoda ja juohke dilálašvuodas leat golbma vejolaš lahkoneami: 1) rasttidit jieŋa, 2) garvit rašes jieŋaid 3) várrogasat vázzit ja iskat jieŋa (*ibid.*). Dán kategoriserema sáhtta buohtastahttit sámegiela muohtaklassifiserema osiiguin, mat gullet jiekŋahámiide, nugo dasa masa omd. *cuoŋu-*, *moarri-* doahpagat gullet (mielddus 1).

Temmerman (2000) deattuha ahte ferte dohkkehit ahte doahpagat sáhttet leat veahá eahpečielgesat ja rájeheamit, nappo ahte eat mii sáhte ipmirdit doahpagiid doarvái dárkilit juohke dilis, mii lea ge lunddolaš giela iešvuohka. Ja nu ii sáhte vuordit hui čielga rájiid.

Sámegiela muohtaterminologijja analiissas ferte vuhtiiváldit fágagiela vuolggasaji njálmmálaš árbevierus ja mii ii oba soaitte ge gávdnot čállojuvvon hámis ja maid ii leat báljo vejolaš viežžat teakstačoakkáldagain dahje korpusiin. Temmerman čilge movt son lea bargan doahpagiiguin iežas dutkansuorggis, ahte son lea teavsttain čoaggán gustovaš fágasuorgesániid, maid de lea ráhkadan listun (Temmerman, 2000:226). Terminologijja sáhtta geavahit reaidun mainna ovdanbuktá doaba- ja doabavuogádaga oppalašgeahčestaga (Nuopponen, 1997)

ja kognitiiva lingvistihka vuodul fas sáhtta iskat kognitiivva struktuvrraid, nugo iskat movt ja makkár govvideamit sáhttet gullat iešguđetlágan mentála modeallaide.

2.2 Diedalaš lahkoneapmi muohttaga ja boazodoalu ektui

2.2.1 Muohta ja dan dovdomearkkat ja dan meakkašupmi dálveekologijii

Máilmmi galbma guovlluin gokčá muohta luonddu (eatnamiid ja šattuid) stuora oasi jagis. Muohttaga váikkuhus dálkkádatvuogádahkii, muohttaga variabilitehtii ja rievdamii leat stuora váikkuhusat luonddu ja olmmošlaš vuogádagaide (Armstrong & Brun, 2008:6). Eanantemperatuvra ja eatnama lahka suddan/galbmonproseassain lea stuora váikkuhus ekovuogádaga diversitehtii ja produktivitehtii (ibid.).

Diedalaš muohtadutkama oktavuodas earuhit muohttaga mii lea atmosfearas ja mii lea eatnama nalde. Muohta ja muohtagovččas³ lea huksejuvvon feara makkár muohta- ja jieknagerddiin, main leat iešguđet assodagat, garasvuohta ja šládja jna. (Pruitt, 1979, Colbeck *et al.*, 1990; Fierz *et al.*, 2009).

Muohttagis lea kompleaksa struktuvra, mii ovtatládje rievdá (Armstrong & Brun, 2008:13; Brattlien, 2008:59). Muohta lea čáhci ”fásta hámis”. Muohtafysihkas muohtačalbmi lea partihkal muohtagokčasis, mii lea mekánalaččat sierranan (LaChapelle, 1992:5). Kristállat, mat dahket muohttaga, leat jieknakristállat mat balvvas šaddet. Áibmu, temperatuvra ja hápmi váikkuhit kristállahámi ja –šlája rievdamii dađi mielde go dat gahččá eatnama guvlui (Halfpenny & Ozanne, 1989:38; Lied & Kristiansen, 2003:39; Landrø, 2007:37). Go áibmotemperatuvra njiedjá vuollelii go 0° C, de rievdá liiggás čáhci jieknakristállan. Mađi vuolit temperatuvra lea, dađi eanet jieknakristállat šaddet (ibid.). Buot jieknakristállat leat gudačiegagat, muhto rivdet ain lievddi ja

³Gerddiid mielde muohta eatnama nalde (Hestnes *et al.*, 2010)

temperatuvrra mielde. Gávdnojit duháhiid mielde iešguđetlágan kristállahámit, muhto dábálemosat leat hámit mat leat dego násttit, pláhtat ja nálut, muhto buot dábálemos muohtakristálla lea guđačiegat nástehámat kristálla (Lied & Kristiansen, 2003:41; Landrø, 2007:35). Ii oktege kristálla leat nuppi kristálla lágan (LaChapelle, 1992:3).

2.2.2 Muohttaga nuppástuvvan

Muohtadutkit juhket muohttaga golmmaláganin: 1) muohtti muohta, 2) muohta, mii lea eatnamis ja 3) muohtagierraga jiekŋašlájat. (Halfpenny & Ozanne, 1989:38-40). Áibmotemperatuvra, áibmolákta, bieggá ja suonjardeapmi váikkuhit dasa ahte muohtakristállat nuppástuvvet dan rájes go ollejit eatnama nala (Halfpenny & Ozanne, 1989:41; Armstrong & Brun, 2008:27). Dát nuppástuvvan gohčoduvvo metamorfosan, mii álgoálggus lei geologijafága tearbma ja man sisdoallu lea struktuvra-nuppástuhttin lieggasa dahje deattu dihte (LaChapelle, 1992:3). Muohtadutkit earuhit goike ja njuoska muohttaga (Armstrong & Brun, 2008:27) ja ahte leat unnimusat njeallje iešguđetlágan proseassa mat nuppástuhttet muohttaga: destruktiivannuppástuhttin, konstruktivannuppástuhttin ja suddan-/galbmanmetamorfosat ja sinteren. Dát proseassat sáhttet dáhpáhuvvat vaikko oktanaga (Armstrong & Brun, 2008; Jaedicke, 2009). Golbma vuosttaš nuppástuvvama dáhpáhuvvet goike ja galbma muohttagis ja njealját fas njuoska muohttagis (Brattlien, 2008:60). Goike muohta definerejuvvo muohtan, mas ii leat golgi (eng: liquid) čáhci ja njuoska muohttagis lea eambo go 0,1 % golgi čáhci voluma ektui (Armstrong & Brun, 2008:27-28).

Destruktiivannuppástuhttinproseassa gohčoduvvo proseassa mii rievdata guđačiegat kristálla kristállan mii lea jorbaseabbo ja unnit go álggus lei. Destruktiivannuppástuhttinproseassa dáhpáhuvvá go temperaturerohus muohtagierraga ja botni gaskka lea unni, ja go temperatuvra lea vissis mearis, 0 °C gitta sullii –8 °C. Dákkár dálkediliin rievdá muohtakristálla hápmi, nástesággegeažagin jorbejuvvon kristállan. Muohtakristállaid hápmerievdan

dagaha ahte muohta deakčasa ja nu lasmmiha, ja kristállat darvánit bures gittalaga. Dákkár muohta sáhtta šaddat hui garas⁴; 300kg/m³. Muohttaga luotkkusvuohta sáhtta unnut sullii 65 %, muhto dattege lea muohttagis eanet áibmu go jiekŋa rehkenaston voluma mielde (Halfpenny & Ozanne, 1989:43; LaChapelle, 1992; Lied & Kristiansen, 2003:50-51; Landrøe, 2007:36-37).

Konstruktiiuanuppástuhttinproseassa dáhpáhuvvá go temperatuvrra erohus muohtagierraga ja botni gaskka lea stuoris. Bodnetemperatuvra sáhtta leat lahka 0 °C vaikko muohtagierragis lea mihá galbmasit. Dás lea sáhka temperatuvrigradieantta birra, nappo man stuora temperaturerohus lea vissis mearis muohttaga gassodaga ektui (° C/m) muohtagierragis bodnái. Muohtagokčasis mihtiduvvo temperatuvra muohtagierragis bodnái, eatnama rádjái, mii čájeha muohtagradiantta, go grádieanta lea unni, de lea omd. -1 °C/m ja go lea stuora grádieanta, de lea -25 °C/m. Konstruktiiuva nuppástuhttinproseassa álgá go grádieanta lea -10 °C/m (Hetsnes *et al.*, 2010). Go temperatuvrigradieanta muohttagis lea sullii -10 °C juohke mehteris, de liegga áimmus lea eanet čáhcelievdi go galbma áimmus, mii dagaha ahte *deaddodássi*⁵, lea stuorit botni lahka go galbmasit muohttagis mii lea dan bajábealde ja nu čáhcelievdi sirdašuvvá vuollin muohttagis bajásguvlui. Dán proseassas nuppástuvvet kristállat jorbalágan hámis hápmin mas leat jalges, bastilis ravddat. Dát kristállat šelgot jus geahččá čuovgga vuostá. Muohtakristállat sturrot ja šaddet njealječiegatláganin, ja sáhttet stuorrut 2-3 mm rádjái (Halfpenny & Ozanne *et al.*, 1989:43; LaChapelle, 1992:18; Lied & Kristiansen, 2003:53-55; Landrøe, 2007:39-40). Go muohtagiera galbmo, de šaddet njealječieगत kristállat muohtagierragii. Vaikko beaivet lea ge destruktiiuva nuppástuhttin, de ii nagot dat bissehit nuppástuhttima. Mađi guhkit dát proseassa bistá, dađi assát šaddá dákkár geardi (Landrøe, 2007:40). Muoraid ja geđggiid birra, maid muohta lea joavgadan, šaddá muohttagii dávjá goavdi.

⁴ Deaškatvuohta mihtiduvvo man ollu mássa volumas lea, dábálaččat kilográtma kubihkkamehtera mielde (kg/m³)

⁵ Mii mearkkaša ahte muhtun temperatuvrradásis lievde- dahje gássadeaddu lea dássálaga lievdefásas, golgifásas dahje fástafásas (snl.no)

Dákkár sajít addet dáidda kristállaide vejolašvuoda stuorrut. Ja jus lea unnán muohta ja buolaš áibmu, de sturrot dat hui jođánit, muohta nuppástuvvá jođánit seanjážin (seakŋu). Guhkilmas buollašat sáhttet seakŋudit olles muohtagokčasa (Lied & Kristiansen, 2003:54-55), mii mearkkaša ahte dákkár muohta lea luotkkus.

Suddannuppástuhttinproseassa dáhpáhuvvá go temperaturvra muohttagis šaddá badjel 0 °C. De suddagohtet jieŋakristállat ja njuoskadit muohttaga. Beaivváš, temperaturvra, alla áibmolákta ja arvi mearridit goas dát proseassa doaibmagoahtá. Go muohta suddá, de juohke kristálla birra šaddá čáhci mii doalvu suddančázi kristálla gežiin kristállarokkiide. Go hui garrasit suddá, de kristálla hápmi šaddá measta jorbbasin. Jus de fas galbmá, de dat fas čatnasit oktii ja muohta/muohtagiera šaddá hui garasin (Halfpenny & Ozanne, 1989:48; Lied & Kristiansen, 2003:55-56; Landrøe, 2007:37-38).

Sinteren lea nuppástuhttinproseassa mas molekyloid sirdin dagaha ahte kristállat galbmojit oktii vaikko muohta ii leat suddan. Kristállat leat nu lahkalaaga ahte laktásit oktii danne go daidda šaddet jieŋačanastagat dakko gokko leat laktojuvvon oktii. Mađi unnibut kristállat leat, dađi eanet jieŋačanastagat leat voluma-ovttadagas. Ovdal go sinteren-nuppástuhttin álgá, de lea muohta oalle luotkkus, earenoamážit go lea muohtán, go bieggá ii leat vel váikkuhan dan. Dađi mielde go jieŋačanastagat šaddet, de garra muohta, ja šaddá hui nanus. Guoldun leat kristállat hui unnit, diamehtara mielde lea unnit go 0,5 mm (Halfpenny & Ozanne, 1989:45; Lied & Kristiansen, 2003:53-54).

Dábálaš gielas *muohta*-tearpma sisdollui gullet maiddái muohtagierragii šaddan jieŋahámit, maid ekologat atnet hui dehálažžan (Halfpenny & Ozanne, 1989:38). Jieŋagearddit leat šaddan golmma ládje; biekká fierahemiin, beaivváža liggemiin (suddamiin/galbmimiin) ja arvvi maŋis galbmimiin (Halfpenny & Ozanne, 1989:49). Go muohtá iešguđetlágan dálkin, de dat čuohcá muohtagierragii, muhto maiddái muđui muohttagii, danne go odđa

vahca gokčá gearddi mii lei muohtagierragis ja nu šaddet muohtagii gearddit (Brattlien, 2008:27).

2.2.3 Muohttaga klassifiseren

2.2.3.1 Muohtafysihkka-vuđot muohtaklassifiseren

Muohtadutkamis leat ráhkadan iešguđetlágan klassifikašuvnnaid mat čilgejit iešguđetlágan muohttaga. Muohttaga leat klassifiseren muohtafysihka mielde (Colbeck *et al.*, 1990; Fierz *et al.*, 2009). Riikkaidgaskasaš klassifikašuvdna man mielde sáhtta juohkit iešguđet áiggi muohtašlájaid mat lea eatnama nalde, lea okta dain boarráseamos muohtaklassifikašuvnnain, mii aittobáliid lea ođastuvvon (Fierz *et al.*, 2009). Klassifikašuvnna ulbmil lea ráhkadit vuodđorámmaeavttuid muohttaga birra muohtakristálla hámi ja sturrodaga kvalitatiiva čilgehusaid mielde (Armstrong & Brun, 2008:21) ja maiddá ahte feara makkár geavahanjoavkkut sáhttet ávkkástallat das, dutkiid rájes čuigiid rádjái. Dat lea ráhkaduvvon nu ahte eanas observašuvnnat sáhttet čadahuvvot eaŋkilis rusttegiiguin dahje dušše áicamiin (Hestnes *et al.*, 2010:2). Klassifikašuvnnas juhket *muohtti muohttaga* ovcci kategorijai muohtahámi mielde (morfologalaš klassifikašuvdna). Das lea maid proseassavuđot klassifikašuvdna ja dasto vel liigedieđut das makkár fysihkalaš proseassat dahket šlájaid ja man nanus dán šlájat muohta lea (Kristensen, 2007; Fierz *et al.*, 2009).

2.2.3.2 Árbevirolašmáhtu-vuđot muohtaklassifiseren

Maiddá sámegiela muohtasániid sáhtta klassifiseret. Israel Ruong (1964:76-77) čulddii muohtatearpmaid faktoraid ja gihpuid mearkkašumi mielde ja juogi ovcci kategorijai: 1) muohtahivvodat (man ollu muohta lea), 2) muohttaga konsisteansa, 3) movt muohta guoddá, 4) siivu, 5) oppas ja luottat muohttagis, 6) ritni ja čoddi (muorain ja dinggain), 7) suddan ja bievlan, 8) muohtadielkkut geasset ja 9) iešguđetlágan dási dálveguohtundilálašvuodát.

Ruong čilgii muohttaga ekologalaš perspektiivvas ja bijai iskama rámma ekologiiija aspeavtta mielde, go čanai organismmaid oktavuodaid birrasii, elliid ja šattuid oktavuhtii, ja lassin vel dálkkádahkii, bibmosii ja eatnamii. Son suokkardalai olbmo ja bohcco gaskavuodaid, eatnama ja olbmo gaskavuodaid ja bohcco ja eatnama oktavuodaid (Ruong, 1964). Dán seammá klassifikašuvnna mielde leaba maiddái Svonni (1981) ja Jernsletten (1994) čilgen sámegeiela muohtaterminologiiija.

Svonni lea čájehan ahte dálketearpmain lea maid hui čielga specialiserendássi, mii fas čájeha ahte sámi álbmogis leat čiekŋalis diedut ja máhttu dálkkádagaid ja dálkkiid birra (1981:6-13). Son leage čállošis čilgen sihke dálke- ja muohtaterminologiiija. Dálkki čilge muohttimiin, biekkain, temperatuvrrain (Svonni, 1981). Svonni (1981) čájeha iežas dálketearbma-oppalašgeahčestagain ahte leat hui ollu doahpagat mat gullet dálkeproseassaide, nugo muohtti-proseassat ja biekkaproseassat main lea váikkuhus muohttagii ja maid doahpagiid main lea temperatuvrrafaktor mielde.

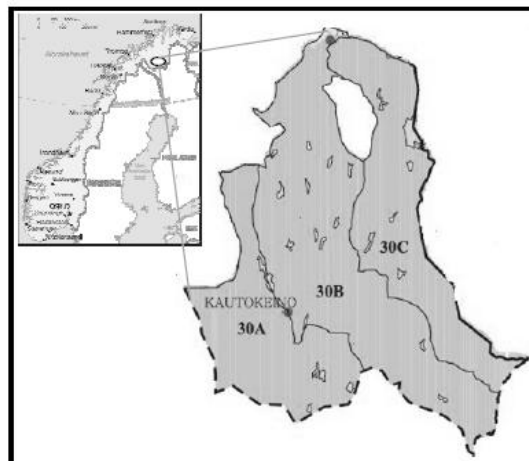
Doabaanaliissa vuodul, mainna lean iskan muohtadoahpagiid muohtafysihka ja strategalaš dovdomearkkaid, sáhtta fuomášit doahpagiid dárkilisvuodaid mat geavahuvvojit boazodoalus (Eira *et al.*, 2011, sáddejuvvon sisa). Dáidda máhcan fas 4. kapihttalis.

3. METODOLOGIIJA

Dutkama vuolggasadjin lea lingvistihkalaš ipmirdanvuogit, nappo muohtaterminologiiija suokkardallan sisdoalu ja geavahusa dáfus boazodoalus. Barggus lea leamaš dárbu geavahit máŋggalágan metodaidda oažžun dihte dieđuid iešguđetge beliide.

3.1 Dutkanguovlu

Prošeavtta dutkan lea čadáhuvvon Guovdageainnu dálveorohagain, Oarje-Finnmárkku boazodoalloguovllus (govus 6). Oarje-Finnmárkku boazodoalloguovllu ollislaš areála lea sullii 24 400 km² ja mas leat Finnmárkku oarjjabealli ja Romssa fylkka davimus guovllut mielde. Guovdageainnu ja Kárášjoga suohkanrádji earuha Oarje-Finnmárkku ja Nuorta-Finnmárkku boazodoalloguovlluid.



Govus 6: Oarje-Finnmárkku boazodoalloguovlu, dálveorohagat, juhkkon golbman johtolahkan.

3.2 Dátaid čilgehus

Dátačoahkkaldagas leat jearahallamat, govat, videobáddemat, guođohanbeaivegirjjit, muohta- ja temperatuvrramihtideamit (tabealla 1).

Tabealla 1: Dutkanmetodaidda geavaheami oppalašgeahčestat

| Dutkanoassi /Dátaid háhkan | Čohkkenmetoda |
|---|--|
| Boazodoalu muohtaterminologiiija | Jearahallan ja báikegodde-vudot bargobájit |
| Muohtaterminologiiija geavaheapmi beaivválaččat | Báikegodde-vudot gozihanvuogádat mas geavahit beaivegirjji. |
| Muohtadoahpágiid ovttaštáhtin muohtafysihkain | Muohtamihtideamit Temperatuvrramihtideamit |
| Dálke- ja muohtaobservašuvnnat | Beaivegirjjit |
| <i>Dátaid analiisa</i> | |
| Muohtadoahpágiid čohkket ja daid sisdoalu čilget. | Čohkket muohtatearpmáid jearahallamiin, listtuin, čállosiin. Ráhkadit muohtatearbmálisttu. Doaba-analiisa ja kategoriseren. Muohtafysihkka Govat |
| Muohtadoahpágiid geavaheapmi | Beaivegirjeanalyseren ovttas meteorologalaš dieđuiguin ja muohtamihtidemiiguin. |
| Registreret boazovázziid vásáhusaid ja ipmárdusa dálkkádatrivdamiid birra, sin heivehanmekanismaid ja sin ipmárdusa ja árvvoštallamiid mii dagaha riskkaid. | Jearahallamat ja beaivegirjeanalyseren. |

Dátaid čohkken lea čađahuvvon semi-struktuvrralaš jearahallamiiguin oažžun dihte dárkilis dieđuid ja čiekŋalit ipmárdusa muohttaga ja guohtundilálašvuodaidd birra. Semi-struktuvrralaš jearahallan lea vuohki mii lea gaskkal struktuvrralaš jearahallama ja luovos jearahallama. Dán barggus geavahuvvo rabas, ráhkkanuvvon, njálmmálaš jearahallan (Dalen, 2004). Jearahallamat ledje sámegillii. Krupnik earáiguin oidne dehálažžan geavahit jearahallamiin dan giela maid olbmot, geaid áiggui jearahallat, hupme (Krupnik *et al.*, 2010).

Jagiid 2007-2009 jearahallojuvvojedje 34 olbmo ("Ceavvi" prošeavttas, mielddus 2). Jearahallamat transkriberejuvvojedje sánis sátnái čállingiela mielde. Dutkamii leat gártan 800 siiddu transkripšuvdna.

Siiddaid beaivválaš muohtaterminologija geavaheapmái leat ráhkadan metoda mas siiddat ieža čálle beaivegirjjiide iežaset gozihanáicamiid. Go muohtadoahpágiid leat ovttahtán muohtafysihkain, de dasa leat sámegiela muohtadoahpágiid dieđuid kombineren muohtamihtidemiiguin, temperatuvrramihtidemiiguin, dálke- ja muohtaobservašuvnnaiguin ja beaivegirjjiiguin (Eira *et al.*, 2010; Eira & Mathiesen, 2011, manus; Eira *et al.*, 2011, sáddejuvvon sisa). Guođohanbeaivegirjjiid analiissain (Eira & Mathiesen, 2011, manus) lean ožžon dieđuid boazovázziid guođoheami vásáhusain dálvemáilmmis, sin heivehanmekanismmaid ja sin ipmárdusaid ja árvoštallamiid mat sáhttet dagahit riskkaid ellui.

Oažžun dihte ipmárdusa ja oainnuid movt guođoheaddjit hálddašit⁶ bohccuid/ealu dálveáiggis, de lean maddái čuvvon boazovázziid ealu luhtte ja observeren sin siiddastallama ja gulahallama siidaguimmiiguin, vai buorebut ipmirdan sin doabageavaheami ovttas ekologijamáhtuin "hálddašit" ealu, mii lea oassálasti-observašuvdna (Stene, 1999). Dákkár vugiin lea vejolaš fuomášit ja ovdanbuktit beliid, mat ovdagihtii eai soaitte leamaš čielgasat.

⁶ Forvalter (jfr. Johan Klemet Kalstad doaba gii gohkke ealu)

3.3 Informánttat

Informánttaid válljemis lean atnán eaktun ahte informánttat fertejit leat oahppan boazodoallofágaterminologijja boazobargguid čađa ja leat hárvánan atnit dáid sániid. Dutkama oasseváldit eai leat válljejuvvon statistihka duhtadeami dihte, muhto danne go sii addet mávssolaš dieđuid dutkamii.

Lean válljen guokte váldoinformántta (olbmot geain lea ekspeartadiehtu ášši birra) danne go 1) soai leaba eallinagi bargan bohccuiguin, mánnávuoda rájes juo, 2) soai leaba measta dadjat guovtti buolvva olbmot, 3) goappašagat leaba čeahpit čilget ja ovdanbuktit áššiid. Isko-Ánte (Aslak Anders Isaksen Eira), riegádan 1917, gullá Cohkolaga orohahkii. Son lea agi beavvi bargan bohccuiguin ja lea johtán moatti johtolagas. Sus ii leat šat siidaoassi, muhto sus leat bohccot bártnis geahčus. Son bargá ain bohccuiguin, čuovvu goit gárddástallamiid. Vaikko lea dan mađe agis, de sus lea hui buorre muitu. Ovlla-Juhán Ovlla Issát-Máhtte (Isak Mathis O. Eira), riegádan 1942, gullá Fávrrorsordda orohahkii. Sus lea siidaoassi ja ieš bargá ealuin beaivválaččat. Son lea guhká leamašan iežas dálvesiidá siiddaisidin. Sudnu čilgehusat leat vuodđun buot muohtadoabaanaliissain, ja nu eai leat merkejuvvon sierra, eará go jus leat lassu čilgehusat muhtun doahpagii.

Barggus ledje maiddá 10 informántta geat gullet viđa siidii Oarje-Finnmárkku boazodoalloguovllu dálveorohagaide (Eira & Mathiesen, 2011, manus). Beavvegirjjiid vuodul leat siiddat ieža gozihan iežaset beaivválaš guohtundili. Báikegoddevuđot resurssagoziheapmi lea proseassa mas báikegoddi ieš goziha, geahččá, guorahallá, árvvoštallá áššiid mat leat dehálaččat báikegoddá (Eira & Mathiesen, 2011, manus). Beavegirjjiid jurdda lei očodit beaivválaččat dieđuid das movt siiddastallan dáhpuhuvvá dálvet, movt boazovázzi árvvoštallá dilliid mat váikkuhit bohccui, movt karakterisere guohtundilálašvuoda ja makkár strategijaid atná čoavdin dihte iešguđetlágan dilálašvuoda mat čuožželit (ibid.).

”Ceavvi”-prošeavttas⁷ leat 12 nuorra sámi dutkanveahki čohkken ja dokumenteren boazosápmelaččaid árbevirolaš boazodoallomáhtu muohttaga ja guohtuma birra. Ulbmilin dáinna prošeavttain lei oanehis áiggis eanemus lági mielde čohkket ja dokumenteret boazosápmelaččaid árbevirolaš boazodoallomáhtu. Jearahallamat leat transkriberejuvvon čállingillii. Informánttaid birra lea čilgejuvvon mildosis 2. Jearahallit leat čađahan juogo boazodoallo-oahpuid Sámi allaskuvllas dahje leat čađahan Ealát-prošeavtta lágidan kurssaid ja ožžon oahpu das movt árbevirolaš máhtu sáhtta dokumenteret, movt sáhtta čađahit jearahallama ja movt sáhtta háhkat informánttaid.

Dutkamis lean maiddái geavahan historjjálaš báddemiid, 1970-loguin, oažžun dihte historjjálaš dieđuid áššiide omd. movt boazovázzit muitaldedje vásáhusaid ja muittuid earenoamáš dálvviid ja eará muohtadiliid birra man sáhtii buohtastahttit historjjálaš dálkkádatdátaiguin.

Eanas informánttaid namat, earet váldoinformánttaid, leat anonymifiserejuvvon iežaset sávaldagaid mielde. Informánttat leat duostan rahppasit čilget áššiid, dáhpáhusaid ja vásáhusaid, main maiddái namahedje guovlluid ja olbmuid, danne go sii ledje oadjebasat go sis lei čálalaččat soabaduvvon ahte sin namat eai galgga almmuhuvvot. Dán dutkamis leat buot informánttat beassan dárkkistit dátaid, dátaanaliissaid, bohtosiid, mat galget almmuhuvvot ja leat ožžon vejolašvuoda buktit mearkkašumiid daidda (ICR, 2006).

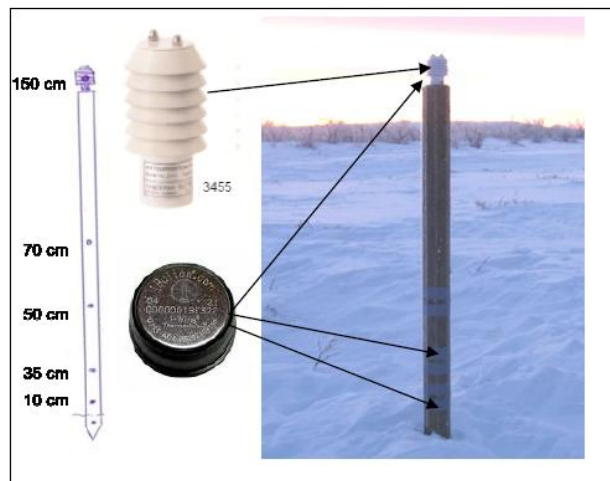
⁷ Prošeakta gulai dán dutkanprošektii, mii lei oassin EALÁT-prošeavttas maid Sámi allaskuvlla/Riikkaidgaskasaš boazodoalloguovddáš (ICR) jodiheigga.

3.5 Muohtafysihkka ja temperatuvrramihtideamit

Muohtamihtideamit leat čadahuvvon guođohanstašuvnnain, duoddaris Čuonjájávrrri lahka, sullii 20 km eret Guovdageainnus ja iskanstašuvnnas, mii lei lahka márkanbáikki.

Sihke guođohanstašuvnnain (Eira & Mathiesen, 2011, manus) ja iskanstašuvnnas lea áibmo- ja muohtatemperatuvra

mihtiduvvon. Dasa leat geavahan mihtidanrusttega, termokrona, mii lei čadnon beannot mehteraš impregnerejuvvon stolpui (govus 7). Termokrona lea ráhkaduvvon guovtti teknologijjas, microchipa stálledoasaža siste (iButton) ja prográmma masa vurket dieđuid



Govus 7: Temperatuvrra mihtidanrusttegat

(1-Wire). Termokrona iButton:is lea temperatursensor, diibmu ja muitu, ja 1-Wire:iin sáhttá logahit mihtiduvvon dátaid (<http://www.thermodata.com.au>). Termokronat prográmmerejuvvojedje mihtidit temperatuvrra mearriduvvon áiggiid nu ahte mihtidedje juohke 6. diimmu, dii. 07.00, 13.00, 19.00, jna.. Dán oktavuodas lean čuvvon áigemeiid maid Meteorologalaš instituhtta geavaha áibmotemperatuvrraid mihtideamis. Juohke termokronai merkejuvvui sierra nummariin identifiserema dihte. Juohke stolpui biddjojuvvojedje guhtta termokrona, ná: eatnamii, 10 cm, 35 cm, 50 cm, 75 cm ja 150 cm (govus 7). Bajimus termokronai biddjui suonjardanšearbma, mii suddje suonjardeami nu ahte oaččuimet eanemus lági mielde rievttes dátaid. Dákkár stoalppu lea juohke guođohanstašuvdna ceggen iežas dálveorohakkii. Prošeavttas leat leamaš 42 termokrona mat leat guođohanstašuvnnain ja iskanstašuvnna stoalppuin ja maid

golbma dálvvi geavaheimmet (Maynard *et al.*, 2010; Eira *et al.*, 2011, sáddej. sisa).

4. DAVVISÁMEGIELA MUOHTADOAHPAGAT, DAID SISDOALLU JA GEAVAHEAPMI

Oktiibuot 318 sáme giela doahpaga mat geavahuvvojit go čilge muohta- ja muohtadiliid ja muohtanuppástuhttimii boazodoalu oktavuodas Guovdageainnu boazodoalloguovllus (mielddus 1). Davvisáme giela muohtadoahpágiid lean juohkán guovtti váldokategoriijai, namalassii muohtadoahpagat mat sisttisdoallet muohta- ja jieknafysihkalaš (muohtašlájaid, muohtadiliid, muohtanuppástuhttimiid ja maiddái beliid mat váikkuhit muohttaga dahje daid váikkuhusaid bohtosiid, nugo temperatuvrra, biekka, arvi, muohta/arvi, ja áimmu). Dasto leat muohtadoahpagat main sisdoalu dáfus lea viidát mearkkašupmi go dušše muohtafysihkka, maid sáhtta defineret boazodoalu vuodđodoaban, mii earenoamážit guoská bohcco birgejumái ja ceavzimii, nu go guohtumii, vánddardeapmái, vuohttimii, oaidnimii.

Teorehtalaš doabaanaliissain mainna mearriduvvo makkár erohusat doahpágiin leat, lean analyseren doahpágiid mearkkašumi ja sisdoalu ja buohtastahtán doahpágiid nubbi nuppiin (Eira *et al.*, 2010; Eira *et al.*, 2011, sisa sáddejuvvo; Eira & Mathiesen 2011, manus). Guorahallan orru duodašteame ahte sáme giella lea dat giella mas lea riggámus muohtaterminologiija ja vel riggát go inuihtaid gielain, main lingvisttat leat navdán 1800-jagi loahpa rájes ahte leat eanemus muohtasánit (Krupnik *et al.*, 2010).

4.1 Artihkkaliid čeahkkáigeassu

Vuosttaš artihkkalis “*Muohtatearpmaid sisdoallu ja geavahus*” (Eira *et al.*, 2010) leat davvisáme giela muohtadoahpágiid álggahusanaliisa, daid geavahus ja definišuvnnat. Dás deattuhit árbevirolaš muohtadoahpágiid mearkkašumi ja earenoamážit daid geavahusa gulahallama dárbbu ektui ja

boazodoalu vuodđoeavttuid ektui. Sámegiela muohtadoahpagat sisdollet eavttuid mat sihke duddjojít bohcco ceavzimii ja ahtanuššamii, muhto maiddáí olbmo bargovejolašvuodáide. Terminologijateoriija vuodul ja earenoamážit guda vuodđoelemeantta vuodul, mat váikkuhit geavatlaš boazodollui (bohcco dárbbuid ektui; guohtun, suodji, siivu, vai goastá lihkadit ja olbmo doaimmaid ja dárbbuid ektui; siivu, vai goastá lihkadit, siivu, vai sabet/reahka johtá, vuohtádat ja oaidnin), leat digaštallan guovddáš muohtadoahpagiid sisdoalu ja geavahusa. Sámegiela muohtadoahpagat orrot čatnaseame nubbi nubbái dan mielde makkár boazodoalu elemeanttaid dat čilgejit ja maiddáí gulahallandárbbuid mielde. Dehálaš fuomášupmi lea ahte sámegiela muohtadoahpagiid geavaheami regulerejit guokte dahje eanet guovddáš dilit 1) áigi goas doaba geavahuvvo ja 2) dilli masa doaba čujuha. Analiisa čájeha málle movt informánttat leat čilgen sámegiela muohtadoahpagiid ja ahte doahpagis leat dávjá mánga dovdomearkka, mas unnimus 7 iešgudetlágan faktora namuhuvvojít čilgehusas: 1) dálkki/muohttaga rievdan, 2) muohtakvalitehta, 3) garasvuohta, 4) stratigráfiija, 5) muohttaga váikkuhus bohccui, 6) áigi goas geavahuvvo ja 7) bohcco/ealu láhtten. Artihkkalis čájehit hástalusaid maid vásiha doahpagiid sisdoalu čilgedettiin, jura dainna go daid iešvuohta lea ahte doaba dábálaččat fátmasta sihke vuodđodefinišuvnna, mii sáhtta hui dávjá leat intuitiivvaláš iige eksplisihtta, ja lassin geavatlaš beliid ja gulahallanbeliid. Dan dihte leat dát earáláganat go dat mat leat ráhkaduvvon čilgen dihte diedalaš definerejuvvon doahpagiid. Orru leamen oalle čielggas ahte lunddolaš árbevirolaš giela doahpagiid lea sakka váddásit čilget go dihtomielalaččat ráhkaduvvon fágadoahpagiid ja tearpmaid.

Nubbi artihkal *“Ođđa siida-vuđot gozihanvuogádat observeret dálveguohtuneatnamiin dálkkádatvariabilitehta váikkuhusaid sámi boazodoalus.”* (Eira & Mathiesen, 2011, manus) guorahallá jearaldaga movt sáhtta gozihit dálkkádatvariabilitehta ja -rievdamiid dálveguohtoneatnamiin árbevirolaš máhtu mielde, man vuodđu lea boazosápmelaččaid fágagiella. Ođđa gozihanvuogádahkii geavahuvvui ođđa ráhkaduvvon guođohanbeaivegirji, mas

deattuhuvvojedje muohtadilit ja dáid váikkuhusat dálveguođoheapmái. Viđa siidda boazovázzit Guovdageainnus gozihedje beaivválaččat muohtadiliid, biekká, arvvi/muohttaga, ealu láhttemii relaterejuvvon duovdagiidda viđa mánuš golmma jagi áigái (2007 -2009) čilgejuvvon sin árbevirolaš máhtuin. Bohtosat čájehit ahte guođohanbeaivegirji sáhtá geavahit gozihangaskaoapmin observeret guohtundiliid variabelitehta ja máŋggabealátvuoda beaivvis beaivái, guohtoneatnamiid gaskka, siiddaid gaskka ja dokumenteret boazovázziid dálveguođohanstrategiijaid. Ovdamearkan dehálaš fuomášumis lea ahte siiddat geavahit dálveguohtoneatnamiid strategalaččat ja systemáhtalaččat áiggi ja eatnamiid ektui. Buot vihtta siidda geavahedje topográfalaš guovlluid hui ovttatládje seammá áiggi jagis. Dasa lassin čájeha gozihanvuogádaga analiisa ahte muohtadilit regulerejit bohcco ekologijja, boazovázziid beaivválaš guođoheami ja boazovázziid ekonomijja. Guođohanbeaivegirje-
methodageavaheapmi movttiidahtá siida-vuodot goziheami geavahit boahhteáiggi go galgá gozihit muohta- ja guohtunressaid. Váldofuomášupmi lei ahte boazovázziid máhttu muohttaga birra lei holisttalaš ja eambo čadnon ealu guohtunekologijii go buohtastahtá luonddudiehtaga dárkilis definišuvnnaiguin mat leat vuodđuduvvon fysihkalaš muohtadovdomearkkaid nala. Čohkkejuvvon dieđut speadjalastet boazovázziid árbevirolaš máhtu muohttaga ja muohtarievdamiid birra ja leat maid movttiidahtán nuorra boazovázziid eanet digaštallat dáid áššiid.

Goalmát artihkal “*Árbevirolaš sámi muohtaterminologijja ja muohttaga fysihkalaš iešvuodaid čilgen - guokte diehtovuogi*” (Eira et al., 2011, sáddejuvvon sisa) čilge movt olmmoš ipmirda luonddu iežas báikkálaš máhtu mielde ja dan mielde movt iežas oktavuoha luondduin lea čadnon iežas beaivválaš eallimii. Dát čilgehusat leat oassin árbevirolaš gielas ja duddjojit fágaterminologijja mii lea earenoamážit heivehuvvon báikkálaš dárbbuide ja geavatlaš diliide. Muohta duddjo eanas eavttuid boazodoalu diliide dálvet. Muohtadoahpaga šlájat bidjet eavttuid makkár vánddardeapmi, vuohthin, oaidnin ja guohtun sáhtá šaddat. Doahpagiid, maid geavahit čilget muohttaga eatnama

nalde, sisttisdoallet dovdomearkkaid mat leat dárbbaslaččat go ságastallat muohtaiešvuodaid birra mat gusket guovllu boazodollui. Dán artihkkalis leat árbevirolaš sámegiela muohtadoahpapiid ja daid definišuvnnaid buohtastahtán luonddudiedalaš ja fysihkalaš muohtaklassifikašuvnnaid. Sámegiela árbevirolaš muohtadoahpapiid guorahallama čadaheamis jearahalaimet boazovázziid. Bohtosat čájehit ahte máŋga sámegiela muohtadoahpaga čilgejit muohtadiliid no go riikkaidgaskasaš standárdat definerejit daid, ja eará muohtadoahpagat fas čilgejit fysihkalaš proseassaid mat dagahit dihto muohtadiliid. Goalmmát muohtasorttas muohtadoabačoakkáldagas lea čielga gulahallanulbmil muohtadiliid birra, ja dat doibmet boazodoalu siskkáldas gulahallamii. Doabasisdoalu analiissat čájehit ahte sámegiela muohtadoahpapiid leat dovdomearkačoahkit mat gullet sihke boazodollui ja muohtafysihkkii. Muhtun sámegiela muohtadoahpapiid čilgehusaid sáhtá buohtastahtit ICSSG (International Classification of snow on the ground) muohtaklassifikašuvnnaid, nu go omd. *seaŋáš* = *depth hoar*; *Vahca* = *Precipitation Particles*. Dása lassin čájeha dát guorahallan man dehálaš lea geavahit sámegiela muohtaterminologijja go galgá ráhkadit hálddašanstrategiijaid dálkkádatrivdamiidda sámi boazodollui deattuhemiin guokte ipmárdusmálla.

Njealját artihkkal “*Árktalaš dálkkádaga ja eanangeavaheami rivdamiid váikkuhusat boazodollui: Eamiálbmotmáhttu ja gáiddusmihtideapmi*” (Maynard et al., 2010) addá oppalašgeahčestaga movt eamiálbmogat, boazoálbmogat leat álggahan dutkama dálkkádatrivdamiid váikkuhusaid birra ja ovdánahtán báikkálaš heivehanstrategiijaid, maid vuodđu lea iežaset árbevirolaš máhttu eatnamiid ja daid geavaheami birra. Dutkan lea riikkaidgaskasaš fágaidrasttideaddji ovttasbargu dutkanásahusaiguin ja viiddis ovttasbargu man bokte buvttadit máhttu. Muhtun bohtosat ja čilgehusat dátavuogádagas movt sáhtá ovttahttit árbevirolaš eamiálbmotmáhttu gáiddusmihtidemiiguin ja eará diedalaš dátaiguin leat ovdanbukton.

4.2 Muohtadoahpágiid dovdomearkkat

Dán guorahallama gielalaš bealis lean deattuhan defineret doahpágiid ja identifiseret doahpágiid vuodđokarakteristihkat dahje -dovdomearkkaid (Eira *et al.*, 2010, Eira *et al.*, 2011, sáddej.sisa). Juohke muohtadoahpágis lea iežas sadji doabavuogádagas ja dán vuodul sáhtta muhtun muddui čilget dan oktavuodaid eará muohtadoahpágiiguin. Sámegeala muohta- ja jiekŋa doabavuogádat lea huksejuvvon smávva doabavuogádaiguin mat gokčēt stuorit ja smávit vuolitosiid fágasuorggis. Muohtadoahpágiin leat dovdomearkačoahkit. Dovdomearkkat sáhttet gullat sihke muohtafysihkkii ja áššiide mat deattuhuvvojit boazodoalus (tabealla 2).

Tabealla 2: Gávcci muohtadoahpaga analiisa dovdomearkkaid mielde

| Faktorat | Earuheaddji faktorat | vahca | seanáš | čearga | cuoŋu | sievlla | soavli | činus | skáva |
|------------------|--|---------------|--------|--------|-------|---------|--------|-------|-------|
| Konsisteansa | njuoska + goike ● | ● | ● | ● | ● | + | + | ● | ● |
| garasvuohta | garra ● dipmá + | + | + | ● | ● | + | + | ● | ● |
| Guoddá go vai ii | guoddá ● ii guotte + | + | + | ● | ● | + | + | + | + |
| Biegga váikkuhan | Biegga váikkuhan + Ii váikkuhan ● | ● | | + | | | | | |
| gearddit | assás + asehis ● | | | + | + | | | ● | ● |
| šládja | muohta ● jiekŋa + | ● | ● | ● | + | | | ● | + |
| Metamorfoosa | Dest. ● Sinter. + Konstr. ■ Suddan/galbmin◆ | | ■ | ●/+ | ◆ | ◆ | ◆ | ● | ◆ |
| Startigrafija | gierragis ● gasku + botnis ■ | ● | ■ | ● | ● | + | ● | ● | ● |
| Áigi | čakčadálvvi ● dálvet + giddadálvvi■ | ● | + | + | ■ | ■ | ■ | + | ■ |
| Vuodđoeavttut | I-VI | I, II, III, V | I | I | IIIb | IIIa | IIIa | I | III |

Muohtadoahpágiid dovdomearkkaid čielggadeapmi čájeha sisdoalu dáfus makkár ovttalárganvuodaid ja erohusaid doahpágiin leat. Earuheaddjefaktorat maid mielde buohtastahttit leat nu go muohtakonsisteansa (leago muohta njuoskkas vai goikkis), garasvuohta (dipmá vai garra muohta),

guoddá go muohta vai ii, leago bieggá váikkuhan vai ii, leat go asehis vai assás gearddit, makkár šládja lea (muohta vai jiekŋa), makkár metamorfosa ráhkada muohttaga, startigrafiija (gokko muohtašládja lea muohttagis) (Eira *et al.*, 2011, sáddej. sisa). Dáidda lassin lea áigi (goas doaba geavahuvvo) (Eira & Mathiesen, 2011, manus) ja vuodđoeavttut I – VI, A. Bohcco dárbbuid ektui: (I) *guohtun*, (II) *suodji* ja (IIIa) *siivu*; B. olbmo doaimmaid ja dárbbuid ektui: (IIIb) *siivu*: (IV) *siivu*, (V) *vuohádat* ja (VI) *oaidnin* (Eira *et al.*, 2010).

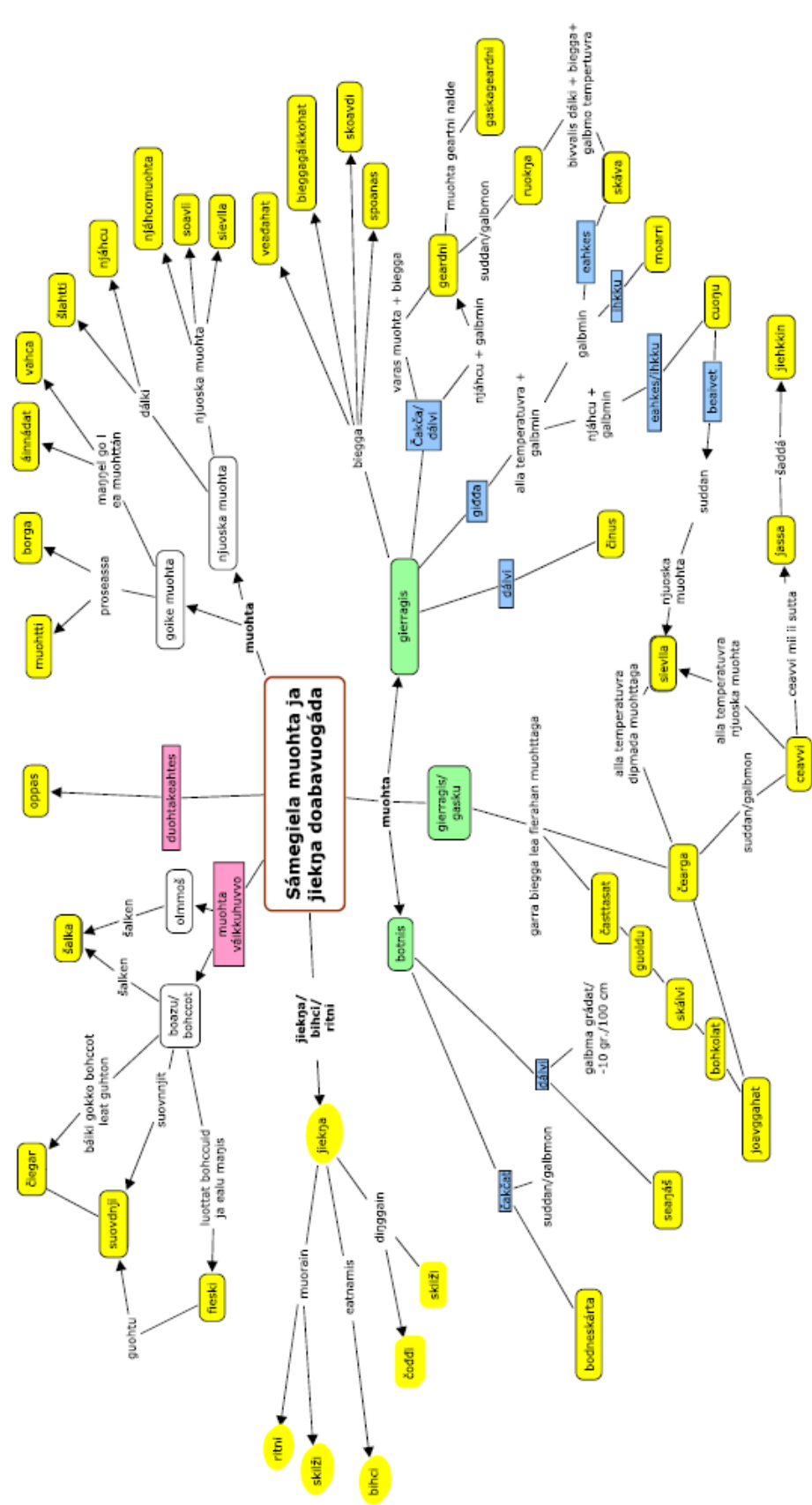
Dákkár analiisa mielde (gč. tabealla 2) sáhtá oaidnit oktavuodaid doahpágiid gaska ja oktasaš dovdomearkkaid mat čájehit doahpágiid ovttaláganvuodaid ja erohusaid. Ovdamearkan čájehan *čínus*- ja *skáva*-doahpágiid mat sisdoalu dáfus orru oalle ovttalágan doahpaga. Dáid doahpágiid ovttaláganvuodát leat ahte goappašat doahpágiid sisdoallu čájeha ahte dat leat asehis muohtagearddit, leat garra muohttagat, mat eai áibbas guotte ja mat leat muohtageramuhttagat. Earuheaddji faktorat leat *čínus*-doahpágiid leat muohtakrystállat, ja *skáva*-doahpágiid fas jiekŋakrystállat, *čínus* lea destruktiiiva metamorfosa boadus ja *čínus* fas suddan/jiekŋun metamorfosa, *Čínus* adnojuvvo dálvet ja *skáva* fas giđas dálvvi ja dasto vel gullá *čínus* guohtumii, I, ja *skáva* fas vánddardeapmái, III. Dáid fáktoriid vuodul sáhtá dadjat ahte dát doahpagat eai leat synonymat, muhto guokte sierranas doahpaga.

Dat ahte sámegeielat eai leat ovttaláganat čájehuvvo go buohtastahtá davvisámegeiela muohtasániid ja lullisámegeiela muohtasániiguin. Go iská jiekŋagertniid sisdoalu, de čielgá ahte lullisámegeilli dat leat dárkileappot go davvisámegeilli. Lullisámegeielas leat 17 iešguđetlágan tearpma mat mitalit geardnešlájaid birra mat leat muohtagierragis. Okta ágga manne lullisámegeielas jáhkkimis leat nu ollu muohtasánit mat čájehit gertniid, sáhtá leat ahte muohttaga nuppástuvvan dáhpáhuvá jođáneappot ja dávjjibut lullin go Davvi-Skandinavia siseatnamiin (Magga, 2010).

4.3 Sámegeiela muohtadoahpágiid kategoriseren ja klassifiseren

Okta oassi guorahallamis lei kategoriseret muohtadoahpágiid daid gaskavuodaid vuodul. Kategoriseren mearkkaša gávdnat ovttalágan- ja earuheaddjedovdomearkkaid ja dan mielde erohusaid ja ovttaláganvuodaid. Lean geahččan movt muohtaga doabamateriála sáhtta juohkit, earenoamážit tearbmalisttu ráhkadeami oktavuodas (mielddus 1). Kategoriseren mearkkaša juohkit diŋggaid dahje fenomenaid iešguđet joavkkuide kriteriaid vuodul, mat dábálaččat leat kategoriijadefinišuvnnat (Greve, 2003).

Dás lean ráhkadan doabavuogádaga, mii gokčá iešguđet doabakategoriijaid ja lean maid čájehan klassifikašuvdnavuogádagain mii lea kategoriijaid mielde. Klassifikašuvdnavuogádagas leat muohtageardevuogádagat, masa omd. gullet '*skáva*', '*činus*', '*geardni*' jna. dahje viiddit vuogádagat, mii gokčá dán muohta- ja jiekŋasuorggi oasi. Doabavuogádat lea čájehuvvon doabadiagrammaiguin veahkehan dihte čájehit doahpágiid gaskavuodaid ja daid saji doabavuogádagas. Kategoriijat mat gullet seammá skálai dahje syklusii, nugo muohtašlájat mat ovddastit garasvuoda, gullet seammá kategoriijai, ja nugo *skáva*, *moarri*, *cuoŋu*, *ruovdecuoŋu* mat gullet garra muohtagearddi kategoriijai. Doabakárttaiguin lea vejolaš govvidit doahpágiid gullevašvuoda ja doahpágiid gaskavuodaid. Muohtadoabakárta sáhtta geavahuvvot gráfalaš veahkkeneavvun organiseret ja ovdanbuktit boazodoalu muohta- ja jiekŋamáhtu (govus 8).



Govus 8: Sámegeiela muohtadoabavuođádat čájehuvvon gráfalaš doabakártain, mii lea ráhkaduvvon muohta- ja jieknadoabapagiid oktavuodain/gaskavuodain ja daid ovttagánvuodain/erohusain dan ektui masa dat gullet. Fiskes rieggá siste leat muohtatearpmat, čuvges alit riekkis čájeha jagi ággi áššiid, čuvges ruoná čájeha stratigráfalaš gaskavuodaid ja čuvges ruokát čájeha guođoheami/guohtuma áššiid. Teaksta mii ii leat rieggáid siste, čilge fyihkkalaš diliid ja muohtametamorfoasa. Njuolat čujuhit proseassaide ja rievddadeaddji sýklusii. Doabavuođádat lea ráhkaduvvon prográmmain Cmap Tools (Novak & Cañas, 2008).

Klassifiseren lea sirret diŋggaid dovdomearkkaid vuodul. Doabakárttain (govus 8) lea veahkehan čorget doahpágiid ja nu maid veahkehan kategoriserenbarggu. Kategoriserema vuoddun leat muohtafysihka (muohttaga vuoddoelemeanttat; čáhci, jiekŋa ja áibmu ja proseassat mat váikkuhit muohttagii) ja muohta boazodoalu oktavuodas. Muohtadoahpágiid dovdomearkkaid lean analyseren juohkimiin doahpaga komponeanttaid earuhan dihte daid iešvuodaid mielde mat leat ontologalaš dásis (Nuopponen, 1994) nugo hápmi, garasvuolta, muohttaga fysihkkastruktuvra, jna. Dán barggu vuoddun (tabealla 3) lean geavahan klassifikašuvnnaid maid muohtafysihkas geavahit (Frietz *et al.*, 2009) ja klassifikašuvnnat mat leat sámeielas (Ruong, 1964; Svonni, 1981; Jernsletten, 1994).

Tabealla 3: Sámeielas muohtadoahpágiid klassifikašuvdna ráhkaduvvon Frietz *et al.*, 2009, Jernsletten, 1994; Svonni, 1981; Ruong, 1964 vuodul.

| 1. DÁLKE – JA MUOHTTI-PROSEASSAT JA DAID VÁIKKUHUSAT | 2.MUOHTA EATNAMA NALDE, DÁID PROSEASSAT JA VÁIKKUHUSAT | 3. JIEKŊAHÁMIT MUOHTTAGIS, ČÁZIS JA EARÁ SAJIS MUOHTTAGIS JA DAID VÁIKKUHUSAT | 4.MUOHTAFAKTORAT MASA BOAZODOALLU LEA VÁIKKUHAN |
|--|--|---|--|
| 1.a. Oppalaš dilli (Riikkaidgaskasaš klassifikašuvdna) | 2.a. Oppalaččat (<i>Riikkaidgaskasaš klassifikašuvdna; Goike, njuoska muohta, šládja, metamorfosa jna</i>) | 3.a. Oppalaččat (Klassifikašuvdna-vuogádat) | 4. a. Mekánalaš váikkuhan 4.a.1 Bohccuid ja olbmuid maŋis |
| 1.a.1 Šládja, krystálla, symbola | 2.b Muohtaiešvuodát | 3.b Šlájat | 4.b. Luodda-kategoriijat 4.b.1 Fieski 4.b.2 luottat |
| 1.b <i>Paramehtarat mat váikkuhit</i> | 2.b.1 Njuoska muohta | 3.b.1 Jiekŋa kategoriijat | 4.c. Guohtun-kategoriijat |
| 1.b.1 Temperatuvra | 2.b.2 garra/dipmá | 3.b.1.1 Eatnama nalde 3.b.1.2 Muorain 3.b.1.3 Diŋggain | 4.c.1 Guohtun 4.c.2 Oppas 4.c.2 Čiegar |
| 1.b.2 Biegga | 2.b.3 Gassa/asehis | 3.b.2 Jiekŋahámit jávrris ja čázis | |
| 1.b.3 Arvi/muohta | 2.b.4 Stratigrafiiija | 3.b.3 Suddan/jikŋon gearddit | |
| 1.C Eará | 2.c Áigi | 3.C. Áigi | 4.d. Eará |

Muohtaterminologijja materiála lea juhkkon njealji váldokategoriija mielde, main juohkehaččas leat vuollekategoriijat (tabealla 3). Vuollekategoriijat lea huksejuvvon sihke muohtafysihkalaš klassifikašuvnnain (hápmi, metamorfosa, stratigrafii ja jna.) ja boazodoalu vuoddoeavttuid mielde (Eira *et al.*, 2010), mat leat merkejuvvon alfanumeralaččat (tabealla 4). Sátnelisttus leat iešguđet kategoriijat čájehuvvon klassifikašuvnna nummáriiguin. Listu sáhtta maid systematiserejuvvot klassifikašuvnna mielde (mielddus 1).

Tabealla 4: Ovdamearka movt muohtasátnelistu lea huksejuvvon. Gurut bealde lea tearbmanummar, muohtatearbma, definišuvdna sámegillii ja de klassifikašuvdna.

| Nr | Tearbma | Sámegillii | Klassifikašuvdna |
|-----|----------------|--|------------------|
| 302 | šuoimir muohta | Rušša, roavvasit muohta. | 3.b.3 |
| 312 | veađahat | Báiki gokko lea unnán ja seakka muohta dahje muohta ii bisán, gokko veađđá, gokko bieggá doalvu muohttaga dađistaga. Báikkit gokko sáhtta veađđan leat dábálaččat: vađat, jalggat, duoddarat, stuora jeakkit. Veađahat lea dakkár mas lea hirbmat buorre guohtun (ja hui buorre ealát). Sullasaš doaba: bieggagaikkohat. | 2.a |

4.4 Guohtun ja boazodoalu vuoddomuohtadoahpagat

Muohtadoahpagat nugo *guohtun*, *oppas*, *čiegar*, *fieski*, *goavvi* leat boazodoalu vuoddoadoahpagat (Eira *et al.*, 2010). Dáid doahpagiid sáhtta defineret dynámalažžan danne go doabasisdoallu fáttmasta dávjá sihke proseassaid ja rievddadeaddji diliid omd. dálkki, áiggi, báikki mielde ja sáhtta maid gohčodit dáid árbevirolašmáhtu kompleksavuogádahkan mii ovddasta boazodoalu holisttlaš ipmárdusa (Eira *et al.*, 2011 sáddejuvvon sisa). *Guohtun*-doahpaga kompleksitehta čájeha ahte doahpaga sisdoallu lea viidát go dušše muohtafysihkka, nappo viidát go dušše muohtašládja. Dán kategoriijai gullet maiddá eará muohtadoahpagat maid ii sáhte dušše muohtašládjan defineret,

oppas, čiegar, fieski, goavvi, maid sisdoalu dovdomearkkat fátmastit sihke boazodoalloelemeanttat ja muohtafysihkka.

Dát kompleaksa kategorijat nugo *guohtun* ja *čiegar* leat čilgejuvvon ja digaštallon sámegeiela muohtadoabaanaliisa vuolggasajis man vuodđu lea ahte doaba lea jurdaga ovttadat mii lea ráhkaduvvon daiguin dovdomearkkaiguin mat gullet muhtun objektii dahje objeaktaklássii (ISO, 1998). Dán gielalaš proseassa váldooassi lea leamaš defineret doahpagiid čilgehusaid boazovázziid čilgehusaid mielde. Definišuvnnat čájehit doahpagiid guovddáš dovdomearkkaid ja mihtilmasvuodaid (omd., garra muohta, jiekŋa gearddit, jiekŋabodni luotkko muohttaga ektui, seanjáš, goike bodni) ja vel unnit ja eanet fásta prototyhpalaš iešvuodaid (nugo ahte gullet áigái, sadjái, stratigrafijii).

4.4.1 Guohtun

Guohtun-doaba čilgejuvvo muohtadiliid ja muohtašlájaid mielde boazodoalu guodohanstrategiijaid ektui. Mu informánttat definerejit guohtuma ná: “*Guohtun sáni lávejit geavahit go meroštallet man álkit boazu beassá goaivumiin muohttaga čađa bodnái eatnama rádjái gos borramuš gávdno. Dát čilgehus geavahuvvo duššo muohttaga birra, makkár dat lea, iige čilge borramuša birra ja dan dihte dat adno dušše dálvet.*” (Eira et al., 2010).

Gielalaččat ii geavahuvvo nu dávjá *guohtun*-tearpma okto, dat dávjá gáibida sániid mat čilgejit dárkileappot *guohtun*-doahpaga dovdomearkkaid. *Guohtun*-doaba lea badjedoba ja dan vuolledoahpagat leat dajaldatdoahpagat omd. “*buorre guohtun*” dahje “*heajos guohtun*” mii mearkkaša ahte dat lea *guohtun*-tearbma ovtas adjektiivvain. Dajaldattearbman definerejuvvo tearbma mas leat guokte dahje eanet sáni mat eai leat goallostuvvon oktii (Arntz & Picht 1995).

Guohtun lea muohttaga birra sáhka, mas leat iešgudetlágan gearddit. Juohke gearddis lea iežas earenomáš dovdomearka garasvuoda dáfus, dat lea ráhkaduvvon iešgudetlágan muohtakrystállain mat balvvain gahččet, ja masa

biegga ja muohttaga temperaturvra váikkuhit, ja maid muohtametamorfosa hábme. Leat mánga muohtašlájja mat váikkuhit guohtuma, mat namalassii sáhttet dagahit heajos dahje buori guohtuma (tabealla 5). Iešalddis ii leat dušše okta muohtašládja mii čilge guohtundilálašvuoda, muhto baicca ollislašvuoha muohttaga dáfus, namalassii dat áššit mat váikkuhit muohttaga nuppástuhttima. *Guohtun*-doahpaga sisdoallu lea hui kompleaksa ja šaddá vel eanet kompleksan dan dáfus ahte dasa váikkuhit áigi, báiki ja dálki. Kompleksitehta lea čilgejuvvon oktii lakton komponeantafierpmádahkan maid ii leat vejolaš čilget mottiin njuolggadusaid (Peloquin & Berkes, 2009).

| Muohta | Guohtun | |
|----------------|-----------------|------------------|
| | <i>positiva</i> | <i>negatiiva</i> |
| Muohtti | + | - |
| Vahca | + | |
| Seanáš | + | |
| Luotkku muohta | + | |
| Ceavvi | | - |
| Cuoŋu | | - |
| Skáva | + | - |
| Skárta | | - |
| Čearga | | - |
| Šalka | | - |
| Muovllahat | | - |
| Oppas | + | - |
| Čiegar | | - |
| Fieski | | - |

Tabealla 5: Muohtašlájat mat sáhttet dagahit heajos dahje buori guohtuma.

Go boazovázzii lea guohtuma iskame, de ferte geahččat mánga variábela oktanaga, nugo muohtafysihka, mii čájeha man álki dahje váttis lea beassat muohttaga čađa ja ferte maid geahččat iešguđetlágan muohtašlájaid. Guohtuma oppalaš dilli vuolgá das makkár oktavuoha lea muohttagis, arvvis/muohttimis, temperaturvrras, gos bieggá boahdá ja man garra bieggá lea (Halfpenny & Ozanne, 1989), ja eará biraslaš variábelat nugo topografii. Nu ahte leat unnimus njeallje faktora mat váikkuhit guohtumii, mat sáhttet dagahit ahte rievdá hui heajos dilis hui buori dillái ja nuppe guvlui, 1) dálki, temperaturvra ja muohtametamorfosa, 2) áigi jagis, 3) báiki, eanan ja/dahje

vegetašuvdna ja 4) guodoheapmi (Eira *et al.*, 2011 sáddejuvvon sisa; Eira & Mathiesen, 2011, manus).

Dálki ja temperatuvra sáhttet dagahit ahte muohta eatnama nalde suddá ja de galbmo nu ahte šaddá jiekŋan. Nu suddan-galbmon proseassa sáhttet ráhkadit muohttagii gerddiid dahje gertniid (Halfpenny & Ozanne, 1989). Temperatuvrigradieanta muohttagis ja muohtagassodat leat dehálaš faktorat mat sáhttet váikkuhit proseassa mii dagaha heajos dahje buori guohtuma. Go lea heajos guohtun, de muohtagierraga ja muohttaga gearddit leat nu garrasat ahte boazu ii nagot cuvket daid guodudettiin. Mađi eanet suddan-galbmon syklusat leat, dađi garrasit šaddet muohtagearddit, nugo *geardni* ja *cuoŋu*. Nu šaddá heajos guohtun danne go muohtadilli lea dakkár ahte boazu ii beasa biepmu rádjái muohttaga čađa. Dálki ja temperatuvra sáhttet maiddái buoridit guohtuma, earenoamážit jus lea unnán muohta, ahte muohta lea luotkkus ja bodni ii leat galbmon. Liehmu ja láfu biekkat sáhttet seakŋudit čiehkara ja nu muohta šaddá nu dimis ahte boazu beassá guohtut. Nils Henrik Sara čilge ”*Lea nu ahte galbma dálkkit ja garra biekkat dálvet garradit muohttaga ja gáržudit guohtuma. Muhto bieggá ii álot heajut boazodoalu. Garra biekkat liehmu dálkin váikkuhit nuppe guvlui; garra biekkat dipmadit muohttaga nu ahte boazu beassá guohtut.*” (Eira *et al.*, 2009). Deháleamos fáktor guohtuma čilgemis, lea bodni. Deháleamos aspekta mii guoská bodnái, lea dat ahte muohta dahje jiekŋa ii galggaše jiekŋut gitta eatnamii ja šattuide ja nu "lášset" daid (Routier, 2011). Muohtašládja, mii jiekŋu eatnamii, (bodneskártta dahje/ja bodnejiekŋa), lea vearrámus muohta bohccui danne go dat sáhttá dagahit boazojámu.

Tabealla 6: Guohtumadiliid vuollevariánttat

| Guohtun | Guohtun varianttat | |
|----------------------|--------------------|------------------|
| | <i>Garasvuohta</i> | <i>Báiki</i> |
| hui buorre guohtun | njunneguohtun | |
| buorre guohtun | goaivvosguohtun | |
| Oalle buorre guohtun | | |
| Oalle heitot guohtun | | biedggus guohtun |
| heitot guohtun | | Rudneguohtun |
| | | Skoavdeguohtun |

Guohtun-doahpaga vuolledoahpagat čilgejit dárkileappot doahpaga sisdoalu muohttaga garasvuoda dáfus ja báikki, mielde gokko lea muohta. Guohtundiliid ja guohtunvariánttaid čanastagat čájehit *guohtun*-doahpaga vuollevariánttaid. Dat kategoriijat main bohtá ovdan makkár muohta lea (garas/luotkkus) gullet kategoriijai buorre/hui buorre guohtun. Vuollevariánttain main lea mielde guovllučanastat, gullet kategoriijai hui heitot/heitot guohtun (tabealla 5). Dán oktavuodas orru guohtun-doahpaga geavaheapmái gullame goit guokte ášši, nappo 1) man garas muohta báikkis lea (*njunneguohtun*, *goaivvosguohtun*) ja 2) movt dákkár muohta lea báikki mielde: (*biedggus guohtun*, *rudneguohtun*, *skoavdeguohtun*). Dát árvvoštallan lea dási mielde. *Njunneguohtun*, geavahuvvo go galgá čilget dili go boazu beassá njuniin muohttaga čađa bodnái. Nubbi sullásaš doaba lea *gutnaguohtun*, mainna muohttaga buohtastahttá gunain, nappo ahte dat lea luotkkus. Dát guokte čilgejuvvojit buoremus guohtundássin danne go dakkár diliin lea muohta nu luotkkus ahte boazu ii báljo dárbbas atnit fámuid guohtut. *Goaivvosguohtun* geavahuvvo go čilgejit guohtuma nu ahte boazu beassá goaivumiin bodnái, ja dát lea maid daddjon Leahkit oalle buorre guohtundillin. Heajut bealde lea *biedggus guohtun*, *rudneguohtun* ja *skoavdeguohtun* maid geavahit go čilgejit diliid mat dagahit ahte boazu beassá dušše muhtin sajiin bodnái. Omd. dadjet rudneguohtumin dalle go muohtaeatnamis leat dego rutnit, mat dábálaččat leat šaddan njáhcun bievlan čakčat/skábman. Dat čájeha ahte čakčadálkkiin ja earenoamáš muohta-/ jiekŋašlájain mat dalle šaddet, nugo bodneskárttas, lea hui stuora váikkuhus guohtumii. Go lea bodneskárta, de boazu ii beasa bodnái ja dat dagaha dálvet *rudneguohtuma*. (Aslak Anders I. Eira).

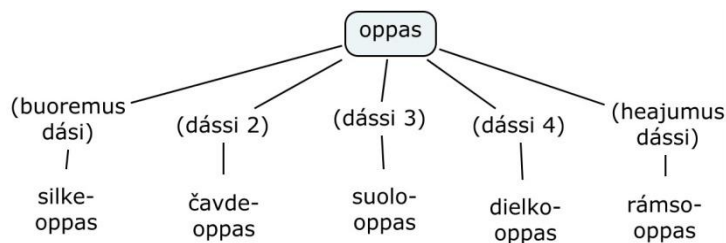
Guohtuma karakteriserema sáhttá leat sulaid meroštallan ipmárdusain mainna sáhttá kategoriseret dieđuid viiddis kategoriseremiiguin, ja mii maiddái sáhttá seammás čájehit movt olbmo jierbmi orru doaibmame. Sulaid meroštallan ipmárdusas geavahuvvo giedahallat kompleksa vuogádagaid. Das leat diehtuoasit ja daid čanastagat sulaid árvvoštallon. Dán válđoiesvuohta lea geavahit giellavuđot variábeliid čilgemii, lassin lohkovuđot variábeliidda (Berkes &

Berkes, 2009). Kompleksa vuogádagain, nu go dán oktavuodas bohcco-olbmo-muohttaga čanastagat ja oktiidoaimamat, háreve leat logut olbmo jurddašeami guovddáš elemeantan, muhto baicca sulaid meroštallančoahkit (Zadeh, 1973; Berkes & Berkes, 2009). Sulaid meroštallama geavaheami sáhttá oaidnit dajaldagas “hui buorre guohtun”, “buorre guohtun” jna., mat leat giellavuđot variábelat, sáhttet čájehit muohttaga ja bohcco kompleksitehta dan ektui movt heivehit guodohanstrategiijaid.

4.4.2 Oppas ja čiegar

Guohtun-doahpaga doabavuogádaga guovddáš doahpagat leat maidái *čiegar*- ja *oppas*-doahpagat. Dát leat dehálaččat mearkkašumi ja dovdomearkkaid dáfus danne go dát mitalit bohcco birgema dahje ceavzima árvvoštallama birra (Eira *et al.*, 2010). *Oppas* lea boazodoalu dálvekapitála mainna boazu galgá birget dálvvi badjel (Nils Isak Eira, 2006, persovnnalaš ságastallan). Mađi eanet čiegar dihto guovllus lea, dađi unnit oppas lea seamma sajis ja nuppe guvlui, nappo mađi eanet čiegar lea ovttá báikkis, dađi heajut guohtun lea (Eira *et al.*, 2010). Goappašat doahpagiin leat mánga vuolledoahpaga, mat dárkileappot čilgejit muohtadili go badjedoba dahká.

Oppas-doaba definerejuvvo guovlun dahje báikin gos lea muohta mii ii leat duohtaduvvon, ahte omd. bohccot eai leat duolbman dakko (Aslak Anders I. Eira). *Oppas*-doahpaga geavahus ii leat nu olu sturrodagas sáhka, muhto baicca mainna lágiin eallu lea guodohuvvon, omd. jus lea čoahkis, de duolbmá diedusge eanet. (Isak Mathis Eira, persovnnalaš ságastallan). *Oppas* lea muohta mii dábálaččat lea hui luotkkus ja olles muohttagis, muohtagierragis bodnái, sáhttet leat dipmá muohtašlájat nugo omd. vahca, luotkko muohta, seaŋáš (Eira *et al.*, 2011, sáddejuvvon sisa). Jus lea oppas, de mearkkaša dat ahte dakko lea buorre guohtun (Eira *et al.*, 2010).



Govus 9: Oppas-variánttat dásiid mielde, buoremus dásis heajumus dássái.

Das movt eallu guohtu ja movt boazovázzi guođoha vuolgá makkárat oppasvariánttat šaddet, obbasa buot buoremus dási buorrevuodas ja obbasa heajumus dási buorrevuhtii.

Oppas-doahpaxis leat unnimus vihtta vuolledoahpaga dan mielde makkár oppas lea (govus 9). Buot buoremus oppasdási variánta, lea *silkeoppas*. Dákkár lea báiki gokko eai leat ovttage ealli luottat. Dákko lea luotkko muohta ja dakkár muohta maid sáhhtá dušše savdnjilit eret. Dát báiki buohtastahttojuvvo silkkiin, mii lea áibbas linis. Go lea *čavdeoppas* dahje *áinnehisoppas*, mearkkaša dat dakkár báikki gokko ii leat guođohuvvon. *Suolo-oppas* lea oppasvariánta mas guovllus leat oppasdielkkut, mat sulastahttojuvvojit suolun. Dát lea sullii seammá go *dielko-oppas*, mii muitala guovllu birra gokko boazu ieš lea beassan válljet obbasa guođodettiin, gokko lea goisten veahá, borralan ja mannan fas. *Rámsso-oppas* lea šaddan danne go eatnamis leat skártadielkkut. Dat ii leat nu buorre, danne go boazu šaddá guohtut dielkkuid mielde. Boazovázziit dadjet ahte muhtun guovlluin sáhhtá leat oppas, muhto dattetge ii soaitte leat guohtun, mii mearkkaša ahte lea luotkko muohta, muhto eatnama vuostá lea skárton. Dán dilálašvuhtii daddjo leat botnis vihki, danne go dakko soaitet jiekŋadielkkut čakčat billistan guohtuma. Boazovázziit dadjet ahte go lea *rámsso-oppas*, de lea guohtumis vihki (Isak Mathis O. Eira).

Čiegar-doaba lea *oppas*-doahpaga vuostedoaba ja mearkkaša ahte dakko lea báiki duohtaduvvon, go dakko leat bohccot guhton ja roggan. *Čiegar*-doahpaga geavaheapmi eaktuda ahte lea muohta eatnama nalde ovdal go sáhhtá

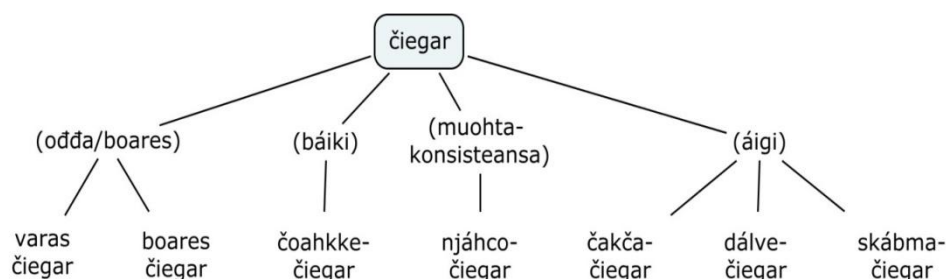
dadjat ahte lea *čiegar*. Hui unnán muohttagis ii báljo šatta čiegar. Čiegarbáikkiin, ii leat bohccuin dahkamuš, danne doppe ii leat guohtun.

Čiegar govvida muohttaga mii lea gas. Proseassa mii dagaha čiehkara lea go boazu guođodettiin duolbmumiin mekánalaččat cuvke muohtakrystállastruktuvraid, mii fas dagaha ahte sinterenproseassa dáhpáhuvvagoahtá hui jođánit. Mañnel sinterenproseassa (mii lea go molekyilat nanusmuhttet ovttaskas muohtakrystállaid čanastagaid) šaddá muohta hui gas. Dákkár muohta lea garraseabbo go čearga, man gasvuohta 250-450 kg/m³, go čiehkariis sáhtta leat eanet 500 kg/m³. Danne lea dákkár báikkis beara garra muohta bohccui guohtut (Eira, *et al.*, 2011, sáddejuvvon sisa). Dábálaččat, čiegar dagaha ahte dakko ii sáhte šat dan dálvvi guođohit.

Čiegar-doahpagis leat golbma elemeantta mielde, namalassii ahte 1) lea báiki gokko leat guođohagat, 2) dakko leat galbma suovnnjit ja 3) muohta lea dakko hui gas. Dat mearkkaša ahte dakkár báikkis dábálaččat eai sáhte guođohit danne go muohta lea nu gas, datte ge vuolgá dat áiggi goas lea čiegarduvvon. Jus ovddabealde juovllaid čiegarduvvo guovlu, de láve fas dakko sáhttit guođohit ođđasit mañnil dálvet. Muhto jus dálvet čiegarduvvo, de dan báikkis ii sáhte šat guođohit ovdal dipmada fas. Go *čiegar* lea galbmon (garran), de lea dakkár muohta mii lea nu gas ahte das sáhtta čuolastit bihtá eret. Boazovázziid čilgehusa mielde, de ii leat varas čiegar galmmas (gas).

Čiehkara sáhtta juohkit goit čieža iešgudetláganin dan mielde goas dat lea šaddan (čiegarduvvon) ja movt lea šaddan (govus 10). Áigi goas lea šaddan; 1) *Čakčačiegar*, mii šaddá jus lea muohtán čakčat ja de lea čiegarduvvon, 2) *Skábmačiegar*, lea šaddan go skábman muohtaáiggi guođohuvvo. Dát čiegar datte ge ii leat nu heitot. 3) *dálvečiegar*, mii dálvet lea čiegarduvvon, mii lea šaddan hui gas. Dát lea heajumus dási čiegar. Muohtakonsisteanssa mielde: 4) *Njáhcočiegar*, mii šaddá go lea njáhcun guođohuvvon. Ođđa ja boares čiehkara mielde: 5) *Varas čiegar* lea dakko gokko aitto lea čiegarduvvon. Dakko ii sáhte dákkaviđe guođohit ii ge dakko sáhte

bisánit ealuin, 6) *Boares čiegar* lea čiegar mii lea muhtun áiggi ovdal čiegarduvvon. Dálkki ja muohtaga divvumiid mielde, de dakko sáhttá fas guođohit go muohta lea garas. Ja čiegarbáikki mielde: 7) Go lea *čoahkkečiegar*, de leat čiehkara hui čoahkis, eai leat oppasdielkkut gaskkaid (govus 10).



Govus 10: Čiegar-doaba juhkkon čieža vuolledoaban.

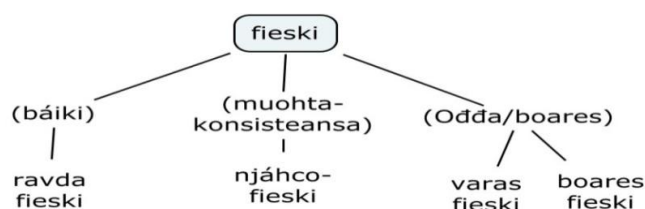
Čiegar-doaba lea boaris ja maid maidái boazodoalloálbmogat mat geográfalaččat leat guhkkálaga, leat geavahan, boazosámiid nuppi guovllus ja boazonjenetsat nuppe guovllus (Roung,1964). Čiegar, nu go omd. guohtutdoaba (Eira *et al.*, 2010) leat doahpagat mat lea seilon dološvuoda árktalaš guovlluid álbmoga ealáhusvuogi mielde. Ruong (1964) mielde namuhii Torneaus, gii elii measta 400 jagi dás ovdal (1600-1681), čiehkara čiegarbivddu oktavuodas. Gielalaččat lea sáme giela čiegar-doahpagis boazodoalu oktavuodas fuolkevuolta Njenetsa, Mánsi ja Khanti gielaide (ibid.).

4.4.3 Fieski

Fieski-doaba mearkkaša báikki gokko lea deaškaluvvon muohta maid boazu lea dahkan danne go dákko lea vázzán ja guđostallan. Fieski lea maid go muohttagis sáhttá luottaid oaidnit. Fieski ii leat njulgestaga muohtašládja, dat doaba gullá muohtaga luoddakategoriijai. Fieski daddjo leat daid rájiid siste gokko bohccot leat leamaš. Go bohccot leat fitnan báikkis dahje boazovázzit leat guođohastán dákko, de leat fieskkástallan. Fieskki sáhttet ollu bohccot ráhkadit, muhto okta boazu maid ráhkada fieskki. Guođohettiin vudjet boares fieskemohkiid birra geahččan dihte leat go bohccot báhcán dohko. Maidái go

leat ohcame meahcečorragiid, de boazovázzit eai oza bohccuid álggos, muhto fieskki ja jus dahje go gávdnet fieskki, de dan gurret jus dette gávdnet bohccuid.

Maiddá *fieski*-doahpagis leat mánga dási, mat leat áiggi ja konsisteansa mielde ja dan mielde gokko fieski lea (govus 11). Dan sáhtta juohkit unnimus 4 vuolledoaban. 1) Ravdafieski sáhtta leat fieski ravddas dahje guovtti ealu gaska sáhtta leat fieskegaska, 2) Boaresfieski gokko lea boares fieski, de dakko lea ovdal guođohuvvon, 3) Varasfieski lea go aitto lea šaddan fieskin ja 4) njáhcofieski, lea fieski mii lea njáhcun šaddan (Govus 11). 2009 čavčča lei njáhcofieski lahka Guovdageainnu.

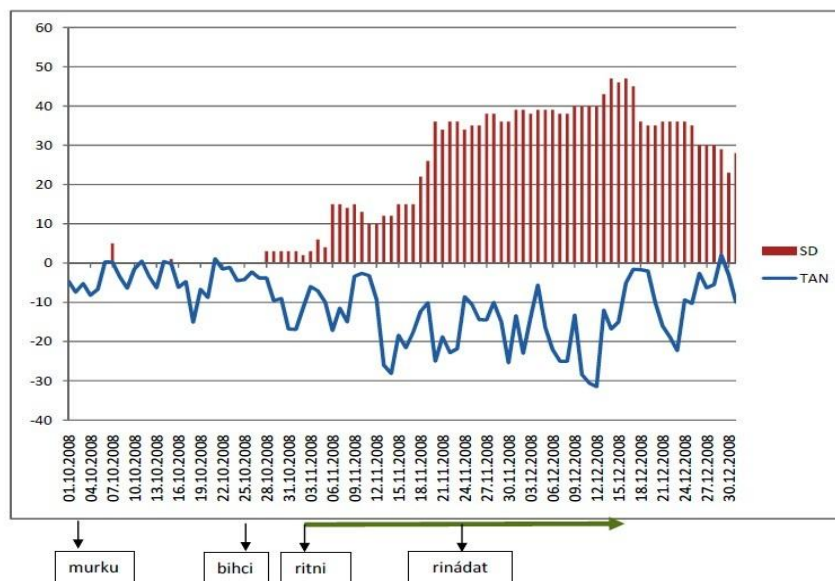


Govus 11: Fieski-doaba vuolledoahpágiiguin

4.4.4 Ritni

Ritni-doaba mearkkaša muohttaga/jieŋa mii lea darvánan muoraide, ja dat gullá kategoriijai mas lea jiekŋuma birra sáhka; jiekŋa mii lea (i) eatnama nalde, (ii) muorain ja (iii) diŋggain. Nappo sámegeielas earuhit dáid dan mielde gokko dat šaddet/leat: *bihci*, (i) mii lea "ásahis" muohta eatnama nalde, *ritni*, (ii), mii lea muohta muorain, *šuhči*, (ii), mii lea jiekŋa muorain ja *čodđi*, (iii), *mii* lea jiekŋa, geđggiid ja diŋggaid nalde ja maid muorain.

Ritni šaddá go lea dakkár dálkesorta mii dagaha ahte muohta darvána muoraide. De šaddá rinádat mii dagaha ahte ii oainne maide muoraid čađa. Ritnigoahtit sáhtta juo skábman, dakkaviđe go muohta lea boahán. Govus 12 čájeha ahte 2008 skábman lei guhká rinádat, bisttii 45 beaivvi. Golggotmánu loahpageahčen bihco eatnamat ja jávrrit gavdo. Moadde beaivvi maŋŋil šattai murku ja beaivvi maŋŋil lei ritnon. Meterologalaš dátaid mielde lei dalle unnit go 50 cm muohta (rukkes gráfa, govus 12), ja dalle ii lean leamaš bieggá, muhto lei buollašiid doallan (alit gráfa, govus 12).



Govus 12: Rinádat bisttii 45 beaivvi 2008 skábman. Gráfas: SD čájeha man gassa muohta lei ja TAN lea maximuma temperaturvra.

Ritni mearkkaša ollu boazodollui danne go lea rinádat, de bohccui lea buorre. Boazu beassá čiehkadit ritnevuvddiid sisa, gos de beassá ráfis guohtut (váikkuha bohcco oadjebasvuoda dovdui) ja orru jaska go ii oidno. Boazovázzi bargui gal dattege ii leat rinádat nu fávdnát danne go dakkárin lea váttis oaidnit bohccuid go omd. galgá čohkket ealu ja lea maid dieđus váttis dakkárin gávdnat čorrageid (Guođohanstašuvdna 2).

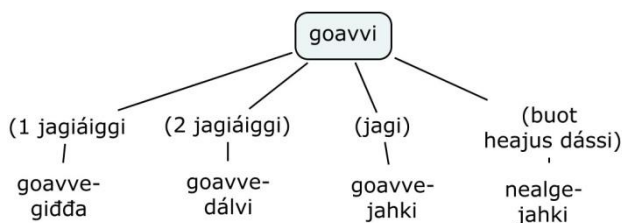
4.4.5 Goavvi

Vuodđomuohtadoaba, *goavvi*, lea doaba mii ii geavahuvvo beaivválaččat, muhto mii dálvet ihtá ekstrema dálkedáhpáhusaid váikkuhusaid oktavuodas. *Goavvi* lea doaba, mii čilge guohtundili ollislašvuoda ja defínerejuvvo earenomáš heajos guohtundillin. Goavvi dilis sáhttet bohccot jápmit nealgái. Goavvi ii geavahuvvo čilget “dábálaš” heajos guohtuma, dalle go lea *cuoju*, *čearga*, *ceavvi* jna. Goavvi-doahpaga sisdoallu čájeha gova das movt ekstrema dálkedilit speadjalastet boazodoallovuogádaga rievdamas (omd. struktuvrra, doaimma, organiserema oktavuodas), danne go ekstrema diliid geažil bohccot nelgot ja nu šaddet boazodollui negatiiva váikkuhusat. Okta dain vuosttaš čilgehusain ekstrema guohtundiliid birra dálvet lea Tromholt (1885)

almmuhan. Guovdageainnu boazosápmelaččat leat sullii 12 gearddi vásiha goavi 100 jagis ja geavahan dán doahpaga daid háviid go dákkár dilit leat leamašan (tabealla 6).

Goavvi sáhtta šaddat go lea assás *jiekŋa* eatnama nalde, *bodneskárta* ja/dahje *gassa muohta*. Faktorat nugo arvi ja šlahti, temperatuvra, muohtametamorfosa ja iešguđetlágan geartnit dagahit iešguđet dási *goavi*. Dát faktorat leat nie dehálaččat go váikkuhit guohtundiliide čakčadálvvi, dalle go bievlaeanan nuppástuvvá muohtaeatnamin ja maiddái olles dálvvi.

Boazovázzit čilgejit goavi dan mielde man garra váikkuhusat dain leat bohccui ja boazodollui. Dákkár dilit leat dábálaččat mihá vearrábut go *hui heajos guohtun* dilit. Goavvi-variánttat (govus 13) leat relaterejuvvon dan mielde makkár goavvi lea. Mađi guhkit goavvi bistá, dađi stuorit váikkuhus das lea boazodollui. Goavi vuolledoahpagat čájehit daid oktavuodaidda áigái ja jagiáiggiide. *Goavvegiđđa*, bistá ovttá jagiáiggi, *goavvedálvi*, fas bistá guovtti jagiáiggi, *goavvejahki*, lea čakčadálvvis gidđii (jahki) ja nealgedálvi, mii lea vearrámus dili mearkkašupmi, lea čavččas gidđii (govus 13).



Govus 13: Goavvi-doaba vuolledoahpagiiguin.

Goavvegiđđa mearkkaša guhkes giđa, go sáhtta leat ollu ja gassa muohta seammás go lea galbma dálkkit, borggat, šlahttit, ja eai báljo leat bievldielkkut. *Goavvejahki* lea go dát heajosvuohta bistá čakčadálvvis gitta gidđii. Jearahallamat čájehit ahte eanas informánttat dávjjimusat geavahit goavi čilget guohtundilliid gidđat ja gidđadálvái. Ii okta ge informánttain geavahan goavi čakča/čakčadálvvi diliid birra, man sáhtta čilget ahte dálke-/muohtadilit čakčat dábálaččat easkka dálvet dovdojit. *Goavvi* sáhtta bistit dassázi go muohta suddá nu ahte bievlá. Goavvedilli sáhtta leat miehtá vassis guovllu, muhto

maiddái sáhttá leat báikkuid. Go lea *goavvi*, de lea váttis birget bohccuiguin, sihke ealihit bohccuid dahje doallat čoahkis ealu danne go bohccot mannet vaikko gude guvlui ohcat ealádaga (informánta c19).

Goavvi mearkkaša ahte sáhttá massit ollu bohccuid, go dat váikkuha garrasit bohcco ceavzimii ja ahtanuššamii ja nu boazodoalu ekonomiijai ja organiseremii. Goavvejahki sáhttá čuoheat vihtta jagi ovddasguvlui (informánta c28). Informánta muitala ahte ekonomalaččat sáhttá navdit ahte lassin dábálaš jagiin massemii, sáhttet goavi dihte šaddet 30% unnit miesit. Dat dagaha ahte ollu bohccot jápmet, njiŋnelasat sáhttet reitot, mat sáhttet nie buktit miesehis jagiid. Päiviö (2006) čilge ahte *goavvi* sáhttá váikkuhit maiddái ahte siidaorganiseren/siiddastallamat sáhttet rievdat, nugo molsut johtingeainnuid, johtolagaid ja orohagaid. Son čájeha ovdamearkkaid Ruotas, Sirgá-čearus, mas siidaorganiseren rievddai goavi geažil, ja mas maiddái manai nu guhkás ahte boazosámit fertejedje heaitit boazodoalus go nohkkojedje, ja álge eará doaimmaide, nu go guollebivdui.

Ekstrema diliid historjjálaš čilgehusaid analiisa Guovdageainnu boazodoalus álgogeahčen 20-čuodi logus dálá áigái čájehit ahte leat leamaš iešguđet lágan dási goavit dán guovllus. Ovdamearkkat goavvediliin čájehuvvojit tabeallas 7. Heajumus dási goavvi, *nealgedálvi* muitaluvvui leamaš 1917/1918, mas gárte stuora negatiivvalaš váikkuhusat boazodollui.

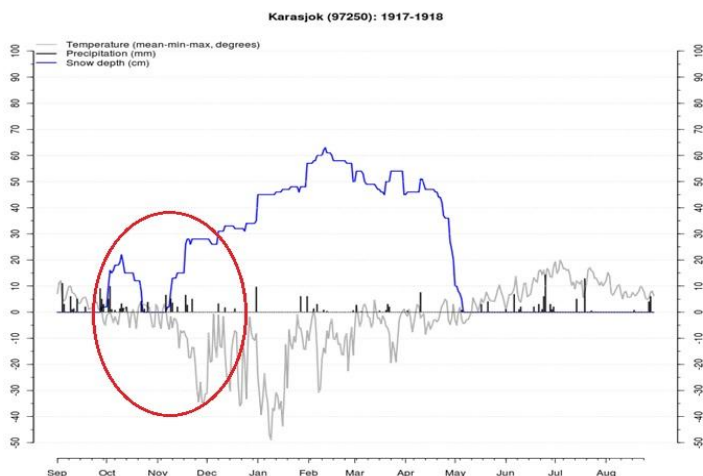
Tabealla 7: Iešguđet *goavvi* –áigodagat, mas *nealgedálvi* 1917/18 lea merkejuvvon fiskadiin, 1967/68 ja 68/69 merkejuvvon ruoksadiin leat *goavvejagat*, ja 1958-1961 ja 1997 merkejuvvon ruonáin leat *goavvegídat*.

| Jahki | Goavvegídda | Goavvejahki | nealgejahki |
|-----------|---------------------|--------------------|--------------------|
| 1907/08 | <i>goavvegídda</i> | | |
| 1917/1918 | | | <i>nealgedálvi</i> |
| 1957/58 | <i>goavvegídda</i> | | |
| 1960/61 | <i>goavvegídda</i> | | |
| 1967/68 | | <i>goavvejahki</i> | |
| 1968/69 | | <i>goavvejahki</i> | |
| 1971 | guhkes <i>gídda</i> | | |
| 1973 | guhkes <i>gídda</i> | | |
| 1996/1997 | <i>goavvegídda</i> | <i>goavvejahki</i> | |
| 1997/1998 | heajos <i>gídda</i> | <i>goavvejahki</i> | |
| 1998/1999 | heajos <i>gídda</i> | <i>goavvejahki</i> | |
| 1999/2000 | heajos <i>gídda</i> | <i>goavvejahki</i> | |

Ovdamearkan čájehan ekstrema dálkediliid váikkuhusa man birra Guovdageainnu boazosápmelaš (riegádan 1909) čilgii 1917/1918 jagiid leat nealgedálvín, dat jahki go bohccot jápme nealgái. Son čilgii ná:

Dat ii lean suohtas jahki. Dalle lei nu heitot ahte dat ii oba birgen ge, dalle šadde johttát gosa nu. Sii geat eai bieđganan oalát siiddaiguin, dat johttájedje dainna mii lei báhcán. Muhtimat bieđganedje ja nu dat dušše manne dat bohccot, muoraid mielde ja juohke guvlui. Doppe ii lean ealát.

Son muitá ovdalaš juovllaid, go čakčat lei borgan hui gassadin ja de fas arvvi hirbmadit ja galmmii nu ahte šattai jiekŋan. Dalle lei nu garas ahte šadde čuollat suvnnjiid bohccuide danne go jiekŋa lei 10-15 cm asu. Sii maid čulle jiekŋalaiggahagaid, laigejedje daid eatnamis eret, ja go jorgaledje daid, dain lea jeagil gitta, maid bohccuide adde.



Govus 14: Geavahettiin temperaturvra-, arve/muohta- ja muohta gassodagadátaid mat Kárášjogas leat mihtiduvvon 1917-1918 sáhttet navdit ja čilget Guovdageainnu dálkediliid (Hansen-Bauer, 2010).

Historjjálaš meteorologalaš dátain sáhttit oaidnit dálkediliid mat ledje 1917 čakčadálvvi (rukses rieggá siste, govus 14) ja mat sáhttet leat dagahan nealgedálvvi. Dálkedátat čájehit ahte golggotmánu álggus ledje buolašgrádat ja maddái muohtadálkkit, mat dagahedje 20 cm muohttaga. Muohta fas sutta, ja árvideamis jienjui go ledje buolašgrádat dakkaviđe go maŋŋil go lei suddan. Temperaturrat molsašuvve galbma grádas lieggagrádaide ja nie joatkašuvai. Gráfas sáhttit vel oaidnit ahte golggotmánu loahpas gitta álggogeahčái skábmamánu šattai oanehis bievlaáigodat dien geažil. Go de muohttigodii, de

bijai 30 cm muohttaga moatti beaivvis. Boazosápmelaččaid mitalusat čakčadálvvi dálke- ja muohtadiliid birra sáhtte heivet meterologalaš dátaid čilgehusaide seammá áiggis (govus 14).

Johan Turi čilgii muohtadoahpágiiguin 1910:is movt lea go bievlaeatnamis rievdá muohtaeamin ja movt dát muohtašlájat šadde. Dáinna čilgehusain čájeha Turi man dehálaččat dálkedilit čakčat sáhttet leat dálveguohtundiliide.

“ Ja dat lávejit ragat loahpas njázut, ja dalle lea gale jo muohtán eatnamii. Ja daid áiggiid, go sarvát leat golggohuvvan, daid áiggiid láve álo njáhcun, ja dat njáhcun gohčoduvvo golggu njáhcun. Ja dalle lávejit biestit ealuid, dainnago dalle leat hui heajos dálkkit - mierkkát ja arvvit. Ja go olu njázuda, de bievlá soames sajiid ja muhtun báikkiide báhcá muohta ja go galbmo, de šaddá dat muohta jiekŋan - dahje gohčoduvvo bodneskártan. Ja dat bissu olles dálvvi dakkárin go dalle lea, go manjemus njáhcun nohká ja galbma ilbmi boahtá. Muhto jos dalle daid ovdalis namahuvvon njázuid [áigge] ii billis muohttaga, de gal boahtá buorre dálvi, jos ii šatta gassat muohta. Muhto gal dat guohtu boazu oba gassada, go lea buhtis bodni, go ii leat jiekŋa botnis. Ja dat áigi lea, goas sámiin lea ballu, makkár dálvi boahtá.” (Turi, 2010:43)

Dát badjel 100-jagi boares čilgehus čájeha ahte elementtat maid Turi dalle namuhii leat hui mearkkašahttin guohtumii, nugo jus njázuáigge muohta jiekŋu ja šaddá bodneskártan, leat ain dán áiggi seammá mearkkašahttit. Dát čájeha kontinuehta sihke doahpágiid sisdoalus ja maid diliid gullelaš čilgehusain.

4.5 Árbevirolaš máhttu muohttaga, heiveheami ja resilieansajurddašeami birra

IPY EALÁT-prošeavttas navdet ahte árbevirolaš máhttu, mii lea sámegeiela fágadoahpágiin, lea vuodđun boazosápmelaččaid návccaide movt čoavdit diliid ja heivehit iežaset rievdamiidda (Tyler *et al.*, 2007; Maynard *et al.*, 2010; Eira *et al.*, 2010; Magga *et al.*, 2011; Eira & Mathiesen, 2011, manus). Dán kapihttalas digaštalan movt boazodoalloservodat lea dusten luondduroasuid nugo *goavi* ja eará heajos guohtundiliid dálvet resilieanssa ipmárdusa mielde. Resilieansa sáhtta oanehaččat čilget ná: siidda návccat dahje vejolašvuodát omd. maŋŋil *goavi*, beassat seammá dillái mii lei ovdal. Resilieanssa sáhtta defineret

iešguđetládje, muhto okta definišuvdna lea dat kapasitehta dahje návccat mat muhtun vuogádagas leat dustet roasuid, ja dat movt vuogádat nagoda iežas oddasisorganiseret roasuid rievdademiid áiggi ja movt de nagoda doalahit iežas guovddáš doaimmaid, struktuvrraid, identitehta dalle go rievdamat dáhpáhuvvet (Berkes & Turner, 2006). Resilieantaservodagat leat dakkárat mat nákkejit birget manjil vaháigiid, maid luondduroasut leat dagahan. Gaillard (2006) čállá ahte luondduroasut leat luonddufenomenat mat áitet olbmuid, struktuvrraid ja ekonomalaš áššiid. Luondduroasut sáhttet ee. leat eanandoarggástusat, stoarpmat, dulvvit ja goikkádagat, muhto báikkálaččat dat fertejit defineret mii sidjiide lea roassun. Boahhteáiggi globálaliegganeami negatiiva váikkuhusat mat čuhcet muohttagii, sáhttet karakteriserejuvvot luondduroassun boazodollui.

Muohtadoahpagat nugo *bodneskártta*, *bearta*, *cuoŋu*, *ceavvi*, main buohkain lea dehálaš árbevirolaš máhtu sisdoallu, leat geavahuvvon observeret ja gozihit muohttaga, maddái luondduroasuid oktavuodas. *Ceavvi* lea muohtadoaba geavahuvvo Guovdageainnus ja man sisdoallu lea garra muohta gidđat (Eira et al., 2010)

Eará guovlluin, nugo lullisámi guovlluin, leat doahpagat mat sáhttet leat davvisámegiela doahpágiid sullásaččat, omd. "tsievie"-tearpmas (man mearkkšupmi lea jiekŋageardni jeahkála nalde; garra muohta mii guoddá smávva bohccuid) (Laila Matsson Magga, 2012, pers. gulahallan) orru leamen korrelašuvdna davvisámegiela ceavvi-doahpágiin. Turi (1933), gii lei Guovdageainnus eret, čállá ahte ceavvi lea čilgehus heajos guohtumis dálvet. Ceavvi lea garra muohta man vuolde lea vel geardni ja go dákkár muohtadilli lea, de bohccot biedganit ozadettiin borrosa, ja danne boazosápmelaččat eai nagot doallat ealu čoahkisin⁸.

⁸ *Jorgalus engelasgielas, go lea dušše dan veršuvnnas: "Tsævve is hard snow with a snow-crust underneath it, and, when the snow is of the consistency, then the reindeer herds spread widely in search for food, and then the Lapps can't hold the herds together."* (Turi, 1933)

Turi gohčodii “ceavvin” daid olbmuid geat dákkár heajos guohtundiliin barge. Son čállá *“Ja dat mat ceavvin gohččojit, dat leat ožžon dan nama ceavvi das, go sii leat álgán ceavvedalvvi čoaggit deid bohccuid mat leat biedġanan miehtá vuvddiid, nu go ceavvejagiid ferte boazu biedġanit nelggiiguin miehtá vuvddiid. Ja go “ceavit” álge veaddit bielloherggiid, de dat bohte váibbatbohccot biellu lusa, ja de sii álge biebmat deid ja reainnidit.”* (Turi, 1910, 2010).

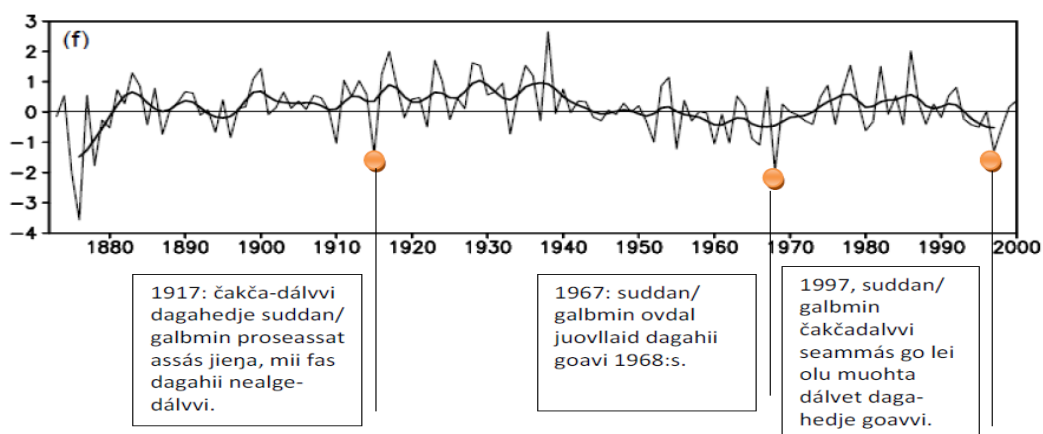
Sámi árbevirolaš máhttu muohttaga birra lea dehálaš oassi Guovdageainnu boazovázziid resilieanssajurddašeamis. Nu sáhtta resilieanssajurddašeapmi leat veahkkin árvvoštallat luondduroasuid ollislaččat (Hewitt, 2004; Berkes, 2007). Resilieansa giedahallá olmmoš-ekovuogádaga čanastagaid ja dan vuodul sáhtta árvvoštallat man rašši vuogádat lea go garvá juohkimis vuogádaga fysihkalaš ja servodatlaš beliid. Dat giedahallá dynámalaččat responssaid mat gusket luondduroasuide, ja maiddá “geahččá” boahhteáigái, mii veahkeha suokkardallat politihkalaš vejolašvuodaid das movt eallit eahpesihkkaris ja rievddadeaddjediliin (Berkes, 2007). Árbevirolaš máhttu sisdoalus leat dávjá dieđut movt olbmot sáhttet heivehit iežaset dramatihkalaš birasrievdamiidda (Reinert *et al.*, 2009). Dál orrot lassáneame duodaštusat das ahte báikegottiid vásáhusat ja árbevirolaš máhttu, fievrreduvvon buolvvas bulvii, sáhttet šaddat dehálažžan go galgá birget luondduroasu-áiggi (Hewitt, 2004; Berkes, 2007). Boazodoalu ja meteorologalaš historjjálaš dátaid vuodul ja vuorrasit olbmuid njálmmálaš mitalusaid vuodul lea vejolaš oazžut eanet dieđuid das movt boazodoalloservodagat leat birgen ja heivehan diliid goavi vuolde ja maŋjel goavi. Informánta (C28) čilgii movt *goavvi* lei sivvan dasa ahte bohccot jápmet nealgái, ahte šaddet miesehisjagit luonddu roasuid dihte, ja ahte bohccot ožžot dávddaid. *Goavvi* váikkuha njiŋnelas bohccui negatiivalaččat, namalassii nu ahte das ii leat mielki njamahit ruksesmisiid, mat dan geažil sáhttet jápmit. Buot boazovázziit geat leat leamaš mielde prošeavttas mitalit ahte ealut unno sakka maŋgil goavi. Go buohtastahtta goavvejagiid Oarje-

Finnmárkku boazologuiguin (almmolaš loguiguin), de oaidnit ahte boazologut dábálaččat njidjet maññil goavi (govus 15).



Govus 15: Oarje-Finnmárkku boazolohku 1945 rájes dálá áigái. Alit linjá čájeha boazologu, rukses stoalpu čájeha goavvejagiid ja ruoná fas goavvegiid. (Almmolaš dátat Boazdoallohálddahusas, Norggas).

Luondduroasut, nugo goavit, mat leat leamaš Oarje-Finnmárkkus nu guhká go olbmot muitet, beroškeahhtá das man stuora ealut (boazologut) ledje, čájehit movt dat váikkuhit guohtunvejolašvuodaide dálvet. Okta čilgehus manne goavádat šaddá, sáhtta leat Davvi Atlántalaš osillašuvnna váikkuhusat (eng: North Atlantic Oscillation) (NAO). NAO lea dálkkádatlaš fenomena mii čilgejuvvo osillašuvdnan, mii lea bieggadeaddoerohus meara dásis Islánda badjel ja seammá deattut Asorasullaid badjel (Hurrel, 1995). Áigeráiddut čájehit movt NAO indeaksa sáhtta varieret 10-jagi skálas ja váikkuhit dálvetemperatuvrra Skandinaviias. Eanemus dovdojit garra positiiva dahje negatiiva NAO-fásat Skandinaviias čakčadálvvi, dálvet ja gidđadálvvi (www.met.no), mat orrot heive dasa go boazovázzit karakteriserejit heajos guohtundiliid. Sis-Finnmárkku dálveguohtuneatnamiin orro áibmotemperatuvrras stuora variašuvdna jagi gaskka ja dát variašuvdna belohakkii korrelere NAO ($R \approx 0,5$) (Magga *et al.*, 2011). NAO-indeavssa variašuvdna čájehuvvo govvois 16.



Govus 16: NAO-indeavssa variašuvnmat čavččaid (1873–2000) ovttas runta čuoggáiguin mii merkejit historjjálaš goavvejagiid 1917, 1967 ja 1996 Guovdageainnu boazodoalloguovllus ja mat heivejit oktii negatiiva čakča NAO-fásaiguin (Ráhkaduvvon Jianping, 2003 mielde).

NAO váikkuha ollu davviguovlluid elliidšlájaide (Ottersen *et al.*, 2001). Positiiva NAO-indeaksa govviduvvo dainna ahte orjješ biekkat lassánit, negatiiva NAO fas buktá unnit orjješ dahje nuorti biekkaid Skandinaviai (www.met.no), muhto ii leat áibbas čielggas man ollu dát čuhcet Oarje-Finnmárkui. Orru aŋkke nu ahte heajos- dahje goavvejagit dálveáiggi šaddet maŋŋil go čakčadalvvi lea leamaš negatiivvalaš NAO-fása. Oarje-Finnmárkku boazodoalu historjá čájeha ahte 1917/18, 1967/68 ja 1996/97 leat mihtilmas goavvejagit, mat dagahedje ee. nealggi ja boazojámu. Mu hypotesa lea ahte Oarje-Finnmárkku historjjálaš goavvejagiid sáhtta čilget čakčadalvvi garra negatiiva NAO-fásain (Govus 16).

Boazovázziid observašuvnmaid mielde, mas muohtadoahpagat adnojedje indikáhtorin, ledje siiddain iešguđetlágan heivehanvuogit hehttet boazomassimiid, ja nu birgehit ealu ja dainnalágiin ceavzit goavi čađa ja vel birget goavi maŋŋil. Mun navddán ahte boazovázzit ja siiddat, geat cevzet dákkár ekstrema dálvediliid čađa, čájehit alla resilieansa rievdamiidda geavahettiin árbevirolaš máhtu muohttaga birra iežaset beaivválaš gielas ja gulahallamis. Muitalusat čujuhit ahte boazovázzit sáhtte massit measta olles ealu goavi dihte, muhto dan maŋŋil nagodedje fas ovdánit measta seammá dássái go ovdal. Päivio, (2008), čállá ahte 1930-jagiin ledje dákkár heajos jagit Sirgá-

čearus Ruotas. Dákkár ekstrema dálkediliid oktavuodas lea resilieansa mihttu das man bures servvodat dahje ovttaskas olmmoš nagoda dustet rievdamiid. O'Brien earáiguin (2009) navdet ahte resilieansejurddašeapmi addá odđa vuogi ipmirdit kompleaksa heivehanvuogádagaid ja sáhtta addit guovddášipmárdusa das movt ovddidit servodatšiehtadusaid, mat dorjot iešguđetlágan stivrenvuogádagaid.

Ekstrema guohtundiliid vásihemiid bokte, leat boazovázzit oahppan movt sáhttet heivehit diliid rievdamiid mielde ja birgema dihte geavahit iešguđetlágan heivehanstrategiijaid. Heivehanstrategiijat leat vuogit maid ovttaskas olmmoš, siiddat ja servodagat geavahit rievdadit iežaset doaimmaid ja dássemiin heivehit báikkálaš njuolggadusaid ja ásahusaid sihkkarastin dihte iežaset ealáhusaid (Berkes & Jolly, 2001). Boazodoalus leat geavahan unnimusat njeallje heivehanstrategiija goavádagaid oktavuodas, 1) diktit biedganit ealu nu ahte boazu ieš gávdná borramuša, 2) Sirdit dahje johttit ealuin eará sadjái/guvlui (mobilitehta vejolašvuohta), 3) johttit davás geasseorohakkii dahje/ja 4) biebmat bohccuid suinniiguin dahje pelletsiguin (tabealla 8). Dáidda lassin vel 5) sihkkarastit ahte ealus galget leat iešguđetlágan bohccot, ealu girjáivuohta (Oskal, 2000), mii sáhtta leat heiveheapmi guhkit áigái. Dát heivehanmállet leat váikkuhan dasa ahte siiddain lea leamaš vejolašvuohta joatkit doaimmain maŋgil goavi.

Tabealla 8: Goavveheivehanstrategiijat

| Jahki | Heivehanstrategiijat | | | |
|-----------|----------------------|---|---------------|---------|
| | Biedganit diktit | Sirdit dahje johttit eará sadjái/guvlui | Johttit davás | Biebmat |
| 1917/1918 | X | X | | |
| 1958 | | X | | |
| 1967/68 | | | X | |
| 1996/97 | | | X | x |

1917/1918 strategiija dasa movt birget goavvin, lei diktit ealuid biedganit nu ahte boazu ieš gávnnai borramuša. Nubbi vuohki lei johttit eará sadjái, gos lei ealát. 1958 gidđadálvvi heivehanstrategiija lei johttit ealuin

nuorttas-lulás, gitta Jávrrášduoddarii, mii lea guovlu nuorttalulábealde Guovdageainnu ja mii guhká 1950-loguin adnui liigeguhtuneanamin, gos siiddat feara man siva dihte besse guođohit jus iežaset orohagas ii lean birgejupmi (Hågvar, 2006). 1967/68 goavvejagi johte ollu Guovdageainnu siiddat árra dálvvi davás, geasseorohahkii. 1997 geavahišgohte odđa strategiija heivehit diliid dálkkádatváikkuhusaid geažil. Dalle biebmagohte muhtun siiddat ealuid, ja muhtun siiddat fas johte árrat geasseorohagaide. Informánttat muitalit ahte ii lean dábálaš dalle vel biebmát. Jus galgá sáhttit geavahit dáid strategiijaid guhkes áiggi heivehemiid v́aras ekstrema muohtadiliid oktavuodas ja maid boahhte áiggi dálkkádatrievdamiid váikkuhusaid oktavuodas, de fertejit boazodoalus leat vejolašvuodát dahje fleksibilitehta das movt geavahit eatnamiid ja movt guođohit. Dát fleksibilitehta addá boazovázzide vejolašvuoda heivehit dálkkádatvariašuvnnaide ja doalahit resilieanssa. Dutkamat boazodoalu sosiála organiserema birra (Turi, 2008), duodaštit ahte boazodoalu siskkáldasresilieansa dustet dálkkádateahpesihkkarvuodaid dahkko árbevirolaš ekologalaš máhtu vuoduin (Magga *et al.*, 2011a). Boazovázzit heivehit diliid rievdamiid mielde geažosgaskka (Reinert *et al.*, 2009). Danne sáhttá árbevirolaš máhttu muohttaga rievdamá birra ja sáme giela muohtadoahpágiid geavaheapmi veahkehit hukset báikkálaččat resilieanssa dálkkádatrievdamiid oktavuodas. Boazodoallu sáhttá doalahit alla resilieanssa ekstrema dálkediliid oktavuodas iežaset máhtuin, man oassin lea giella.

Mañemuš 50-jagiid lea boazoealáhus olu nuppástuvvan (Eira, 1984; Saijets & Helander-Renvall, 2009), mii maid sáhttá váikkuhan boazodoallogillii. Boazosápmelaččat dovddahit ahte boazodoalu barggu oasis rivdet nu jodánit ja ahte boazodoalu bargovuogit, sáhttet oalát nohkat (J. Magga pers. ságastallan, 2003). Dálkkádatrievdamiin dáidet šaddat mearkkašahtti biraslaš, ekonomalaš, kultuvrralaš ja gielalaš váikkuhusat sámi boazodollui. Juohke hedjoneapmi giellastruktuvrras čájeha maiddá birasipmárdusa hedjoneami, mii váikkuha ovddeš buolvvaid oahpahan luonddumáhttui ja máilmmi oidnui (Näkkäljärvi, 2009). Lea ballu ahte bargovuogit, giella ja boazodoallu sáhttá nohkagoahtit ja

nie geavatlaš bargu maiddái rievdá. Kalstad (1999) čállá ahte jus boazodoallofágalaš dajaldagat ja doahpagat jávket beaivválaš anus, de šaddá heahti maiddái boazodoallofágalaš bargui. Giella lea dehálaš gaskaoapmi kulturheiveheaddji máhtu dulkomii. Danne ferte árbevirolaš máhtu seammáládje gáhttet go giela gáhtte (Nakashima, 2000; Nakashima & Roue, 2002).

Go giela geavaheapmi, mii lea boazovázziid máhttovuođđu, hedjona, sáhtá dat mearkkašit ahte árbevirolaš hálddašanmálla rievdá, mii sáhtá raššudit boazodoalu. Ákkastallo ahte dálkkádatrievdamiidda heiveheapmi lea juoga mii boazodoalus dahkko báikkálaš dásis. Dát gáibida ahte báikkálaš árkálaš guovlluid jodiheaddjit fertejit guhkesáiggi ceavzilvuodajurddašeami birra oažžut oahpu, mas geavahit sihke diedálaš, vásáhusmáhtu ja báikkálaš máhtu (Turi, 2009). Doalahan dihte alla resilieanssa ja heivehanstrategiijaid, mat leat hutkojuvvon dálkkádatrievdamiid vásáhusaid vuodul, fertejit ráhkaduvvot earenoamáš heivehuvvon oahppofálaldagat nannen dihte boazovázziid árbevirolaš máhtu, kultuvrralaš ja gielalaš vuoigatvuodaid (Bongo, 2010). Jáhkku lea ahte dákkár heivehanstrategiijat sáhttet doalahit Finnmárkku boazodoalu resilieansan nu ahte boazodoallu sáhtá gierdat dálkkádatrievdamiid. Njálmmálaš mitalusaid bokte, ekstrema guohtundiliid birra maid olbmot muitet, jáhkán sáhttit oažžut odđa máhtu ja ipmárdusa boazodoalu birra, mat sáhtá šaddat dehálaš oahppun boahhteáiggi boazodoallohálldašeapmái.

5. LOAHPPAJURDAGAT

Dán fágaidrasttideaddji barggus, lean gielalaččat guorahallan muohtadoahpágiid, mat leat anus geavatlaš sámi boazodoalus dálkkádatvariabilitehta ja –rievdama ektui. 318 doahpagis (mielddus 1), mat Guovdageainnus geavahuvvojit muohttaga olis, lean muhtun guovddáš doahpágiid čilgen dárkileappot das movt dat geavatlaččat adnojit iešguđege guohtundillin ja fysihka ektui. Dát guorahallan čájeha ja digaštallá muohttaga nuppástuvvama guovtti perspektiivvas boazodoalu oktavuodas.

Dát guorahallan čájeha muhtun muddui ahte boazovázziid muhtadoahpagiid geavaheami vuodđun leat boazodoalu vuodđoeavttut dálvemáilmmis áiggi, sisdoalu, muhtafysihka ektui. Muhtadoahpagat leat dávjá dynámalaččat danin go doahpagiid sisdoallu lea proseassaid ja diliid birra mat rivdet dálkki, áiggi, báikki mielde. (1. artihkkalis) Bohtosat čájehit ahte muhtadoahpagat čatnasit geavaheami ja bargguid oktavuodaide.

Muhtadoahpagiid mánggadimensunála ipmárdus čájeha ahte muhtun doahpagiin leat čielga muhtafysihkkadovdomearkkat, maid sáhtta buhtastahttit definišuvnnaiguin mat leat riikkaidgaskasaš muhtaklassifikašuvnnain. Eará doahpagat gullet iešguđet guođohanstrategiijaide. Boazovázzit observerejit ja hálddašit muhttaga guovtti perspektiivas, muhtafysihka mielde ja ealu ekologijja mielde dálveguohtoneatnamiin, mii mearkkaša ahte sis lea holisttalaš máhttu ja –oaidnu muhttaga birra. (2. ja 3. artihkkaliin)

Siida-vuđot gozihanvuogádagaid vuodul, ovttas jearahallamiiguin, lean sáhtán dokumenteret movt muhttaga váikkuhus beaivválaš boazobargguide govviduvvo. Goziheami bohtosat čájehit ahte dálveguohtoneatnamiid geavaheapmi lea strategalaš ja systemáhtalaš báikki ja áiggi ektui. Dát maddái čájehit ahte leat stuora erohusat Oarje-Finnmárkku siiddaid muhtadilliin jagiid ja báikkiid ektui. Juohke siiddas lea iežas earenomáš guohtundilli, mii váttisin dahká buhtastahttit nuppi siidda dili nuppiin ja generaliseret dilliid. (2. artihkkalis)

Muhtun vuodđomuhtadoahpagat, mat leat anus boazodoalus, leat kompleaksa kategorijjat, dan mielde ahte doaba sisttisdoallá oktanaga ollu faktoraid nu go dieđuid muhttaga, muhtadiliid, muhtafysihka, dálkki, temperatuvrra, báikki, áiggi ja bohcco/olbmo váikkuhusaid birra. (1., 2. ja 3. artihkkaliin) Dát muhtadoahpagat, mat leat dehálaš oasit boazodoalu árbevirolaš máhtus, leat áibbas dárbbaslaččat beaivválaš boazobarggus,. Dáid dehálašvuhta vuhtto maddái das go doahpagiin leat mánggat vuolledoahpagat, mat čilgejit dárkileappot báikki, áiggi ja muhtakonsisteansa. *Goavvi* lea

maiddái dákkár doaba, danne go das leat dieđut ekstrema dálkkádatdiliid birra, máhttu movt heivehit dálkkádatvariašuvdnii ja boazodoalu resilieansa- ja ceavzilvuodamáhttu. Muhtun muhtadoahpagat speadjalastet muohtanuppástuhttimiid, maid ferte ipmirdit jus boazodoallu galgá lihkostuvvat. Dat leat dehálaččat go galgá árvvoštallat boahhteáiggi dálkkádatrievdamiid váikkuhusaid boazodollui.

Sámegiela muhtadoahpagat leat oassin boazodoalu fágaterminologijias ja leat olu anus beaivválaš boazobarggu gulahallamis dálvet. Muhtadoahpagat speadjalastet boazovázziid árbevirolaš máhtu movt hálldašit ealu dálvemáilmmis ja movt sii orrot hálldašeame kompleksa vuogádagaid geavahettiin mentálagovaid ja čálekeahces njuolggadusaid (“rules of thumbs”) (1., 2. ja 3. artihkkaliin) Dákkár máhttu lea váikkuhan boazodoalu seailumii doloža rájes dássáži, dál go olggobeale áššit orrot váikkuheami nu garrasit boazodollui, nu go dálkkádatrievdamat, guohtuneatnamiid massin ja globaliseren (4.artihkkalis). Árbevirolaš máhttu lea dehálaš eaktun dasa ahte boazodoalu ceavzinvuodđu ja kultuvra cevzet boahhte áiggis. Boazodoalu terminologija ja máhttu leat dehálaš vuodđun guohtungozihanvuogádaga ovdánahttimis boahhte áiggis ja dat sáhtta veahkehit siiddaid hukset báikkálašresilieansa.

Dovddahan balu das movt boahhte áiggis geavaš boazodoalu fágagiela ja máhtu geavahemiin Norgga boazodoalloeiseválddiin. Go einnostuvvo ahte dálvetemperatuvra loktana gávcciin grádain Oarje Finnmárkkus, de soaitá maiddái fertet vuordit ahte muohta- ja guohtundilit rivdet. Dát rievdamat deattuhit man dehálaš lea boazosápmelaččaid beaivválaš fágagiela geavaheapmi ja giela máhtu boahhteáiggis. Einnostuvvon dálkkádatrievdamiid sáhttet váikkuhit ahte omd. Guovdageainnus sáhttet jávkat muhtun muhtadoahpagat boazovázziid dála beaivválaš giela ektui. Jus sámi boazodoallu ja boazodoalu heiveheapmi dálkkádattvariabilitehtii ja -rievdamiidda boahhte áiggis galgá ceavzit, de ferte máhttit hálldašit eahpesihkkaris luonddudiliid. Dát gáibida iešguđetlágan máhtu, ja dan dihte ferte ovttahttit sihke eamiálbmot

boazodoalloárbevirolaš máhtu ja oarjemáilmmi dieđalaš máhtu gulahallama dihte. Lea dehálaš geavahit ja bisuhit boazodoalufágagiela ja -fágaterminologija boazodoalu hálldašeamis ja hálldahusas. Lea maiddái dehálaš hukset vuogádaga mii dáhkida ahte maiddái earálágan máhttu geavahuvvo go oarjemáilmmi máhttu. Dán barggu vuodul navddán ahte lea dárbu ovttahttit guovttelágan máhtu huksen dihte sosiála–ekologlaš resilieanssa vuogádaga nu ahte lea vejolaš hálldašit eahpesihkkaris luonddudiliid. Sámegiella, máhttu ja resurssageavaheapmi čájeha vuogádagaid oktiičanastagaid. Dán barggu vuodul orru lunddolaš árvalit ahte riikka heivehanstrategiijat fertejit váldit vuhtii boazodoalu árbevirolaš máhtu, ja kultur- ja giellavuoigatvuodaid nu ahte dat váldojit mielde heivehanstrategiijaide dálkkádatrievdamiid dustemii. Danne lea dehálaš ráhkadit ođđa servodatšiehtadusaid gaskkal boazodoalu ja servodaga, masa boazodoalu árbevirolaš máhttu ja -giella váldo mielde.

**THE INTRODUCTION OF THE THESIS IN ENGLISH,
TRANSLATED FROM SÁMI LANGUAGE.**

Part 1

CONTENT

| | |
|--|------------|
| FIGURES AND TABLES | 88 |
| ABSTRACT | 89 |
| 1. INTRODUCTION | 91 |
| 1.1 THE AIM OF THE STUDY | 93 |
| 1.2 REINDEER HERDING AND ITS' BASIC PREMISES..... | 95 |
| 1.3 INDIGENOUS KNOWLEDGE VS. SCIENTIFIC KNOWLEDGE | 96 |
| 1.3.1 <i>The Definition, Form and Characteristics of Indigenous Knowledge</i> | 96 |
| 1.3.2 <i>Traditional Knowledge and Scientific Knowledge</i> | 98 |
| 1.4. PAST AND FUTURE CLIMATE IN GUOVDAGEAIDNU REINDEER HERDING REGION WESTERN FINNMARK | 100 |
| 1.4.1 <i>Past climate in the Guovdageaidnu herding region</i> | 100 |
| 1.4.2 <i>Future projected climate in Guovdageaidnu</i> | 103 |
| 2. THEORETICAL APPROACHES | 104 |
| 2.1 LINGUISTIC THEORETICAL APPROACH | 104 |
| 2.1.1 <i>The basis of Sámi terminology</i> | 105 |
| 2.1.2 <i>The function of language and terminology</i> | 106 |
| 2.1.3 <i>Concepts</i> | 110 |
| 2.1.4 <i>Concept analysis and categorization</i> | 111 |
| 2.2 A SCIENTIFIC APPROACH IN RELATION TO SNOW AND REINDEER HERDING | 114 |
| 2.2.1 <i>Snow, its characteristics and its role in winter-ecology</i> | 114 |
| 2.2.2 <i>Snow transformation</i> | 115 |
| 2.2.3 <i>Snow classification</i> | 118 |
| 3. METHODOLOGY | 119 |
| 3.1 RESEARCH AREA | 120 |
| 3.2 DESCRIPTION OF DATA..... | 120 |
| 3.3 INFORMANTS..... | 122 |
| 3.4 SNOW PHYSICS AND TEMPERATURE MEASUREMENTS..... | 124 |
| 4. NORTH SÁMI SNOW CONCEPTS, THEIR CONTENT AND USE..... | 125 |
| 4.1 SUMMARY OF THE ARTICLES..... | 126 |
| 4.2 CHARACTERISTICS OF SÁMI SNOW CONCEPTS | 129 |
| 4.3 CATEGORIZATION AND CLASSIFICATION OF THE SÁMI SNOW CONCEPTS | 131 |
| 4.4 GUOHTUN AND BASIC SNOW CONCEPTS FOR REINDEER HERDING..... | 135 |
| 4.4.1 <i>Guohtun</i> | 136 |
| 4.4.2 <i>Oppas and čiegar</i> | 140 |
| 4.4.3 <i>Fieski</i> | 144 |
| 4.4.4 <i>Ritni</i> | 144 |
| 4.4.5 <i>Goavvi</i> | 146 |
| 4.5 TRADITIONAL KNOWLEDGE ABOUT SNOW, ADAPTATION AND RESILIENCE THINKING..... | 150 |
| 5. CONCLUSIONS | 157 |

FIGURES AND TABLES

| | |
|---|-----|
| Figure 1: Mean winter (Dec, Jan, Feb) (a) and spring (March, April, May) (b) air temperature measured in Guovdageaidnu from 1889 (Vikhamar-Schuler et al., 2010). | 101 |
| Figure 2: Mean winter (Dec, Jan, Feb) A) and spring (March, April, May) B) precipitation in Guovdageaidnu from 1889 (Vikhamar-Schuler et al., 2010). | 101 |
| Figure 3: Variation and change in first A) and last B) day with snow on the ground in Guovdageaidnu from 1955 (Vikhamar-Schuler et al., 2010). | 102 |
| Figure 4: Changes in number of days with air temperatures <-15 degree C in Guovdageaidnu from 1955 A), and variation of maximum snow depth in Guovdageaidnu B) from 1995. (Vikhamar-Schuler et al., 2010). | 103 |
| Figure 5: Annual and seasonal temperature average for 1961-1990 measured at inland Finnmark (Karasjok) winter pastures and coastal Finnmark (Nordreisa) summer pastures, (full drawn lines) and the similar averages calculated from 50 downscaled climate models for the year 2085 (dotted lines) (Magga et al., 2011a). | 104 |
| Figure 6: western Finnmark reindeer herding region, winter grazing lands, divided into three herding zones. | 120 |
| Figure 7: Equipment for measuring air temperature. | 124 |
| Figure 8: Sámi snow concept system, shown as a graphical concept map, based upon the relationship of similarities/differences of Sámi snow and ice concepts in relation to influencing matters. | 133 |
| Figure 9: Variants of oppas, from best level to the worst. | 141 |
| Figure 10: The concept čiegar, divided in seven sub-concepts. | 143 |
| Figure 11: The fieski-concept with its sub-ordinate concepts. | 144 |
| Figure 12: The rinádat period lasted for 45 days. In the graph the SD is snow depth and TAN is maximum temperature. | 145 |
| Figure 13: Goavvi concept with sub-concepts. | 147 |
| Figure 14: Using temperature, precipitation and snow depth data from Karasjok 1917-1918 can give indication and description of the conditions in Guovdageaidnu. | 149 |
| Figure 15: Numbers of reindeer in western Finnmark from 1945 to the present. The blue line indicates the number of reindeer, the red bar in the graph marks goavvi years and the green bar marks goavvi-springs. (Official data from the Directorate of Reindeer Husbandry). | 153 |
| Figure 16: The NAO index variation in fall (1873–2000) and orange circles shows historical goavvi years 1917, 1967 and 1996 in Guovdageaidnu reindeer herding region, which is correspond to negative NAO phases (Prepared from JIANPING, 2003). | 153 |
| Table 1: Overview of research methods used. | 120 |
| Table 2: Identification of characteristics of eight snow concepts. | 129 |
| Table 3: Classification of Sámi snow concepts based on Fiertz et al., 2009, Jernsletten, 1994; Svonní, 1981; Ruong, 1964 | 134 |
| Table 4: Example of how the Sámi snow glossary has been created made. From left; term number, Sámi snow term, definition in Sámi language, and classification number. | 135 |
| Table 5: Snow types that can cause either bad or good grazing conditions | 137 |
| Table 6: Sub-variants of guohtun | 139 |
| Table 7: Various goavvi –periods, including 1917/18 marked in yellow were characterized as stravation years (nealgedálvi), 1967/68 and 68/69 marked in red were goavvi years, and 1958-1961 and 1997 marked in green were goavvi spring | 148 |
| Table 8: Adaptative strategies during goavvi periodes | 155 |

ABSTRACT

This thesis is a linguistic study with an interdisciplinary perspective with the aim to investigate the content and the use of Sámi snow concepts about grazing conditions for reindeer on snow covered ground in Sámi reindeer herding in Guovdageaidnu, Norway. As basis for the analysis of snow concept, interviews, linguistics, and physical aspects and reindeer herders' knowledge was used, thus combining indigenous people's knowledge and snow physic measurements. In addition, a *siida*-based monitoring system based on herders' specialist language was developed, where herders from five different *siidas* used herding diaries in monitoring and making daily observation of variations in snow condition, wind, precipitation, topography related to herd behavior and welfare. 318 snow related concepts used by reindeer herders in this area, contain factors that affect reindeer survival and sustainability, well-being of reindeer and the human working conditions. The concepts contain a set of characteristics belonging to reindeer herding and snow physics, and their multidimensional content show that some concepts are based on the physical characteristics of snow and can therefore be compared with international snow classification, while others have elements connected to the different herding strategies. Some snow concept are complex categories in the sense that a term contains and includes many factors simultaneously, such as information of snow, snow conditions, snow physics, weather, temperature, location, time and impacts of animals and humans. Snow concepts are central for daily work with the reindeer, and constitute important parts for reindeer herders' traditional knowledge. Reindeer herders observe and manage snow from two perspectives; the snow physics and the ecology of herds in the winter grazing area, which reveals a holistic knowledge and view. The data indicate strategic and systematical use of grazing areas in terms of time and space and, shows variability between the *siidas* in terms of snow conditions between years and between pasture areas. Every winter *siida* has its unique grazing condition, which makes it difficult to compare one *siidas* grazing condition with others, and draw general conclusions. The use of Sámi snow concepts mirror reindeer herders' traditional knowledge of the management of the herd on snow covered ground and how herders deal with these complex systems. This kind of knowledge has contributed to the survival of reindeer herding since time immemorial. The analysis of snow concepts show the importance of using Sámi reindeer herders' specialist language and traditional knowledge in mainstream the governance of reindeer herding. Thus The national adaptive strategies must recognize reindeer herders' traditional knowledge, and their cultural and linguistic rights must be included in adaptation strategies for climate change. This requires different ways of knowing, combining both herders' experienced-based knowledge and scientific knowledge.

Keywords: *Sámi language, snow concepts, “guohtun”, reindeer herding specialist language, traditional knowledge, snow physics, climate.*

1. INTRODUCTION

“When the herd has their needs met, the reindeer herder’s mind is calm and all is well, no matter how much hardship and effort he has experienced. On the other hand, he is seized by hopeless restlessness and despairs if, as sometimes happens the herd cannot find pasture because the ice crust has settled on the lichen.”(Smith 1938:311)¹

This thesis investigates a system of Sámi snow-concepts as well as the significance of snow for Sámi reindeer pastoralism in Guovdageaidnu/Kautokeino, western Finnmark, Norway. Linguistics, physical science and reindeer herders’ knowledge have all been used as basis for the Sámi snow concept analysis in this work. This is a first step to gaining insight into the effects of weather conditions on local snow conditions and thereby the grazing conditions for Sámi reindeer herding.

This study is a part of the IPY (International Polar Year Project) *EALÁT Reindeer herders’ vulnerability network study*, a following up to the Arctic Climate Impact Assessment (ACIA) (ACIA, 2004). The IPY was a large scientific program, organized through the International Council for Science (ICSU) and the World Meteorological Organization (WMO) and was actually the fourth international polar year. An estimated 50,000 participants from more than 60 countries have been involved this time in more than 200 projects, in range of physical, biological and social research topics. One of the very few IPY research sites which hosted both projects in 2007/09 (Orheim & Ulstein, 2011) and 1882/83 (Tromholt, 1885) was Guovdageaidnu.

Since 1995 there has been a paradigm shift in Arctic research into a holistic and multidisciplinary perspective, include the human dimension, indigenous knowledge and a more integrated understanding of the Arctic as part

¹ Translated from Norwegian: “Når hjorden har sitt behov tilfredsstilt, er fjellappenens sinn rolig og alt er bra, hvor store strabaser og anstrengelser han enn har hatt. På den annen side gripes han av håpløs uro og fortvilelse, når hjorden, som stundom hends, ikke finner beite fordi isskorpe har lagt seg på laven” (Smith 1938:311)

of the world (Bowden *et al.*, 2005). Accordingly The IPY EALÁT is multicultural and multidisciplinary vulnerability study with components from different field of linguistics, social and natural sciences combined with reindeer herders' knowledge. The IPY EALÁT sought to examine the impact of future challenges on reindeer herders and their communities and to look at how they can best adapt, develop and prosper to ensure the survival of reindeer husbandry for future generations (Magga *et al.*, 2011a; Mathiesen & Magga, 2011). The project adopted a new methodological approach since the project recognized that reindeer herders' ability to adapt to change is based on traditional knowledge embodied in the language, in the institutions of herding and in the action of individual herders (McCarthy *et al.*, 2005; Tyler *et al.*, 2007).

During the next 30 - 50 years, the effects of climate change are expected to be most pronounced in the Arctic regions, affecting the circumpolar reindeer herding pastures. Throughout this thesis, the word "climate change" is used as this phase encompasses the concept of global warming, changes in temperatures and changes in precipitation, land use and land cover change, decade scale climate and weather variability and the impacts and consequences of changes to natural and human societal systems. In Norway, the effects of future climate change are expected to be most strongly felt inland Finnmark, the main winter pastures for Sámi Reindeer herding (McCarthy *et al.*, 2005; Tyler *et al.*, 2007; Oskal *et al.*, 2009). Climate change is causing various forms of vulnerabilities for indigenous and local communities in the Arctic (Henriksen, 2007). Furthermore, Climate and socio-economic change are now evident across the Arctic, and is particularly evident in reindeer herding cultures and in their traditional areas (Magga *et al.*, 2011a,b,c). The Arctic indigenous peoples, their life, culture and traditional knowledge are adapted to and largely dependent on the cold and extreme physical conditions of the region. As recently stated by Sheila Watt-Cloutier, the former chair of the Inuit Circumpolar Conference, the culture of the indigenous peoples of the Arctic depends on the cold. Their

culture is inseparable from the conditions of their physical surroundings (Bæhr, 2010).

Snow has always been important for the existence and livelihood of the Sámi people (Ruong, 1964; Svonni, 1981; Eira, 1984; 1994, Jernsletten, 1994; Magga, 2006), because it is critical for maintaining a supply of food, tracking, travel (Ruong, 1982; Krupnik *et al.*, 2010;), and determining the ability of the reindeer to graze for in winter (Saijets & Helander-Renvall, 2009). Since rapid changes, both environmental and social, are predicted for northern regions, (Magga *et al.*, 2011a) it is essential to prepare for these changes in order to reduce the risk of negative impacts in the reindeer herding society.

In various different areas of work in the mainstream society, some specialists use particular specialized words and phrases that are not part of everyday language. Johns (2010:411-13), who has provided a linguistic description of Inuit snow and ice terms, believes that the knowledge behind the vocabulary used to refer to and describe sea ice is important both for indigenous peoples and for others. Communication requires that the speakers are familiar with the relevant concepts, which, in turn, entails a terminology consisting of specialists' concept. The Sámi reindeer herders' experience of living with nature and from what nature provides has created a specialist language rich in vocabulary for describing natural phenomena (Jernsletten, 1997:234). Reindeer herders' understanding is based on the experience of generations, which has been collected and preserved about the specialized work techniques and language of the herders, both on the individual and herding group levels (Joks *et al.* 2006; Turi, 2009).

1.1 The Aim of the Study

The main aim of this study was to examine how key Sámi snow concepts are used in everyday reindeer herding in winter in Guovdageaidnu related to different kinds of weather and herding practices. An additional goal

was to identify and to understand the concepts used to assess pasture availability through the snowpack. In this study, linguistic and multidisciplinary approaches were used in order to discover new insights of the concepts. Furthermore, a system of Sámi snow concepts was discussed which might be useful in future adaptive management strategies in times of climate variability and change.

The theses focus on:

An identification of snow terms and concepts related to Sámi reindeer herding in the winter, including a review of the current literature on Sámi snow terms and how the concepts are understood and used locally in Guovdageaidnu (Paper I).

An examination of how each concept is used in the work of the reindeer herders in observation and monitoring of variability and change of snow and how these concepts are used in communicating the practical work with the herd; thus, providing a system of Sámi snow concepts. The aim was to develop a method to map the content and use of these concepts. (Paper II, IV)

An analysis to determine if different kinds of knowledge about snow could be combined and compared. The snow concepts were analyzed according to linguistics, snow physics, and reindeer herding practices. The different Sámi snow concepts of key importance for herding were then compared with snow physical characteristics from the International Classification for Seasonal Snow on the Ground. (Paper III).

A discussion of the importance of the knowledge embodied in the reindeer herders' terminology from the perspectives of resilience thinking and adaptive capacity of future reindeer herding management (Paper II, III, IV).

1.2 Reindeer herding and its' basic premises

Approximately 2.5 million reindeer (*Rangifer tarandus*) graze and are herded in the world's tundra and taiga regions (Turi, 1999; Turi, 2002; Oskal *et al.*, 2009; Maynard *et al.*, 2010). Reindeer herding is a traditional livelihood in Eurasia, carried out by more than 20 different ethnic indigenous Arctic peoples in Norway, Sweden, Finland, Russia, Mongolia and China, involving close to 100 000 herders (Oskal *et al.*, 2009; Magga *et al.*, 2011) In Norway approximately 3000 Sámi persons have private ownership of reindeer (www.reindrift.no). Reindeer herding has great cultural and economic significance for the indigenous peoples of northern Eurasia as well as for other peoples.

The basic ecological premises of reindeer herding as a pastoral means of subsistence are the variations of the seasons and the learned behavior by reindeer of migrating between and remaining in the same areas at different times of the year (Sara, 2001:81). Central features of pastoral life are the weather and wind. In the passage of the seasons there is certain consistency, yet, at the same time there are uncertainties that a humans cannot predict (Sara, 2007:9). Reindeer herding consists of three basic components: reindeer, human and ecology. The relationship among these three is dynamic and characteristic of the nomadic way of life (Hågvar, 2006:132). Reindeer herding is an example of a human- environment coupled ecosystem (Turi, 2008; Oskal *et al.*, 2009). Within the basic confines of reindeer herding, there are two types of variations: one is climate variations, i.e., the changing seasons which affect the availability and use of resources, and the other is the variation in human labor input (Sara, 2001).

The basis of Sámi reindeer herding is nomadism, characterized by movement over vast areas along migration routes (Sara, 2001; Joks *et al.*, 2006:93). Sámi reindeer herding exists in Norway, Finland, Sweden and Russia. In Norway and in Sweden, reindeer herding is, by law, restricted to the Sámi people, which means that only Sámi are allowed to own individual reindeer. The

Sámi people are the indigenous people in the Sámi areas, and these areas are also identical with areas characterized by the Sámi language.

This study was carried out in western-Finnmark' Norway where the winter-grazing area consisted of 53 herding-groups (Sám: *siida*) in 2011 occupying an area of about 10787 km² of winter-grazing land, (Figure 1). These winter herding-groups are divided into three herding zones: eastern, central and western. In the year 2008-2009 in western Finnmark, there were a total of 93603 reindeer, belonging to 1717 persons, who, in turn, belonged to 217 *siidas* (www.reindrift.no).

1.3 Indigenous Knowledge vs. Scientific Knowledge

1.3.1 The Definition, Form and Characteristics of Indigenous Knowledge

Indigenous communities have always had their own knowledge that has helped them in their everyday lives and enabled them to manage and survive for thousands of years in Arctic regions and in other parts of the world where indigenous peoples live (Magga *et al.*, 2011a). Traditional knowledge is indigenous peoples' and local communities' cumulative experience, gained through hundreds of years, from a traditional way of life and from the use and conservation of resources in the regions they inhabit and manage (Henriksen, 2002; Turi, 2009). It is through traditional knowledge and local know-how that these communities and cultures have maintained their way of life.

The concepts, “indigenous knowledge (IK)”, “traditional knowledge (TK)”, and “traditional ecological knowledge (TEK)” signify the unified body of knowledge and systems of knowledge. Berkes defines traditional knowledge thus: “TK is a cumulative body of knowledge, practice and belief, evolving by adaptive processes and handed down through generations by cultural transmission” (Berkes, 2008:7).

Indigenous knowledge is dynamic, because 1) knowledge is adaptable to environmental changes, and each generation can add to it with its own self-experienced knowledge and observations and 2) it incorporates social processes such as exploitation of resources, which vary from community to community (Peloquin & Berkes, 2009:534). The difference between indigenous knowledge and traditional knowledge is that indigenous knowledge, from an indigenous perspective, is something that has been passed on through generations, and contains, as a dimension, in historical, social and cultural contexts, the experience of the relationship between state and the minority population (Keskitalo, 1993; Jannok-Nutti, 2007).

Krupnik *et al.* (2010) argues that the indigenous way of knowing about, or being able to do, was traditionally founded on careful attention to what was said and to the stories told by elders or adults. From a young age, children and young people start to accompany learned and experienced members of the community in order to observe and learn how they deal with practical problems and performed tasks. Their daily attention to how things were dealt with, both everyday things as well as dangerous things, taught them how to recognize phenomena such as dangerous ice and how to avoid it, while at the same time learning how to describe and point out these precise situations (Krupnik *et al.*, 2010:351-52).

Some disciplines, such as ecology, considered a relatively new discipline, have shown their awareness of traditional knowledge. It should be added that this type of knowledge is, of course, also found among other peoples, although in western societies it appears in many respects to have disappeared, from areas such as science and the public arena. In Sámi societies, the demand has come for traditional knowledge to be given more emphasis, for example in the management of biological resources (Joks *et al.*, 2006).

Reindeer herding knowledge may be defined as the knowledge of how to make use of the reindeer how to maintain an independent *siida*

throughout and how to manage each individual animal as a resource, as well as of the relationship between the herd and its natural environment (Sara, 2001). The reindeer herder's knowledge and sense of the natural environment is extraordinary, and of a different kind from that of a non-herder, for the herder has come to know the natural environment as a basic condition of life. While following the reindeer, the herder gets to experience nature in all its different situations, suffering bad weather as well as enjoying good weather (Sara, 2003: :94). Comparing the content of reindeer herding knowledge with that of indigenous knowledge and traditional knowledge, reindeer herding knowledge can be characterized as both indigenous and traditional knowledge categories. Knowledge of nature is of fundamental value to the reindeer herder as it contains both his heritage and his identity (Sara, 2003:94).

1.3.2 Traditional Knowledge and Scientific Knowledge

Borgos (1993) believes that scientific knowledge and traditional knowledge are two paradigms of science in the Kuhn sense (Kuhn, 1996). This opinion shows that in the matter of these two models of knowledge, it does not necessarily have to be a question of one or the other (Borgos, 1993:8f.). Integration of scientific and indigenous knowledge, for example in the domain of renewable resource co-management, purportedly blends the best of two world-views (Nakashima, 2000). Kalstad placed traditional knowledge within a reindeer herding context when discussing fundamental knowledge in connection with a plan for reindeer herding (Kalstad, 1993:40f.). In such knowledge-model systems, there are some features that divide traditional and western systems of knowledge, though it must be emphasized that the two models should not be regarded as separate “spaces”, which was also Borgos' point.

When comparing the characteristics of traditional knowledge with scientific knowledge, we find that traditional knowledge has certain distinctive features that distinguish it from scientific knowledge, such as the holistic way in

which traditional knowledge views entire ecological systems (Berkes, 2008; Peloquin & Berkes, 2009). Knowledge is tested or verified by each person's own experiences in the everyday life of the community (Jernsletten, 1997; Berkes, 2008; Krupnik *et al.*, 2010). Knowledge is constantly growing and developing and this means that things are constantly being learned through work, trial and error and the acquirement of skills (Berkes, 2008). In knowledge, quantifiable aspects are not emphasized, although that does not mean that knowledge is not precise or detailed (Magga, 2010). Knowledge may be mirrored in language, social-organization, norms, values, views, institutions and regulations. Knowledge comes in the form in which it has been carried by the bearers of traditional knowledge. Therefore, it is important to remember that knowledge grow roots where it is developed and used (Turi, 2009). Broadly speaking, traditional knowledge can be said to differ from scientific knowledge with regard to structure, function, origin, basis and age (Borgos, 1992; Helander, 1993; Jernsletten; 1994; Joks *et al.*, 2006; Berkes, 2008; Peloquin and Berkes, 2009).

Much research has been done and much is still in progress, aimed gaining a deeper knowledge and understanding of climate change from traditional knowledge models and also to investigate the concept of traditional knowledge (Berkes & Jolly, 2001; Peloquin & Berkes, 2009; Krupnik, *et al.*, 2010). It is clear that indigenous peoples and their unique systems of values, knowledge and practices have been overlooked. There is an urgent need to correct the imbalance of mainstream-thinking by actively integrating indigenous peoples in the future starting with the framework for action. There is a real need to involve indigenous peoples directly in development processes, whether at local, national or global levels (Nakashima & Chiba, 2006). Several projects have studied systems of traditional knowledge looking at issues such as weather-forecasting, monitoring of the environment, vegetation, animals, survival and adaptation strategies etc. (Nakashima, 1991; Burgess, 1999; Berkes & Jolly, 2001; Davidson-Hunt & O'Flaherty, 2007). Traditional knowledge has inspired

research into complex models of nature (Nakashima & Roue, 2002). Traditional knowledge can also be viewed in the context of power and power relationships. It has, up until now, hardly been touched on by governing authorities, either being rejected as an element or an argument in their decision-making (Joks *et al.*, 2006). However, Dr. Robert Corell, who led the Arctic Council's work on the "Arctic Climate Impact Assessment" report, has clearly emphasized the value of including the voice and insights of indigenous peoples in climate research (Aftenposten, June 2006). The ACIA report pioneered the combination of traditional knowledge and western science and is an excellent example of how indigenous knowledge and know-how are important and valuable in understanding natural phenomena.

1.4. Past and future climate in Guovdageaidnu reindeer herding region western Finnmark

To better understand how Sámi reindeer herders' specialist language about snow and snow change, I will in this section characterize the historical and future winter climate locally in Guovdageaidnu where this language has been developed and used.

1.4.1 Past climate in the Guovdageaidnu herding region

Basic climate parameters such as temperature and precipitation have been recorded in the upper village of Guovdageaidnu in since 1889, and provide a unique set of data for use for characterizing the historical weather and climate conditions (Vikhamar-Schuler *et al.*, 2010). Sámi reindeer herding has developed in Guovdageaidnu in a relative stable winter climate. The mean average winter (Dec-Jan-Feb) temperature has varied between about -8 and -22 °C (Figure 1a) providing cold and dry winters inland Finnmark for reindeer grazing (Vikhamar-Schuler *et al.*, 2010).

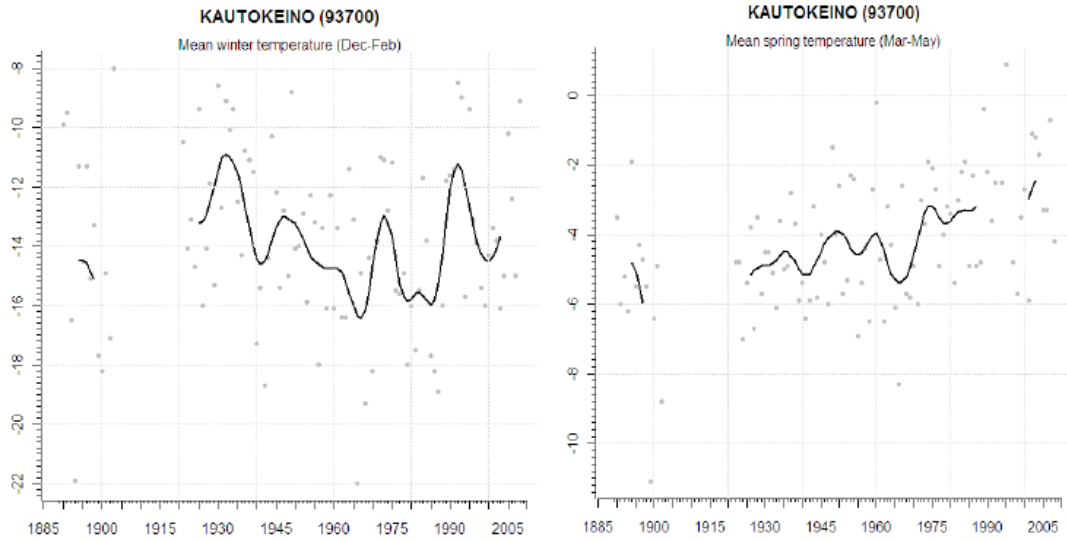


Figure 1: Mean winter (Dec, Jan, Feb) (a) and spring (March, April, May) (b) air temperature measured in Guovdageaidnu from 1889 (Vikhamar-Schuler et al., 2010).

The coldest mean annual average temperature $-5.1\text{ }^{\circ}\text{C}$ measured in Norway was measured in 1893 and 1985 in the Guovdageaidnu region. The coldest absolute air temperature measured in Guovdageaidnu was $-57\text{ }^{\circ}\text{C}$ (not officially recorded) in January 1999. The highest and lowest maximum snow depth was 110 cm in 1936 and 34 cm in 1972 respectively.

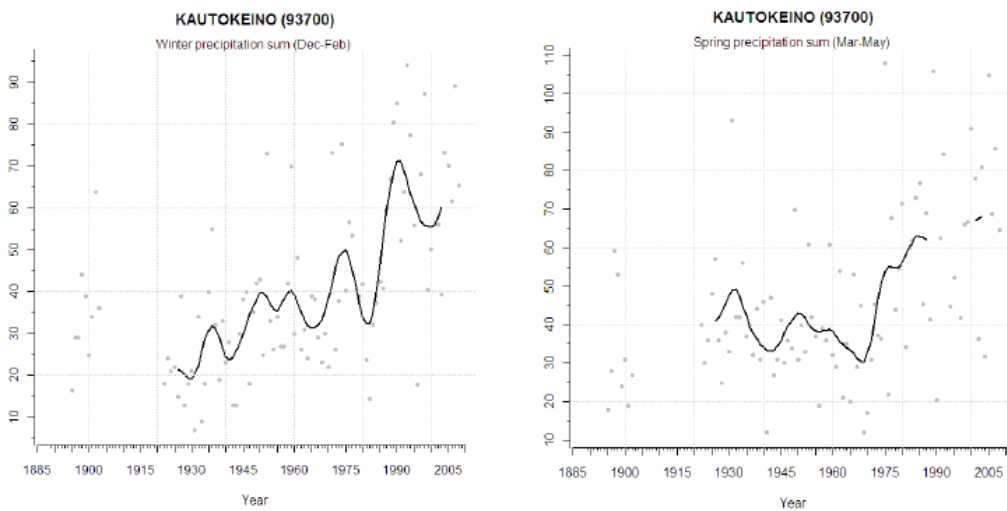


Figure 2: Mean winter (Dec, Jan, Feb) A) and spring (March, April, May) B) precipitation in Guovdageaidnu from 1889 (Vikhamar-Schuler et al., 2010).

Studies of time-series of Guovdageaidnu winter and spring temperatures through the 20th century show large inter-annual and inter-decadal

variability (Figure 1 a,b) (Vikhamar-Schuler *et al.*, 2010). The spring air temperatures are the only season for which the long-term temperature trends are statistically significant. In Guovdageaidnu, temperatures in spring increased by 1.5 °C from 1900 to 2000 (Hansen-Bauer, 2010). The average winter temperatures in Guovdageaidnu confirm that the winter temperatures in the inland area are about 10°C lower than they are along the coast.

On average there are 228 days annually with snow on the ground in the reindeer pastures (Vikhamar-Schuler *et al.*, 2010). The duration of the snow season can be divided in to three main periods: first, a decreasing snow season from 1900 to the 1940’s, when the snow season was delayed by one month; second, an increasing snow season from the 1950’s until the 1970s; third, a variable snow season from about 1995 (maximum) followed by a reduction thereafter. The duration of the snow season in Guovdageaidnu decreased mainly as a result of increased air temperatures in the spring from 1955, but no trends were observed in fall (ibid.).

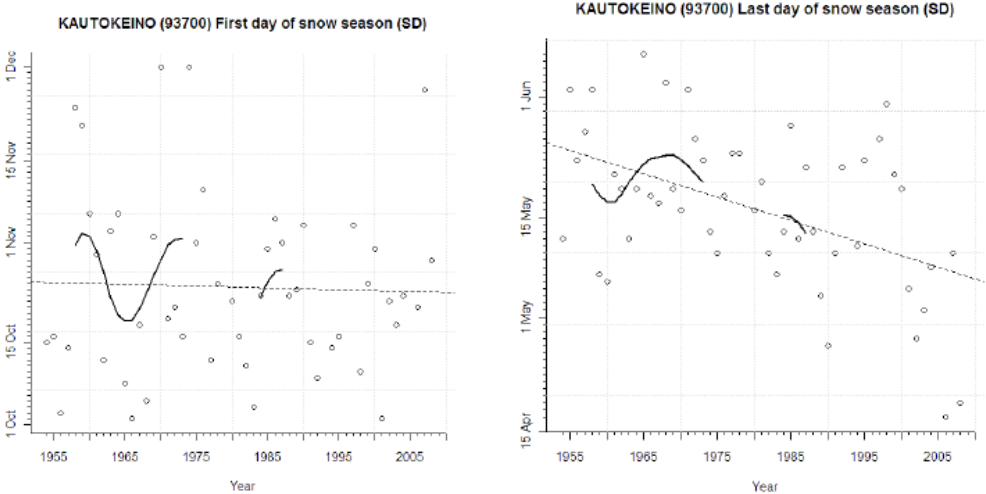


Figure 3: Variation and change in first A) and last B) day with snow on the ground in Guovdageaidnu from 1955 (Vikhamar-Schuler *et al.*, 2010).

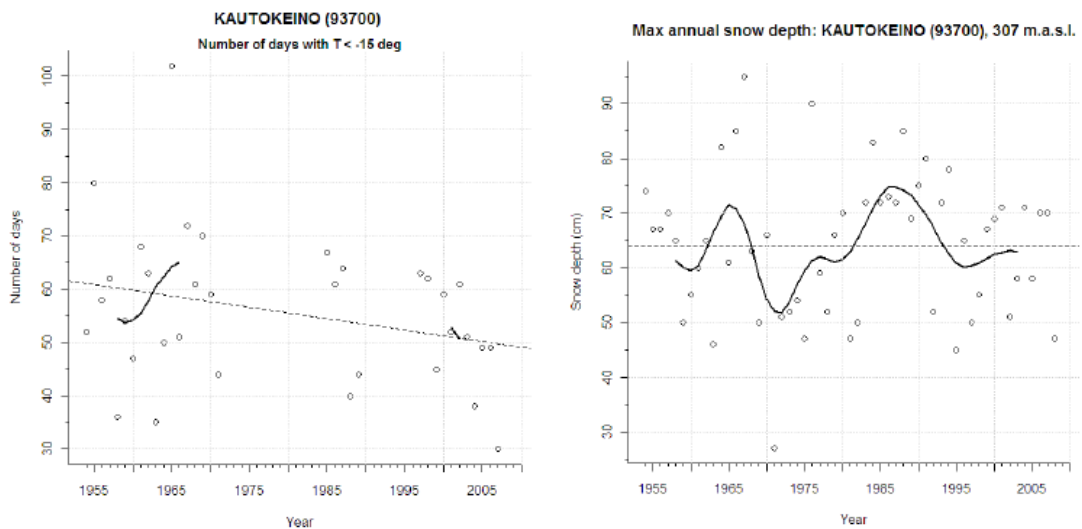


Figure 4: Changes in number of days with air temperatures <-15 degree C in Guovdageaidnu from 1955 A), and variation of maximum snow depth in Guovdageaidnu B) from 1995. (Vikhamar-Schuler *et al.*, 2010).

There is a negative trend in the numbers of days with temperatures below -15°C over the last 50 years, whereas there is no clear positive or negative trend in the length of the cold season (number of days with temperatures below -15°C) over the last 100 years (Vikhamar-Schuler *et al.*, 2010). The air temperature in Guovdageaidnu has increased primarily in spring, while precipitation seems to have increased in all seasons (*ibid*).

1.4.2 Future projected climate in Guovdageaidnu

The projected future warming of air temperature in winter (Dec-Jan-Feb), in Guovdageaidnu is more than 7°C toward the end of the century (Benestad, 2011). The future winter temperatures in Guovdageaidnu may be similar to the present conditions in Nordreisa at the coast (Fig 5). The annual precipitation may increase by 5%, while the snow season may be more than one month shorter (Engen-Skaugen, 2007).

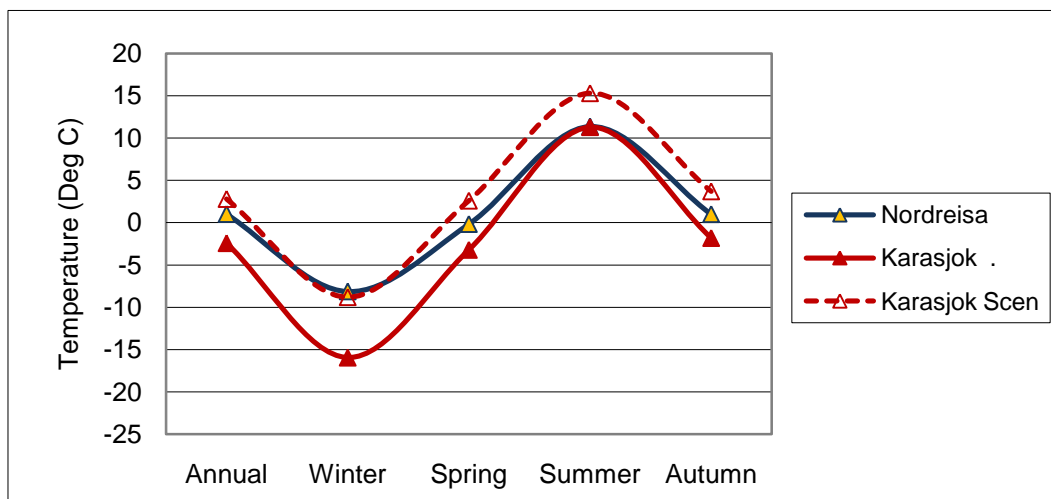


Figure 5: Annual and seasonal temperature average for 1961-1990 measured at inland Finnmark (Karasjok) winter pastures and coastal Finnmark (Nordreisa) summer pastures, (full drawn lines) and the similar averages calculated from 50 downscaled climate models for the year 2085 (dotted lines) (Magga et al., 2011a).

2. THEORETICAL APPROACHES

2.1 Linguistic theoretical approach

It is the interdisciplinary nature of a research subject, viewed from an indigenous perspective that determines the theoretical approaches. The starting-point is the reindeer herders' specialist knowledge of the reindeer and of snow, how they use the specialized snow vocabulary in herding, how they discuss these matters and how, in their cognitive world, they consider them in relation to the survival of the individual animal and the herd as a whole. The theoretical approaches should describe this specialized vocabulary in linguistic terms as well as the cognitive aspect of the words and their use in a reindeer herding environment. I have chosen to combine linguistic methods of approach with terminology theory and cultural linguistics, and then analyze the data in relation to this. I have emphasized the terminology in the context of terminology science, which is the study of structure, formation, development, use and processing of concepts and terminologies in various subject areas (Myking, 2009). Linguistic methods of approach may support one another to provide patterns and an overview that may, in their turn, present the characteristics of the research

subject. In this part I will present the theoretical methods of approach that may provide a theoretical explanation of Sámi snow terminology and snow concept analysis.

2.1.1 The basis of Sámi terminology

There is as strong a connection between the Sámi language and Sámi culture as there is between the language and the traditional Sámi livelihoods, since the language is both the language of work and the specialized technical language of these livelihoods (Helander, 1997:22). The concept of culture is wide ranging and includes, among other things, the acts and perceptions of people in their society as well as the values and evaluations made by people in their own life situation. The culture that belongs to a particular specialist subject field is part of a cultural environment's heritage and acts (Lauren *et al.*, 2007:15). The Sámi have, until now, managed to maintain their traditions as a hunter –gatherer society over thousands of years, which have contributed to the survival of traditional knowledge of weather and climate, nature, and animals - knowledge which survives to the present day (Jernsletten, 1997).

Snow terminology is in daily use in winter, at least in reindeer herding (Eira, 2011 submitted). Sámi snow and ice terminological description provides systematic information about snow and ice conditions. Some snow and ice-related words are said to be as old as the Sámi language itself, and their use has been passed down from generation to generation until the present (Roung, 1964; Jernsletten, 1997:234-36), and they cannot therefore be compared to more recently constructed terms, used to designate modern articles or ideas.

Terms and phrases create a specialist language in each specialist field. A specialist language is a form of language belonging to a certain subject or area of knowledge, which is used by experts (Store Norske Leksikon) and which is not part of everyday speech. A set of terms belonging to specialist language is defined as terminology (Sager, 1990; Lauren *et al.*, 1997:47). The development

of specialist language is the starting point for the science of terminology and its terms represent the concept system of a particular specialist field (ISO, 1990). Communication about the content of a specialist subject requires that the speakers are familiar with the relevant concepts and to this end both terms and terminology are necessary. It can therefore be said that communication in a specialist field is more demanding than communication in general language. According to Jernsletten (1997:235), the Sámi have many specialist fields within their own specialist languages with specialist terms and phrases, which also contain cultural tradition and information from the Sámi's own understanding of their life and environment.

2.1.2 The function of language and terminology

Language is the means by which a person describes his or her own environment, acts, objects and events, etc, and concepts and terms are necessary to explain their meaning to other people (Eira *et al.*, 2010).

Terminology has both a linguistic and a semantic basis (Sager, 1990:1-2) and this also applies to the study of signs like linguistics, semantics and semiotics (Rey, 1995:25). Terminology is, first and foremost, a tool for other functions such as specialist field communication and documentation, etc. The development of terminology has been influenced by many scientific disciplines, such as, linguistics, logic, ontology, philosophy, theory of science and informatics (Lauren *et al.*, 1997:26).

Language has a cognitive function, while at the same time having a textual and communicative function (Temmerman, 2000:61). On the cognitive side, descriptive linguistics defines and describes knowledge (Temmerman, 2000). Specialist language (terminology) also has cognitive, linguistic and social aspects (Rey, 1995:116). Myking (1996:115) argues that terminology is a linguistic discipline that organizes cognitive and communicative knowledge.

Some of the principal researchers into terminology in the Nordic countries are Picht, Myking, Lauren (Lauren *et al.*, 1997). They argue that terminology is founded on a basis of Aristotelian philosophy and of semantic and structural field theory, to which, in recent years has been added prototype theory. In this discipline, the emphasis is on disjunction as well as on concept-realization on the synchronic level (*ibid.*). Palmer combines linguistic anthropological theories, adding cognitive linguistic elements to produce a theory of cultural linguistics. He believes that particular circumstances can reveal language's cognitive patterns. These circumstances show that a world view influences basic models, depending on which languages of the world are the template (Palmer, 1996). Both cognitive and cultural linguistics utilize mental models that are memorized thoughts about how things function and fit together, in order to show how cognitive processes produce patterns from what a person thinks and understands. Mental models play a central role in representing objects and phenomena, defining matters and designating events and showing how we understand the world. Mental models are thought memories of how things function and how they fit together. Cognitive researchers have studied mental models in order to understand how a person knows, recognizes, decides and behaves in different environments. Mental models contain a person's understanding of things and affect the way he or she is able to predict the consequences of their actions. They are a simplified version of the reality that objects and concepts represent (Palmer, 1996:55-56). Berkes & Berkes (2009) argue that the production of indigenous peoples' mental model follows the patterns of people's language use, as language generates terms and concepts, the mental process in an information bundle and the concept from production to storage. They present examples from Inuit society, their mental model, how they evaluate the health and quality of animals, e.g. how fat/thin a seal is (*ibid.*). This evaluation is a language-based construction and pays less attention to numerically precise data. The Inuit rarely make simple linear cause-and-effect type of connections as is often the case in western science. Rather, they study

empirically environmental changes and make related observations. According to the Inuit world-view, it is childishness and thoughtlessness that generates simplifications and generalizations of complex phenomena (ibid.). If all holistically constructed concept realizations were to be specified, whole thought would become unmanageably complex. There seems to be a mutual connection between the complexity of the system and the preciseness of the definition, and this can be used to describe something meaningfully (Berkes & Berkes, 2009:7-8). The more we study languages, the clearer it becomes how much environment, circumstance and need influence the creation of concepts (Magga, 2004). This was also the opinion of Sapir and Wolf, who proposed the hypothesis used in linguistic realism. They believe that the prerequisite of thought is language, and that people view the world in different ways, according to which language they speak, since they constitute and classify the world according to those categories that our language possesses (Sapir, 1968).

The definition of mental models from an indigenous perspective is termed fuzzy logic and it was initially introduced as a mathematical approach to deal with complex systems (Berkes, 2008; Berkes & Berkes, 2009). In the case of fuzzy logic things need not be precisely defined or quantified before they can be considered mathematically. Information is classified into broad categorizations or groups which show the working of the human mind. The premise is that the most important elements of human thinking are not numbers, but labels containing fuzzy sets (Zadeh, 1973:28; Berkes & Berkes, 2009:7-12). Fuzzy logic has three main features: 1) the use of linguistic variables rather than, or in addition to, numerical variables; 2) characterization by simple relationships between variables of fuzzy logic; and 3) characterization by complex relationships between fuzzy algorithms. For example “fat, thin, very thin” values of linguistic are variability for how fat something is (Berkes & Berkes, 2009:9). These features are also found in the methods used by reindeer-herders to categorize snow, where they use phrases like thick layer of ice instead of 10 cm layer of ice (Eira *et al.*, 2011, submitted).

Berkes & Berkes (2009) argue that like the human mind, fuzzy logic also brings together related objects according to category in order to reduce the complexity for problem solving. Fuzzy logic facilitates classification in extremely wide-ranging or diverse categories or groups. Halfpenny & Ozanne (1989:38) also mention how indigenous peoples (Native Americans and Inuit) use language to precisely define snow conditions that may be dangerous for them. They also write that indigenous peoples did not use numbers to define these conditions, but rather that their rich descriptive vocabulary enabled them to define, both fresh and transformed types of snow and snow conditions. Reindeer herders are in the same situation, since they preside over very many variables. When herding, they must, at one and same the same time, attend to and watch over the herd, to see how it behaves, how the animals are doing, what the temperature is, how wet it is and from which direction the wind is blowing etc. This is part of their mental model, the main rule of which is to, check the edge of the herd and assess how hard the snow is (Eira *et al.*, 2011, submitted).

Nils Isak Eira (1994:23) writes that reindeer-herding is arranged in such a way that all the members of a herding-group have to communicate and resolve matters in council for the success of the group and this is why understanding, communication and knowledge are so important. In herding internal communication with respect to the actual herding is of major importance (Sara, 1990:92), and this communication often contains specialist reindeer herding terms, which are used to inform others about the state of the herd, the grazing, the reindeer and the terrain. This includes precise identification and description relating both the reindeer and the terrain and to the prevailing natural conditions. An experienced reindeer herder can, with just a few words, explain in detail to another about, e.g., grazing conditions, a characteristic or easily identifiable reindeer etc., as well as to other matters (Eira, 1994). The content of the information that is most valuable rather than the amount of information, “It isn’t a question of how many words and explanations or descriptions are presented, but how much information they contain (Eira, 1984).

2.1.3 Concepts

Concepts are mental or logical representations of reality that create a system in the human mind for classifying and understanding the perception of the intellect (Antia, 1999). Linguists of various traditions have long argued about how to define the content of a concept and how to test it. Here we have, on the one hand, those who follow traditional terminological methods and on the other, those who emphasize the cognitive and cultural aspects of language. Temmerman (2000), who has studied biology texts, believes that the principles and methods of traditional terminology do not take account of the fact that terminology plays an important role in communicative and cognitive settings. According to her theory, traditional terminology must require methods that can investigate and describe all the aspects that play an important role in the process of understanding specialist language (Temmerman, 2000:220-221).

A terminologically defined concept may be compared to a semantic structure in which the semantic characteristics are one with the concept's intention (Lauren *et al.*, 1997:76). Researchers define the concept-concept in many different ways, but central to all these definitions is that the concept at least touches on the cognitive aspect of the word's explanation. Magga (2007) states that a concept is something that a person pictures in the mind, and which he/she believes that function in such a way as to require or be suited by a designation. The international terminology standard states that the concept is a unit of thought constituted through abstraction on the basis of properties that is common to a set of objects (ISO, 1990). This may be characterized as a phenomenon (a part of the real world that one wishes to describe), an understanding or thought. Temmerman (2000:42) calls the concept a unit of understanding. Concepts possess characteristics (Suonuuti, 2008), which means that it is the concept's characteristics that make the concept. The characteristics are important in the making of the definition (Picht & Draskau, 1985).

2.1.4 Concept analysis and categorization

The content of a concept can be explained with a definition (Lauren *et al.*, 1997:107). The oral and/or written definition of a concept helps in distinguishing one concept from another neighboring concept (Suonuuti, 2008:15). In order to define the meaning of a lexical unit, we need a definition that provides the smallest and most important piece of information about the concept (Temmerman, 2000:83). The function of the definition is that, it can show the position of the concept in the concept system in such a way that the term is placed at the level above, in relation to the concept, and that it is given the sufficient number of characteristics necessary to separate and distinguish it from other concepts on the same horizontal plane of the concept-system (Temmerman, 2000). Definition helps to show the concept in relation and with reference to other concepts.

Specialist field concepts, for example, may be analyzed with terminological methods to determine the concept's characteristics and to investigate their relationships and connections to other concepts in the same specialist field. Nuopponen, (1994:30; 1996:171) believes that each concept should be able to be placed in a concept-system so that it is easier to structure a particular specialist field, and that type of systematic thinking is in accordance with structuralism (for example Saussure and Wüster) (Lauren *et al.*, 1997:113-14).

On the terminology side it is believed that a concept should have a term or designation so that its meaning is precise, and best of all is if the definition determines the term's meaning so that it can be identified and understood (Wüster, 1985:7). However Temmerman (2000:81) believes that it is impossible to give a clear, unambiguous concept structure that provides a definition including the necessary and extensive characteristics that distinguish the concept from other concepts. A concept-system is a system containing related concepts which together form a whole. In terminology, we cannot study

individual concepts as separate units, only in their own concept-context, together with other concepts (Picht & Draskau, 1985:62; Lauren *et al.*, 1997). Concepts may be in different concept-systems, depending on what connection there is between the concepts (Nuopponen, 1994:237).

The term “extension” is used in cultural linguistics to refer to similarities’ in categorization groups (Palmer, 1996:78). This term is also used in terminology science and has the same meaning there, i.e. the extension of a concept that designates characteristics (referents) which belong to the concept, often shown as a list (Lauren *et al.*, 1997:115; Suonuuti, 2008). The opposite term to this is elaboration, which refers to categorization which is entirely re-enforced by the upper level schema (Palmer, 1996:92). In terminology, the opposite term is known as the intension of concept by which the concept’s distinguishing features and peculiar characteristics are identified and distinguished in relation to other concepts (Lauren *et al.*, 1997:116; Suonuuti, 2008:23). These concepts are used in connection with terminology when creating definitions.

It is possible to organize knowledge using category systems. (Davidson, 1984:182) Nuopponen argues that if we wish to present human knowledge that has been produced and developed in a certain specialized field, then not only the concepts must be defined but also the relationship between the concepts, in what she calls a concept-system. Hierarchical concept-analysis assists in transmitting one’s thoughts to another to communicate with others about one’s own thoughts (Nuopponen, 1994:36). Concept systems are like maps that show us what the world is made of and how it is put together.

Traditional terminology puts a concept in a concept structure, which is almost like categorization. This concept structure is a logic-based structure, which shows that X is some kind of Y, or an ontological classification, thus X is a part of Y. A category and each category in a cognitive model is produced by the understanding of it (Temmerman, 2000:224). Concepts make categorization

possible and provide information about individual, category-related, knowledge concerning entities (Cruse, 2004:127). Temmerman (2000:65) believes that categories are units of mental understanding. Understanding is experienced-based and is built on previous knowledge.

Classification, on the other hand, can provide a systematic overview which shows the similarities and varieties of the matter under investigation (Nuopponen, 1994:33). Indigenous peoples' snow and ice terminology contains different classifications and categories. Among the Slave Indians of Northwest Territories an ice-taxonomy is used for evaluating travel conditions. They have 13 categories divided into three groups: solid ice, melting-ice and cracking ice. The 13 concepts do not consist of separate or individual words, but are derived from a single root (Silver *et al.*, 1997:72-73). Certain types of ice are better for transport in all three kinds of travel; other types do not permit travel at all while others, though not all, do allow passage. There are 39 situations in all and for each there are three possible approaches: 1) cross the ice, 2) make a detour, or 3) proceed cautiously, and examine the ice (*ibid*). This can be compared with *sámi* snow classification that includes various ice forms, eg. *cuoŋu*, *moarri*. (Appendix 1)

Temmerman (2000) believes that we are not always able to understand concepts precisely enough, but rather that we have to take into consideration that concepts may be slightly unclear or undefined. This is the feature of general language. Thus, one cannot expect clear boundaries between them.

When analyzing *Sámi* snow-terminology, consideration must be given to the starting-point of this specialist terminology, which is drawn from oral tradition and not from collected texts or a corpus of written material. Temmerman explains how, in her area of research, she has worked with words, making particular mention of how she has collected specialist vocabulary from texts, which she has subsequently made into a list (Temmerman. 2000:226).

Terminology can be used as a tool with which to present concepts in a concept-system overview (Nuopponen, 1997), and cognitive linguistics on the other hand can be used to test cognitive structures, such as, for example, images related to mental models. In this study, I have used conceptual analysis based on the language of reindeer herders and the theoretical approaches mentioned to describe Sámi snow terminology.

2.2 A scientific approach in relation to snow and reindeer herding

2.2.1 Snow, its characteristics and its role in winter-ecology

In the cold regions of the world, snow covers the land for a large part of the year. The impacts of snow on the climate system and snow cover variability and change have important consequences for nature and for human systems (Armstrong & Brun, 2008:6). The temperatures on and close to the ground, and the melting/freezing process have a major impact on the diversity and productivity of the ecosystem (ibid.).

Snow science distinguishes between snow in the atmosphere and snow on the ground caused by precipitation. Snow and snow-covering² is built up of different layers of snow and ice of different thicknesses, hardness and types etc. (Pruitt, 1966; Colbeck *et al.*, 1990; Fierz *et al.*; 2009).

Snow has a complex structure, which is constantly changing (Armstrong & Brun, 2008:13; Brattlien, 2008:59). Snow is water in “solid form”. In snow-physics, a snow-grain is a mechanically separate particle in a covering of snow (LaChapelle, 1992:5). The crystals, which make up snow, are ice crystals that form in the clouds. Air, temperature and form affect the changes in the form and type of the crystal as it falls towards the ground (Halfpenny & Ozanne, 1989:38; Lied & Kristiansen, 2003:39; Landrø, 2007:37). If the air temperature decreases below 0°C, the extra water content turns to ice crystals.

² Snow in layers on the ground (Hestnes *et al.*, 2010)

The lower the temperature, the more ice crystals are formed (ibid). All snow crystals are hexagonal, but are constantly changing according to humidity and temperature. There are thousands of different forms of crystals, but the most common are forms resembling stars, plates and needles, while the most common snow crystal of all is a hexagonal, star-shaped crystal (Lied & Kristiansen, 2003:41; Landrø, 2007:35). No two crystals are alike (LaChapelle, 1992:3).

2.2.2 Snow transformation

Snow is divided into three types: 1) Falling snow, 2) snow on the ground and 3) surface ice features. (Halfpenny & Ozanne, 1989:38-40) Air-temperature, air-humidity, wind and radiation effect transformations of the snow-crystals from the time they reach the ground (Halfpenny *et al.*, 1989:41; Armstrong & Brun, 2008:27). These changes are called metamorphosis, which is basically a geological term meaning structural change, caused by heat or pressure (LaChapelle, 1992:3). A distinction is made between wet and dry snow metamorphism (Armstrong & Brun, 2008:27). There are at least four different processes that transform snow: destructive, constructive, melt/freeze metamorphosis and sintering. These processes can occur at simultaneously (Armstrong & Brun, 2008; Jaedicke, 2009). The first three occur in dry, cold snow while the fourth occurs in wet snow (Brattlien, 2008:60). Dry snow is defined as snow that contains no liquid water, whereas in wet snow more than 0.1 % of the volume is liquid water (Armstrong & Brun, 2008:27-28).

Destructive transformation refers to the process by which hexagonal crystals are turned into smaller, more rounded ones. Where there is little difference in temperature between surface and depth/bottom snow, and where the temperature is sufficiently high, from 0 °C to about -8 °C, is the situation in which the destructive transformation process starts to occur. It is in such weather conditions that the snow crystals change shape, from a pointed-star to a more rounded crystal. This change in shape causes the snow to sink, whereupon the

snow is squeezed and pressed and the crystals stick together easily. The density³ of the snow may increase, reaching up to 300kg/m³ in normal circumstances. The porosity of the snow may be reduced by about 65%, but snow contains, by volume, more air than ice (Halfpenny & Ozanne, 1989:43; LaChapelle, 1992; Lied & Kristiansen, 2003:50-51; Landrøe, 2007:36-37).

The constructive metamorphism process occurs where the temperature difference between surface and ground is great. For example, the ground temperature may be close to 0 °C, but at the surface it may be much colder. A temperature gradient will show how much the temperature diverges from a certain given value of the snow depth (°C/m). In a covering of snow, the temperature is measured from the surface to the bottom, right down to the ground, and a small gradient would be, for example, -1 (°C/m) and a steep gradient would be -25 °C (°C/m). The constructive transformation process starts when the gradient is at least -10 °C per meter (Hestnes *et al*, 2010). When the temperature gradient in the snow is approximately -10 °C per meter, warm air has more water-vapor than cold air. This means that the saturation-pressure is greater near the bottom than in the colder snow above it and, thus the water-vapor rises up through the snow. During this process, the crystals change from a rounded shape to a shape with flat, sharp edges. These crystals sparkle if viewed in the light. The snow crystals increase in size and become square-shaped, and may increase in size by up to 2 -3 mm. (Halfpenny & Ozanne *et al.*, 1989:43; LaChapelle, 1992:18; Lied & Kristiansen, 2003:53-55; Landrøe, 2007:39-40). When the surface of the snow freezes hard, the crystals at the surface become square-shaped. Though the destructive process is at work during the day, it is not able to maintain the transformation. The longer this process lasts, the thicker such a layer becomes (Landrøe, 2007:40). Around trees and stones that the snow has covered, there are often hollow spaces. Such places give the crystals room to grow, and if there is little snow as well as freezing temperatures, they increase

³ Density refers to Mass per Volume, specified in kg/m³

quickly in size and the snow quickly turns to *seanáš*. Following a long, cold-spell, the whole covering of snow may be *seanáš* (Lied & Kristiansen, 2003:54-55), which means that the snow is porous.

The melt-freeze process occurs when the snow temperature rises above 0 °C. Ice crystals then begin to melt and make the snow wet. The sun, temperature, high air-humidity and rain determine when this process takes place. As the snow melts, water forms around each crystal, transporting the melt-water from the ends/tips of the crystals to the hollows. When the melting is rapid, the shape of the crystals becomes almost completely round. If it then freezes again, the crystals stick together and the snow and surface of the snow become very dense (Halfpenny & Ozanne, 1989:48; Lied & Kristiansen, 2003:55-56; Landrøe, 2007:37-38).

Sintering is a transformation process in which the movement of molecules causes the crystals to freeze together, even though the snow has not melted. The crystals are so close to one another that they stick together, bound by threads of ice. The smaller the crystals are, the greater the amount of ice-binding per unit of volume. Before the process of sintering begins, the snow is quite porous, particularly if it has recently been snowing, without drifting. The snow density becomes very high because of the formation of the ice-threads bindings. In drifted snow, the crystals are very small, less than 0.5 mm in diameter (Halfpenny & Ozanne, 1989:45; Lied & Kristiansen, 2003:53-54).

In general language, the term snow also includes the surface-created ice-features that ecologists believe to be so important (Halfpenny & Ozanne, 1989:38). Layers of ice occur in three different ways: rolled or compressed by the wind, with the heat of the sun (melting/freezing) and freezing following rain (Halfpenny & Ozanne, 1989:49). When it snows in different types of weather, it affects the surface of the snow, but also the snow cover in general, so that fresh snow covers the layer that was previously at the surface and thus the snow gains layers (Brattlien, 2008:27).

2.2.3 Snow classification

2.2.3.1 Snow classification based on snow physics

Research into snow has led to the formulation of various different classifications to describe the various different types of snow. Snow has been classified according to its physics (physical properties) (Colbeck *et al.* 1990; Fierz *et al.*, 2009). The International Classification of Seasonal Snow on the Ground is one of the oldest snow classifications and has recently been revised (Fierz *et al.*, 2009). The aim of classification is to create qualitative descriptions of the shape and size of the snow grains (Armstrong & Brun, 2008:21), that numerous different user-groups can employ, from researchers to skiers. Classification is based on observations made using simple equipment or purely by means of visual observation (Hestnes *et al.*, 2010:2). In these classifications, falling snow is divided into nine categories according to form (morphological classification). They also contain process-based classification as well as additional information on the physical processes behind the various types of snow and how strong the particular type of snow is (Kristensen, 2007; Fierz *et al.*, 2009).

2.2.3.2 Snow classification based on ecologic traditional knowledge

A classification of Sámi snow-vocabulary has also been produced by separating terms into groups according to meaning, but it was Israel Ruong (1964:76-77) who put a clear dividing line between the various term-groups: 1) amount of snow (how much snow there is), 2) consistency of snow, 3) the snow's bearing capacity, 4) snow-conditions (for mobility/transport), 5) untrodden snow and tracks in the snow, 6) rime and coating of ice (on trees and other things), 7) melting and baring (of ground), 8) remaining spots/areas of snow in summer and 9) the various levels of winter-grazing conditions. Ruong describes snow from an ecological perspective, and his point of departure was to

explain ecology as knowledge of the relationship of organisms (living and dead) to the environment as well as the connection animals and plants have to one another and to the climate, to food, and to the land. He examined the relationship between herder and reindeer and between reindeer and the land. (Ruong, 1964) Ruong believes that it is possible to divide snow into many categories according to factors such as amount or quantity of snow, consistency of snow and he created nine categories for his classification,. Using this same classification, Svonni (1981) and Jernsletten (1994) have also described Sámi snow-terminology.

Svonni has shown that weather-terms have an extremely clear degree of specialization, which demonstrates that the Sámi people have deep knowledge of weather and climate (1981:6-13). Indeed, in his article he has provided an explanation of both weather and snow terminology. He describes weather through snowfall, wind and temperature. Svonni shows, with his own overview of weather-terms, that there are many concepts that are related to weather processes, such as the processes involved in snowfall and wind that affect the snow as well as concepts where temperature is also a factor (Svonni, 1981).

The use of concept analysis on physical and strategic characteristics reveals the details in these snow concepts used in reindeer herding (Eira *et al.*, 2011 submitted). This is also discussed in Chapter 4.

3. METHODOLOGY

The starting point of this study is linguistics, i.e. it is an investigation of the content and use of snow terminology in reindeer herding. To gain and achieve the interdisciplinary dimension in the study, it has been necessary to use methods that reflect this.

3.1 Research area

The project was carried out in the winter grazing area of Guovdageaidnu in the reindeer herding region of western Finnmark (Figure 6). The total area (total surface area) covered by the western Finnmark reindeer herding region is approx. 24,400 km² and includes the western part of the county of Finnmark as well as the northernmost areas of the county of Troms. The Guovdageaidnu – Kárášjohka municipal boundary marks the division between the herding regions of western -Finnmark and eastern-Finnmark.

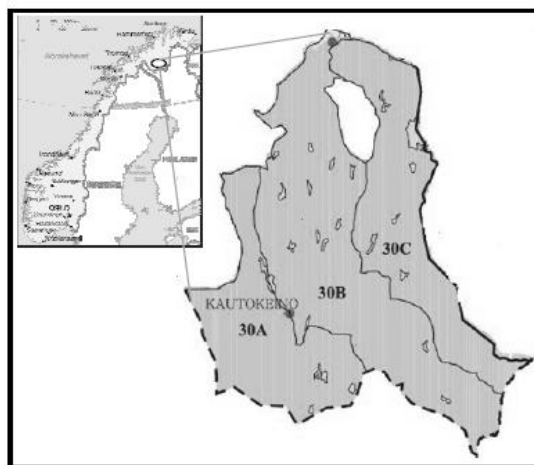


Figure 6: western Finnmark reindeer herding region, winter grazing lands, divided into three herding zones.

3.2 Description of data

The collected data consists of interviews, video recordings, photographs, herding diaries, snow measurements and temperature measurements (Table 1)

Table 1: Overview of research methods used

| Research element /Collection of data types | Collection method |
|---|---|
| Snow terminology in reindeer herding | Interview and community based workshop |
| Day to day use of snow terminology | Community based monitoring system in terms of diary use. |
| Combination of snow concepts and snow physics. | Snow measurements Temperature measurements |
| Weather and snow observations | Diaries |
| Data analysis | |
| Collect snow concepts and extract their meaning and content | Collect snow terms from interviews, lists, articles. Make a list of snow terms. Concept analysis and categorization Snow physics |

| | |
|---|--|
| | Photographs |
| Use of snow concepts | Analysis of diaries with meteorological data and compared with snow measurements |
| Reindeer herders experience and understanding of climate change, their adaptation mechanisms and their understanding and assessment of what constitutes a risk to the herd. | Analysis of interviews and diaries. |

The collection of data has been carried out by means of semi-structured interviews in order to obtain detailed information about, and a greater insight into snow and grazing conditions. The semi-structured interview lies somewhere between pure structured interview and loose interview. Here, it is an open, prepared, oral interview (Dalen, 2004). The interviews were conducted in the Sámi language. According to Krupnik *et al.* (2010) it is important to use the language spoken by the people interviewed.

The interviews of 34 peoples (from the CEAVVI project, appendix 2) were conducted between 2007 and 2009. The interviews were fully transcribed. The study has obtained a substantial amount of material, 800 pages of transcriptions.

With regard to monitoring the day-to-day of snow terminology within the *siida's*, a method was developed in which the members of the *siida* themselves conducted the monitoring by keeping diaries. In unifying the snow concepts with snow physics, we have combined the content in Sámi snow concepts with snow measurements, temperature measurements, weather and snow observations and monitoring diaries (Eira *et al* 2010; Eira & Mathiesen, 2011 in prep; Eira *et al.*, 2011, submitted). From the analysis of the herding dairies (Eira & Mathiesen, 2011, in prep) we have obtained information about how reindeer herders experience and understand climate change, about their adaptation mechanisms and their understanding and assessment of what might constitute a risk to the herd.

In order to understand and gain insight into how herders manage their herd in winter, I have also accompanied the herders in the field and observed them in their interaction and communication with others in the *siida*. This has enabled me to see and better understand how the herders, through their use of concepts and their ecological knowledge, manage the herd, which is a participatory observation (Stene, 1999). It is also possible, using these methods, to discover and to present dimensions that have previously been little understood. In addition to direct observations and conversations, I have also taken notes throughout in addition to visualizing the subject on photograph and film.

3.3 Informants

In choosing informants for this study, it was a necessary requirement that each participant should have learned the specialist reindeer herding terminology through working in the field and that each should have been accustomed to using this terminology on a daily basis.

The two focus informants, people having expert knowledge about the issue, were chosen based on the fact that: 1) they have worked with reindeer their whole life, from a very early age, 2) they both span two generations, 3) they are both good at presenting and explaining things. The first focus informant was Mr. Aslak Anders Isaksen Eira, born in 1917, who is a member of the Cohkolat herding district. He has worked with reindeer his whole life and has moved with the reindeer along several of the migration routes. He is no longer part of a herding-group, but he still has reindeer, under his son's supervision. He still works with reindeer, or at least when the herd is corralled. Though he is advanced in years; he still has an extremely good memory. The second informant, Mr. Isak Mathis O. Eira, born in 1942, is a member of the Fávrosorda herding district. He is part of a *siida* and deals with the herd on a daily basis. He has also long been head of his winter *siida*. Their descriptions

have formed the basis for the snow conceptual analysis, and therefore these are not marked in the text, except where informants have described specific factors of the concept.

Ten informants from five *siidas* belong to one of western Finnmark's three herding zones (Eira & Mathiesen, 2011, in prep). With the help of dairies, *siidas* have themselves been able to monitor snow conditions affecting grazing. Monitoring, or keeping track of resources is a process in which the community itself monitors, checks, investigates, and assesses the things that are important to the community. (Eira & Mathiesen, 2011, in prep) The idea of the herding diaries was to obtain daily data showing how reindeer herders manage their herd in winter, how they assessed the conditions affecting reindeer, how they characterized grazing snow conditions and the strategies they used to solve different situations and conditions (ibid.).

In the CEAVVI⁴ project 12 young Sámi research assistants have collected and documented reindeer herders' traditional knowledge of snow and grazing conditions. The aim of this project is, is to collect and document as much of the reindeer herders' traditional knowledge as possible. The interviews have been transcribed. Information about the informants is provided in Appendix 2. The research assistants had either completed a course in reindeer herding at the Sámi University College or taken courses as part of the EALÁT project. They had also received training in how to document traditional knowledge, and how to conduct an interview, in how to find relevant informants.

In the study I have also used historical recordings from the 1970s in order to access historical data subjects such as the way in which herders recounted their experiences and memories of unusual winters and snow conditions, so as to compare snow conditions with historical climate data.

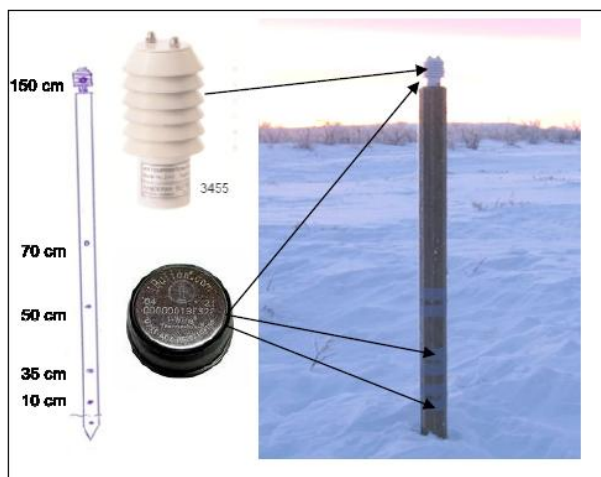
⁴The project is connected to this research project and also forms a part of the EALÁT project run by the Sámi University College together with the International Centre for Reindeer Herding (ICR).

Most of the informants, with the exception of the focus informants, are anonymous at the request of the informants themselves. The informants were far more open in describing issues and experiences, and in naming persons and areas, because they were confident that they would remain anonymous in accordance with a written agreement. In this study all the informants have been informed of and provided with the facility to review and comment on the data, data analysis and the results to be published (ICR, 2006).

3.4 Snow physics and temperature measurements

Snow measurements were made in the herding stations, on the tundra, near Čuonjávri, approx. 20 km from Guovdageaidnu, and at a test station near the village.

Air- and snow temperature measurements were taken both at the herding stations (Eira *et al.*, 2011, submitted) and the test station, near the village. For this purpose we used the ThermoChron measuring device, which was fixed to a one and a



half meter long impregnated pole (Figure 7). The ThermoChron

incorporate two pieces of technology - a micro-chip in a small steel box (iButton) and a program for recording data (1-wire). It is the iButton that is ThermoChron's temperature sensor, clock and memory. A 1-wire can be used to read off the data it has recorded. (<http://www.thermodata.com.au>). Thus, the ThermoChron measured the temperature every six hours, at: 07.00, 13.00, 19.00 etc. To each snow pole six ThermoChron were placed at: 10 cm, 35 cm, 50 cm, 75 cm and 150 cm to the ground, (Figure 7). A radiation shield was attached to

the most elevated Thermochron which protected against radiation, so that we obtained the most reliable possible data. A snow pole like this was erected in the winter area of each herding station. The project has had 42 Thermochrons attached to poles at the herding stations and at the observation station. The Thermochrons were used for three winter periods. (Maynard *et al.*, 2010; Eira *et al.*, 2011, submitted).

4. NORTH SÁMI SNOW CONCEPTS, THEIR CONTENT AND USE

A total of 318 traditional Sámi concepts of various types of snow and snow conditions and snow transformation related to reindeer herding in the Guovdageaidnu reindeer herding region, are shown in Appendix 1. These concepts can be divided into two main categories: first, snow concepts containing elements of the physical nature of snow and ice (snow type, snow conditions, snow transformation, and also on matters affecting the snow or the result of impact, such as temperature, wind, precipitation, air) and, second, there are snow concepts with a wider meaning than snow physics, which can be defined as basic concepts in reindeer herding related to reindeer survival mobility, tracking conditions and visibility.

A theoretical concept analysis was used to determine the differences between the concepts related to content and use (Eira *et al.*, 2010; Eira *et al.*, 2011, submitted; Eira & Mathiesen, 2011, in prep).

The study confirms that the Sámi language is probably the language with the richest terminology relating to snow, and even richer than the Inuit languages which since the end of the 1800s have been believed by linguists to have the most snow words of all languages (Krupnik *et al.*, 2010).

4.1 Summary of the articles

The first article on “*North Sámi snow concepts meaning and usage*” (Eira *et al.*, 2010) is a review of the literature and an introductory analysis of North Sámi snow concepts and snow terminology, their use and definitions. The focus of this article is on explaining the meaning of traditional snow concepts and particularly their usage with respect to the need for communication and to the basic premises of Sámi reindeer herding. Sámi snow concepts are related to factors that affect reindeer survival and sustainability, the well-being of reindeer and the human working conditions. The content and use of the most central snow concepts is discussed on the basis of terminological theory, and in particular on the basis of six basic elements of practical reindeer herding (the reindeer's needs; access to pasture, access to shelter, snow conditions, and mobility; the human tasks and needs; snow conditions, mobility for skiing, tracking, and visibility). The concepts appear to be linked to one another depending on which elements of reindeer herding they are used to describe and communicate. An important finding is that there are frequently two or more critical conditions that regulate the use of Sámi snow concepts: 1) the time when the concept is used and 2) the context of the concept. Analysis shows a pattern in how herders describe Sámi snow concepts, and also that the concept often contains several characteristics, in which at least 7 different factors are mentioned: 1) Weather/snow transformation, 2) Snow quality, 3) Density, 4) Stratigraphy, 5) The impact of snow on reindeer, 6) Time of use and 7) The behavior of reindeer. The article demonstrates the challenges encountered in defining the conceptual content. The content of snow concepts comprises both a basic definition, which often can be intuitive and not explicit and connected to practical use, but also to communicative functions. In this respect, they differ in an important way from concepts which have been developed to express scientifically defined concepts. It seems that the concepts of a natural traditional language are far more difficult to define than consciously constructed specialized concepts and terms.

The second article is “A novel *siida*-based monitoring system to observe effects of climate variability of winter pastures in Sámi reindeer herding” (Eira & Mathiesen, 2011, in prep). It deals with the question how to monitor effects of climate variability, and changes in reindeer winter pasture based on traditional knowledge embodied in Sámi reindeer herder specialist language. A novel observational system was developed, using a specially designed herding diary which focused on snow conditions and their impact on herding practices in winter. This involved herders from five different *siidas* from Guovdageaidnu in northern Norway monitoring and making their own daily observations of variations in snow condition, wind, precipitation, topography related to herd behavior and welfare for a five-month period over three consecutive winters (2007 - 2009) and expressed through their traditional knowledge. The results indicate that the herders’ diaries can be used as a monitoring tool to observe variability and diversity in grazing condition between days, grazing locations, and between *siidas*, and to document the herders’ herding strategies in winter. One example of an important finding is that the *siidas* use the winter grazing area strategically and systematically in relation to time and space. The ways in which all five *siidas* used the same types of topographical areas at the same time of the year were almost identical. Furthermore the analysis of the monitoring system shows that the snow conditions regulate reindeer ecology, the herders' daily management of the herd and also the herders' economy. The method using the herder diaries is encouraging for a future *siida*-based monitoring of snow and grazing resources. A main finding was that the herders’ snow knowledge is more holistic and integrated in herding grazing ecology when compared to detailed scientific definitions based on physical characteristics of the snow. The collected data mirrored reindeer herders’ traditional knowledge of snow and snow change and increased the prevalence of discussion among young herders on these topics.

The third article “*Traditional Sámi snow terminology and physical snow classification - two ways of knowing*” (Eira *et al.*, 2011, submitted)

describes how humans understand the natural environment on the basis of their local experience and their interactions with nature in terms of its relevance to their daily lives. These descriptions are incorporated into traditional local languages and form a specialized terminology that is unique and specifically applicable to local needs and practices. Snow defines most of the conditions which must be met to support reindeer pastoralism. Snow is a prerequisite for mobility, tracking, visibility and availability of grazing. The concepts used to describe the snow on the ground include characteristics needed to communicate snow properties relevant to reindeer herding in the region. In this paper, traditional Sámi snow concepts and their definitions are compared with the latest version of the scientific and physical classification of snow on the ground. The study of traditional Sámi snow concepts was carried out by means of interviews with the herders. The results showed that many traditional Sámi concepts describe snow conditions as they are defined by the international standard; whereas other traditional concepts describe the physical processes leading up to certain snow conditions. A third group of snow concepts have as their main purpose the clear communication of the snow conditions for reindeer herding, and these belong to the internal communication within the herding community. Conceptual analyzes show that the Sámi snow concepts contain a set of characteristics that belong to both reindeer herding and snow physics. Some of the traditional Sámi conceptual descriptions can be compared with the descriptions in the ICSSG (International Classification for Seasonal Snow on the Ground) classification e.g. *seañáš* = *depth hoar*; *vahca* = *Precipitation Particles* (*class = PP*). This study illustrates the importance of using traditional Sámi terminology when developing climate change adaptation governance strategies for Sámi reindeer herding emphasizing the importance of two ways of knowing.

The fourth article is “*Impacts of Arctic Climate and Land Use Changes on Reindeer Pastoralism: Indigenous Knowledge and Remote Sensing.*” (Maynard *et al.*, 2010). This article provides an overview of how indigenous reindeer herders have developed an important initiative to study the

impacts of climate change. Furthermore, to develop local adaptation strategies have been developed based upon the reindeer herders' traditional knowledge of the land and its uses – in an international, interdisciplinary partnership with the science community, involving extensive collaborations and co-production of knowledge. Some results are presented, as well as a description of the data sharing system including traditional indigenous knowledge and remote sensing, are presented.

4.2 Characteristics of Sámi snow concepts

The major linguistic utility in this study is based on the definition of the concepts and the identification of their basic characteristics (Eira *et al.*, 2010, Eira *et al.*, 2011, submitted). Each snow concept has its place and can be clearly defined by their relationships with other snow concepts. The Sámi snow and ice conceptual system is made by a numbers of small conceptual systems covering large and small sub-areas of the field. The Sámi snow concept has a sets of characteristics that includes snow physics and circumstances that are of importance to reindeer herding (Table 2).

Table 2: Identification of characteristics of eight snow concepts.

| Factors | Distinguishing factors | Vahca | Seanáš | Čearga | Cuoŋu | Sievlla | Soavli | Činus | Skáva |
|-------------------|------------------------|---------------|--------|--------|-------|---------|--------|-------|-------|
| Consistency | Wet + | ● | ● | ● | ● | + | + | ● | ● |
| | Dry ● | | | | | | | | |
| Density | Hard ● | + | + | ● | ● | + | + | ● | ● |
| | Soft + | | | | | | | | |
| Carrying capacity | Carries ● | + | + | ● | ● | + | + | + | + |
| | Does not carry + | | | | | | | | |
| Wind affected | Wind affected + | ● | | + | | | | | |
| | Not affected ● | | | | | | | | |
| Layers | Thick + | | | + | + | | | ● | ● |
| | Thin ● | | | | | | | | |
| Type | Snow ● | ● | ● | ● | + | | | ● | + |
| | Ice + | | | | | | | | |
| Metamorphose | Dest. ● | | ■ | ●/+ | ◆ | ◆ | ◆ | ● | ◆ |
| | Sintr. + | | | | | | | | |
| | Constr. ■ | | | | | | | | |
| | M/F ◆ | | | | | | | | |
| Stratigraphy | Surface ● | ● | ■ | ● | ● | + | ● | ● | ● |
| | In themidle + | | | | | | | | |
| | Bottom ■ | | | | | | | | |
| Time | Fall-winter ● | ● | + | + | ■ | ■ | ■ | + | ■ |
| | Winter + | | | | | | | | |
| | Spring-winter ■ | | | | | | | | |
| Basic assumptions | I-VI | I, II, III, V | I | I | IIIb | IIIa | IIIa | I | III |

Identifications of characteristics of Sámi snow concepts show similarities and differences according to content. Characterization has been done using factors like consistency (whether the snow is wet or dry), density (whether the snow is hard or soft), carrying capacity (whether the snow carries the reindeer/human or not), wind affected, layers (whether the layer is thin or thick), type (whether the snow contains ice particles or not), metamorphosis (to which metamorphic process the snow concept may belong to), stratigraphy (location in the snowpack), (Eira *et al.*, 2011, submitted). In addition there is time (season when the concept is used) (Eira & Mathiesen, 2011, in prep), and the basic prerequisites for herding, I – VI, A. for reindeer: (I) access to grazing, (II): access to shelter, (IIIa) snow conditions, mobility, B. for humans tasks and assumptions: (IIIb) snow conditions, mobility, (IV) snow conditions, mobility on skis, skis run easily, (V) track snow and (IV) visibility (Eira *et al.*, 2010).

Such analysis (Table 3) can help to ensure relationships between concepts and equally characteristically shows the conceptual similarities and differences. As an example, the concepts *čínus* and *skáva* are perceived as very similar concepts. The similarities between them are that they are both concepts that have characteristics like thin layers and dense snow. The differences between them are that *čínus* has snow crystals and *skáva* has ice crystals; *čínus* is a result of destructive metamorphosis and *skáva* is a result of a melt/freeze metamorphosis. *Čínus* is used in winter, while the *skáva* is used in late winter/spring. Finally *čínus* belongs to the *guohtun* category, while *skáva* is used to describe mobility. Taking these factors into account, one can conclude that the concepts are not synonyms names for the same concept, but two separate concepts.

The fact that the various Sámi languages differ significantly from one another is demonstrated by a comparison of snow words in the North Sámi and South Sámi languages. In the describing the snow crust and ice sheets, Southern Sámi is more accurate than Northern Sámi. Southern Sámi has 17 terms for different kinds of layers of the snow surface. One reason for this richness of the South Sámi snow concepts is probably that the shifts in the snow conditions have been and are more frequent in the south than in the inland to the north of Scandinavia (Magga, 2010).

4.3 Categorization and classification of the Sámi snow concepts

One part of the study was focused on categorizing the concepts of snow in terms of relationships. To categorize means to find similar and different characteristics, and thus to establish the differences and similarities. It is important to discuss how the snow conceptual material could be divided, especially in relation to the preparation of the list of snow terms (Appendix I). Categorization means placing things or phenomena in different groups according to some more or less clear criteria, usually in the form of definitions of the

categories (Greve, 2003). A conceptual system is created to cover the different categories of concepts showed by a classification system made of categories. The classification system consists of a system for example of layers; '*skáva*', '*čínus*', '*geardni*' etc., a broader system that covers the section of snow and ice. Conceptual system is presented in the form of conceptual diagrams that help to illustrate the relationship between concepts and their place in the conceptual system. Categories that are within the same scale, or cycle, such as snow types related to density, belong to the same category for example the category of dense snow layer: *skáva*, *moarri*, *cuoŋu*, *ruovdecuoŋu*.

A concept map visualizes where the concepts belong and their relationship between concepts. Such map can be used as a graphical tool for organizing and representing knowledge about snow and ice related to reindeer herding (Figure 8).

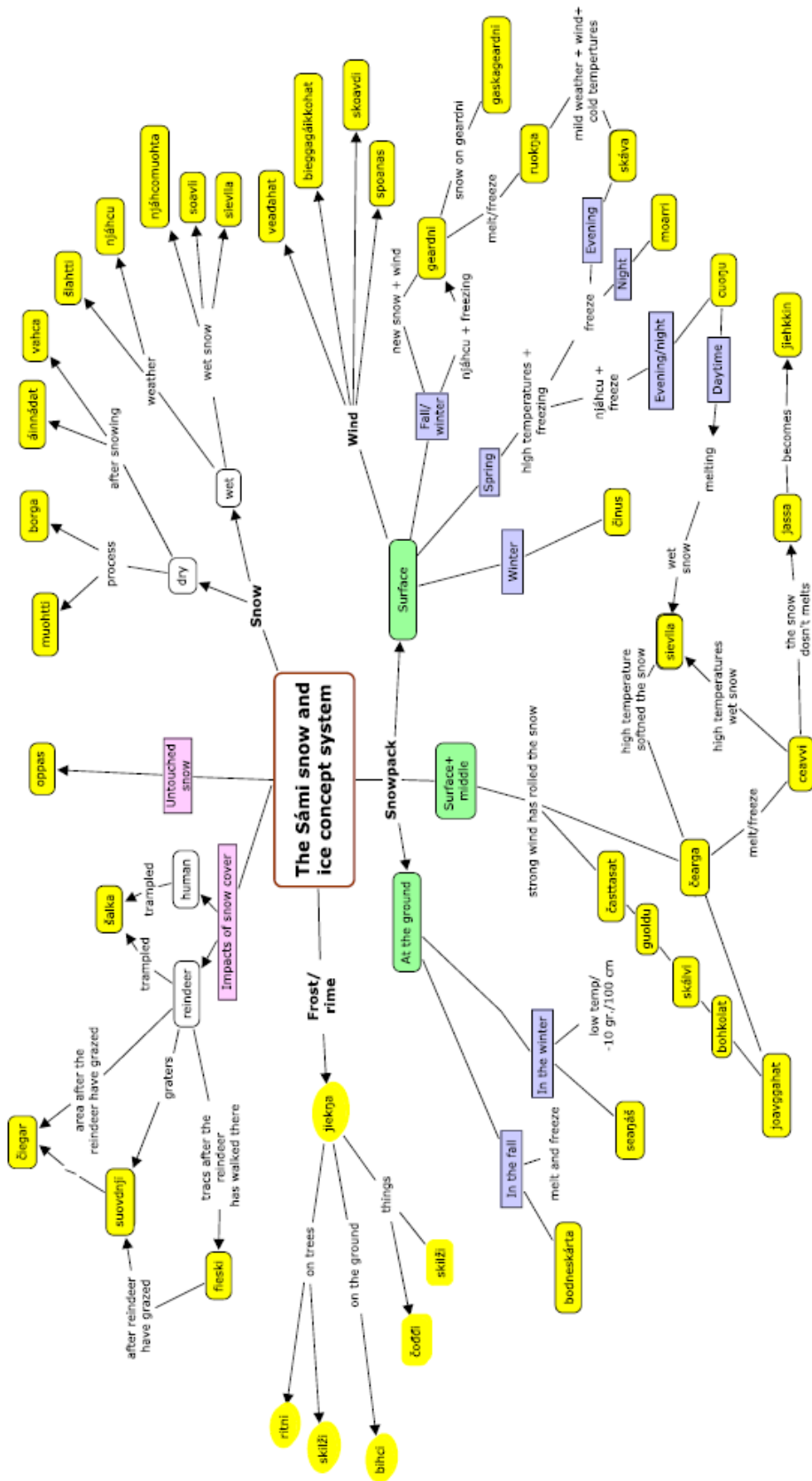


Figure 8: Sámi snow concept system, shown as a graphical concept map, based upon the relationship of similarities/differences of Sámi snow and ice concepts in relation to influencing matters. Yellow ring indicates snow terms, bright blue ring indicates seasonal/time matters, light green indicates stratigraphical relationships and bright red indicates reindeer herding matters. Text without a ring is about snow physical conditions and snow metamorphism. Arrows indicate processes and changing cycles. The concept system is prepared with Cmap Tools (<http://cmap.ihmc.us>) (Novak & Cañas, 2008).

The conceptual map (Figure 8) has contributed to the systematization of the concepts and thus also to their categorization. As a basis for this categorization snow physics is used (snow basic elements of water, ice and air and processes that affect snow) in addition to snow in relation to reindeer herding. The characteristics of snow concept were analyzed by dividing up the components in order to distinguish their properties, located on an ontological level (Nuopponen, 1994), such as shape, hardness, texture, etc. (Table 3). The basis for this work is the snow classification system that is used in snow physics (Fiertz *et al.*, 2009) and classifications that are found in the Sámi language (Ruong, 1964; Svonni, 1981; Jernsletten, 1994).

Table 3: Classification of Sámi snow concepts based on Fierz et al., 2009, Jernsletten, 1994; Svonni, 1981; Ruong, 1964

| PRECIPITATION – AND WEATHER PROCESSES (IN THE AIR) WITH IMPACTS | 2.SNOW ON THE GROUND, PROCESSES AND IMPACTS | 3.ICE FEATURES IN SNOWPACK, WATER AND OTHER PLACES AND IMPACTS | 4.SNOW FACTORS AFFECTED BY REINDEER HERDING |
|---|--|--|---|
| 1.a. General (International Classification) | 2.a General (International Classification, dry, wet snow, forms, Metamorphism) | 3.a General (Classification system) | 4.a. Mechanical impacts 4.a.1 affected by deer and humans |
| 1.a.1 Type, crystal, symbol | 2.b Snow types | 3.b Types | 4b. Track categories 4.b.1 <i>Fieski</i> 4.b.2 <i>Luottat</i> |
| 1.b Parameters | 2.b.1 Wet snow | 3.b.1 Ice categories | 4.c. <i>Guohtun</i> categories |
| 1.b.1 Temperature | 2.b.2 Hard/soft | 3.b.1.1 On the ground 3.b.1 .2 On the trees 3.b.1 .3 On things | 4.c.1 <i>Guohtun</i> 4.c.2 <i>Oppas</i> 4.c.2 <i>Čiegar</i> |
| 1.b.2 Wind | 2.b.3 Thick /thin | 3.b.2 Ice features in lakes and water | |
| 1.b.3 Rain/snow | 2.b.4 Stratigraphy | 3. b.3 Melt-freeze layers | |
| 1.c Other | 2.c Time | 3.c.Time | 4.d Other |

The snow terminology material of is divided into four main categories that all contain subcategories (Table 3). Sub-categories are made up of both snow-physical classifications (forms, metamorphism, stratigraphy etc.) and basic

assumptions in reindeer herding (Eira *et al.* 2010) marked alphanumerically. The different categories are displayed with the classification numbers in the glossary; the terms are set up alphabetically in a list (Table 4). The list might also be systematized by classification (Appendix 1).

Table 4: Example of how the Sámi snow glossary has been created made. From left; term number, Sámi snow term, definition in Sámi language, and classification number

| No. | Term | Definition in Sámi language | Classification |
|-----|----------------|---|----------------|
| 302 | šuoimir muohta | Rušša, roavvasit muohta. | 3.b.3 |
| 312 | veađahat | báiki gokko lea unnán ja seakka muohta dahje muohta ii bisán, gokko veađđá, gokko bieggá doalvu muohttaga dađistaga. Báikkít gokko sáhtta veađđan leat dábálaččat vađat, jalggat, duoddarat, stuora jeakkit. Veađahat lea dakkár mas lea hirbmat buorre guohtun ja hui buorre ealát. Sullásaš doaba: bieggagaikkohat. | 2.a |

4.4 Guohtun and basic snow concepts for reindeer herding

Some snow concepts like *guohtun*, *oppas*, *čiegar*, *fieski*, *goavvi* are basic concepts for reindeer herding (Eira *et al.*, 2010). These concepts can be defined as dynamic because the conceptual content is often about processes and conditions that change according to weather, time, location, etc. They can also be expressed as a complex system of traditional knowledge, reflecting the holistic understanding of reindeer herding (Eira *et al.*, 2011, submitted). The complexity of the *guohtun*-concept shows that the concept is broader than a purely physical concept of snow; it is broader than just snow type. Snow concepts, in this category, which cannot be defined as pure snow type, are *oppas*, *čiegar*, *fieski*, *goavvi*, because they contain characteristics that cover reindeer herding elements, and the physics of snow.

In this section these complex categories, like *guohtun* and *čiegar* are described and discussed from the starting point for the conceptual analysis of Sámi snow concept, that a concept is a unit of thought constituted by those characteristics which are attributed to an object or to a class of objects (ISO/DIS

1087). The main linguistic utility in this process relies on the definition of the concepts, obtained from reindeer herders' descriptions of them. According to the definitions these concepts have core features and distinctive features (e.g., dense snow, ice layers, bottom ice versus soft snow, depth hoar, dry bottom) as well as more or less fixed prototypical properties (e.g., related to time, space, stratigraphy).

4.4.1 Guohtun

The *guohtun*-concept describes snow conditions and snow types in relation to herding strategies. *Guohtun* is, according to Eira *et al.* (2010) defined by reindeer herders in the Guovdageaidnu in the following terms: “*People usually use the concept guohtun to estimate how easily the reindeer is able to dig through the snow to the ground below where the food is to be found. This definition is only used about the snow what it is like and is not used to describe the feed; for this reason it is only used in winter*”.

Linguistic *guohtun* is not used as a single concept. It is rather, a concept that requires subordinate concepts to describe *guohtun* characteristics more clearly. The *guohtun*-concept is a super-ordinate concept and its subordinate concepts are phrasal concepts, e.g. ‘good *guohtun*’ (*buorre guohtun*) or ‘bad *guohtun*’ (*heajos guohtun*), which means that this is a *guohtun*-term connected with an adjectival term. A phrasal term is defined as a term with two or more words separated by a space or multi-word terms as a special case of compounding (Arntz & Picht, 1995).

Guohtun is about the nature of the snowpack, which is comprised of different layers. Each layer has its own unique characteristics in terms of density, formed by diverse snow crystals falling from the sky, developed from drifting and the temperature in the snowpack, and influenced by snow metamorphism. A lot of Sámi concepts of snow types can either cause bad or good grazing conditions (Table 5). Results show that snow types cannot in

isolation associate *guohtun* characteristics. It is the overall snowpack and the processes that transform the snow which characterize *guohtun*. The content of this concept is consequently highly complex and becomes even more complex as it is affected by time, space and weather. The complexity is described as an inter-connected network of components that cannot be described by a few rules (Peloquin & Berkes, 2009).

| Snow types | <i>Guohtun</i> | |
|-----------------------|-----------------|-----------------|
| | <i>Positive</i> | <i>Negative</i> |
| Precipitation (snow) | + | - |
| <i>Vahca</i> | + | |
| <i>Seanáš</i> | + | |
| <i>Luotkku muohta</i> | + | |
| <i>Ceavvi</i> | | - |
| <i>Cuoŋu</i> | | - |
| <i>Skáva</i> | + | - |
| <i>Skárta</i> | | - |
| <i>Čearga</i> | | - |
| <i>Šalka</i> | | - |
| <i>Muovllahat</i> | | - |
| <i>Oppas</i> | + | |
| <i>Čiegar</i> | | - |
| <i>Fieski</i> | | - |

Table 5: Snow types that can cause either bad or good grazing conditions

In order to assess *guohtun* conditions, one must deal with many variables simultaneously, like snow-physical variables that determine whether access through the snowpack is easy or difficult. This also includes various different snow types. The overall formation of *guohtun* depends on the relationship among snow, precipitation, temperature, wind direction (Halfpenny & Ozanne, 1989), and velocity, as well as other environmental variables such as topography. Thus there are at least four factors that affect *guohtun*, that can change from very negative conditions to positive conditions or vice versa: 1) Weather, temperature and snow metamorphosis, 2) Time of year, 3) Area, ground and/or vegetation and 4) Herding. (Eira *et al.*, 2011, submitted; Eira & Mathiesen, 2011, in prep).

Weather and temperature can cause the snow or the ground to melt/thaw and then freeze and then become ice: thus the melt-freeze process can cause different melt-freeze layers or crusts in the snowpack (Halfpenny and Ozanne, 1989). The temperature gradients within the snowpack and snow depth are some important factors which may control the processes resulting in good or bad *guohtun*. If *guohtun* is bad, it means that the layers on the top or within the snowpack are so hard that the reindeer have difficulties in crushing and digging through the hard layer. The strength in the snow layer increases with the number of melt-freeze cycles, as *geardni*, *cuoŋu*. Thus *guohtun* becomes bad (bad *guohtun*) because the snow condition is such that reindeer cannot reach the food under the snow. Weather and temperature can also make the *guohtun* good, especially if there is little snow and the snow is porous and soft and if the ground is not frozen. Mild weather and mild winds can change *čiegar* to *seañáš* and thus soften the snow so that there will be opportunities in the area for reindeer to dig through the snow. The Sámi reindeer herder, Mr. Nils Henrik Sara, characterizes the result of snow conditions and wind and how they influence the possibility of the reindeer gaining access to the nutrition, thus: "It is a fact that cold weather in winter with strong winds packs the snow, and this snow reduces the pastures because the reindeer cannot access the food. But wind is not always harmful to reindeer herding. Strong wind during mild weather brings the opposite effect; strong wind softens the snow so that the reindeer can access the food." (Eira *et al.*, 2009).

According to reindeer herders the most essential factor in the characterization of *guohtun*, is the ground (Sámi: *bodni*). According Routier (2011) the most important aspect of *bodni*, is that the snow or the ice should not fasten to the vegetation or "lock it in". The types of snow that freeze solid in *bodni*, (*bodneskárta* and/or *bodnejiiekŋa*) (Eng: ground ice), are the worst types because they can lead to major losses and the mass death of reindeer.

Table 6: Sub-variants of *guohtun*

| <i>Guohtun</i> access | <i>Guohtun</i> variants | |
|---------------------------|-------------------------|-------------------------|
| | Density | area |
| Very good <i>guohtun</i> | <i>Njunneguohtun</i> | |
| Good <i>guohtun</i> | <i>Goaivvosguohtun</i> | |
| Quite good <i>guohtun</i> | | |
| Quite bad <i>guohtun</i> | | <i>Biedggus guohtun</i> |
| Bad <i>guohtun</i> | | <i>Rudneguohtun</i> |
| | | <i>Skoavdeguohtun</i> |

The *guohtun*-concept has sub-varieties that contain characteristics in terms of density and the opportunities for *guohtun* in the area. Coupling between the characterization of the access and *guohtun* variants shows that sub-variants' descriptions of the density belongs to the category of very good/good *guohtun*. In relation to this, the sub-variants related to area belong to the category of quite bad/bad *guohtun* (Table 6). In relation to this, the use of the *guohtun*-term contains at least two factors: 1) density, (*njunneguohtun*, *goaivvos guohtun*), and 2) area-specific, (*biedggus guohtun*, *rudneguohtun*, *skoavdeguohtun*). The concept is discussed in terms of degrees, for example *njunneguohtun* ('nose' *guohtun*), which is descriptive of fact that the reindeer only uses their nose to get through the snow to graze the vegetation, and *gutnaguohtun* ('ash' *guohtun*"), which compares the snow with ash. These are characterized as the best grazing conditions because the snow is so loose that the reindeer need to use virtually no energy to graze. *Goaivvos guohtun* ('easy to dig' *guohtun*) implies that reindeer easily dig through the snow: These are also considered as quite good grazing conditions. Bad grazing conditions are characterized by *biedggus guohtun* and *rudneguohtun*, which explain that the reindeer are just about able to reach to the bottom at a few places in the area. This means that there are holes in the snow cover caused by the melt and freeze process (*njáhcu*) in fall/late fall. The weather in fall has therefore, and especially in snow-ice types that occur in the fall, like *bodneskártta*, major consequences for *guohtun*. If *bodneskártta* occurs, then the reindeer cannot get through the ice to the vegetation, thus making *rudneguohtun* in the following winter (Aslak Anders I. Eira).

The characteristic of *guohtun* can be compared with ‘fuzzy logic’, which is a tool for categorizing information into broad categorizations or clusters, while at the same time showing how the human mind function. It is a mathematical approach for dealing with complex systems where only approximate information of components and connections is available. The distinguishing feature of fuzzy logic is the use of linguistic variables in addition to numerical variables (Berkes & Berkes, 2009). To understand such complex systems, in this case the interconnection between reindeer, human beings and snow, the ‘key elements of human thinking are not numbers, but labels of fuzzy sets’ (Zadeh, 1973; Berkes & Berkes, 2009). Phrases such as ‘very good *guohtun*’, ‘good *guohtun*’ etc. are language-based variables. They give reindeer herders the possibility of characterizing *guohtun*, as well as an understanding of the complexity of the snow-reindeer relationship so that they can adapt their herding strategy accordingly.

4.4.2 Oppas and čiegar

In the conceptual system of the *guohtun*-concepts there are also the concepts of *oppas* and *čiegar*. These are the most important reindeer herding related concepts in the winter with regard to meaning and characteristics, because they explain the evaluation of the survival and sustainability of reindeer (Eira *et al.*, 2010). *Oppas* is the reindeer herders’ winter capital which can contribute to the survival of reindeer during the winter (Nils Isak Eira, 2006, personal communication). The more *čiegar* there is in a particular area, the less *oppas* there can be, and vice versa, and furthermore the more *čiegar* there is in one place, the worse the grazing (*guohtun*) there is an opposite (Eira *et al.*, 2010.) Both concepts have a lot of subordinate concepts which provide a further description of snow conditions that the concept is describing.

The definition of the concept *oppas* is a snow area where the snow is untouched, i.e. not trampled by reindeer. *Oppas* has not so much to do with the size of area, but how the herder has allowed the herd to graze. For example if the

herd has grazed in very dense pattern, then the area is more trampled (Isak Mathis Eira, 2009). *Oppas* is a type of snowpack that is generally composed of very loose snow layers. The entire snowpack, from the surface to the bottom, includes snow types like *vahca*, *luotkkomuohhta*, *seañáš*, (Eira *et al.*, 2011, submitted). *Oppas* implies that the grazing snow conditions are good.

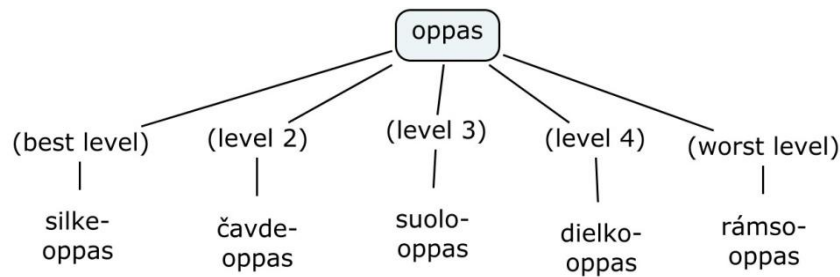


Figure 9: Variants of *oppas*, from best level to the worst.

The herds grazing and the herders' management of the herd lead to different variants of *oppas*, from the best variant of the positives to the worst variety. The *oppas*-concept has at least five sub-concepts that are relative to the variation of *oppas* (Figure 9). *Silkeoppas* is the best variant of *oppas*, where the area with this kind of snow is soft, comparable to silk. This is an area where there are no traces of any animal. The snow is so porous that the animal needs only to shake (*savdnjilit*) the snow. *Čavde-oppas* or *áinnehisoppas*, denotes the area that is not touched by the reindeer. The *suolo-oppas*-concept means that *oppas* is compared with an island. This concept is almost the same as the *dielko-oppas*-concept. When there is *dielko-oppas*, then the reindeer themselves have selected *oppas* when grazing, dug a little, eaten and left the area. *Rámsó-oppas* denotes that reindeer must graze in spots, for example in situations when there are bottom ice patches in open, treeless level ground (*vađđá*). In such a site there can be *oppas*, and yet there is not *guohtun*, caused by the malfunction of the bottom, for example because ice patches have occurred in the fall. According to reindeer herders there is something wrong with *guohtun* when it is *rámsó-oppas* (Isak Mathis O. Eira).

The opposite concept of *oppas* is *čiegar*, which means that the snow in an area has been touched, because the reindeer have grazed and dug in the area. The use of the *čiegar*-concept presupposes that there is snow on the ground before it can be said that there is *čiegar*. When there is very little snow, then it is almost not possible to be *čiegar*. The reindeer has nothing to do in an area where there is *čiegar*, because there is no *guohtun*.

Čiegar means that the snow is very dense. The process that makes *čiegar* is that the reindeer by grazing is destroying the snow crystal structure, so that the sintering process goes much faster. After deposition the process of sintering (molecular growth of bonds between single snow crystals) leads to a hard and dense snow. This snow is even denser than *čearga*, with its density of 250-450 kg/m³. The density of *čiegar* is more than 500 kg/m³. Thus, the snow in such an area is too dense for grazing. (Eira, *et al.*, 2011, submitted). In general, *čiegar* will make it difficult to use the same area again during the same snow season.

The *čiegar*-concept contains three elements, namely 1) it is an area where reindeer have been grazing, 2) in the area there are cold grazing holes (*suovdnji*) and 3) the snow in the area is very hard. This means that in such an area reindeer may not be able to graze because the snow is dense, although this depends on when the mechanical impact has occurred (Sám: *čiegarduvvon*). If the impact has taken place before Christmas, the area can usually be used once more later in the winter. But if the impact has occurred in the winter, then the area cannot be used before the snow's structure has changed, and become looser. When *čiegar* is frozen (dense), it is so dense that it is possible to cut a piece of it. According to reindeer herders' new *čiegar* is not defined as cold (dense).

Čiegar can be divided into at least seven different levels in relation to when and where the *čiegar* occurs (Sám: *čiegarduvvon*): Seasonal *čiegar* may be: 1. *Čakčačiegar* (fall *čiegar*) which occurs if it has been snowing in fall and the snow has occurred to form *čiegar*, 2. *Skábmačiegar*, (the dark time *čiegar*)

which occurs when the reindeer graze on the snow-covered ground before Christmas (Sám: *skábma*), although this type of *čiegar* is not yet that bad, 3. *Dálvečiegar* (winter *čiegar*), which is very hard and this is the worst level of *čiegar*. Snow consistense; 4. *Njáhcočiegar* (thaw *čiegar*), which occurs when the reindeer graze when there is thaw snow (Sám: *njáhcu*). New and old *čiegar*; 5. *Varasčiegar* (new *čiegar*), which is an area where the snow have just transformed to *čiegar*. The herder cannot immediately after this transformation leave the herd to graze in such an area, 6. *Boares čiegar* (old *čiegar*) is *čiegar* that has been like that a good while. The weather and snow conditions can softens the snow, which implies that it is possible for the herd to be allowed to graze in the area again. *Čiegar* related to area: 7. *Čoahkkečiegar*, (compiled *čiegar*) is when the grazing has been concentrated in an area without spot of *oppas* between the *čiegar* spots (Figure 10).

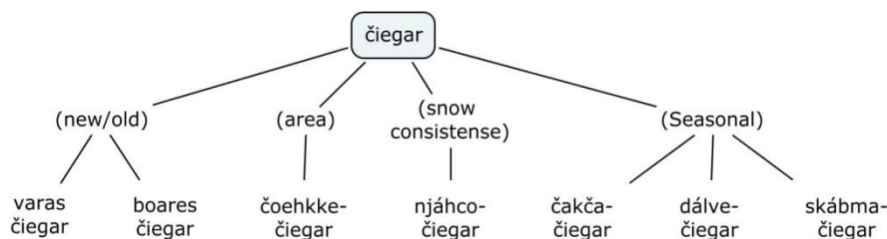


Figure 10: The concept *čiegar*, divided in seven sub-concepts.

The *čiegar*-concept is an old concept, and it has been used by reindeer herding peoples that are geographically far apart, The Sámi, on the one hand, and Nenets on the other (Roung,1964). *Čiegar*, such as the *guohtut*-concept (Eira *et al.*, 2010), is a concept that has been preserved from ancient Arctic people and their ways of life. According to Ruong (1964), Torneaus (1600-1681), mentioned the *čiegar*-concept in relation to *čiegar*-hunting. Linguistically the concept of *čiegar*, in the Sámi language indicating the relationship to reindeer herding, is related to equivalents in the Nenets, Mansi and Khanty languages (ibid.).

4.4.3 Fieski

The *fieski*-concept denotes an area where reindeer have been and it is possible to track them. The *fieski*-concept belongs to the category of tracking. *Fieski* is not a typical snow type, but it is snow trampled by reindeer grazing in the area for a short period. *Fieski* is characterized in relation to boundaries where the reindeer have been. When the reindeer have barely been on a place, or the herders have just let the reindeer graze for a short, then it is called *fieskastallan*. A lot of reindeer can make *fieski*, but so can also a single reindeer. While herding the reindeer, the reindeer herders drive around old *fieski* and look for tracks (*fieski*) to verify that no reindeer are left there. In searching for reindeer that have not been in the herd (Sám: *meahccečorra*ga), they do not look firstly for the reindeer but for *fieski*. If they see *fieski*, then the herders will follow it hoping to find lost reindeer.

Also *fieski* have subordinate concepts that are in relation to time, snow consistency and where the *fieski* area is: 1. *Ravdafieski* (*fieski* on the edge) may mean that it is edge *fieski*, or *fieski* between two reindeer herds (*fieskkegaska*); 2. *Boaresfieski* (old *fieski*); means that the reindeer have earlier been grazing in the area; 3. *Varasfieski* (fresh *fieski*) means that it has just occurred, and 4. *Njáhcofieski*, (thaw *fieski*) is encountered during *njáhcu* (Figure 11). In fall 2009 there were *njáhcofieski* (thaw *fieski*) in Guovdageaidnu.

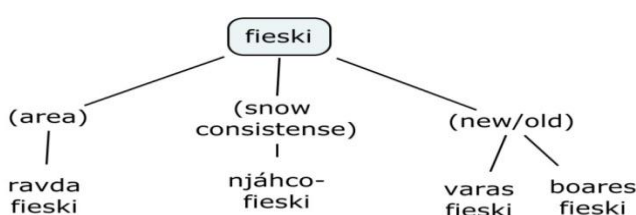


Figure 11: The *fieski*-concept with its sub-ordinate concepts.

4.4.4 Ritni

The *ritni*-concept denotes snow and ice on the trees and belongs to the ice categories: (i) ice on the ground, (ii) ice on the trees, and (iii) ice on

things. Other concepts that have relation with *ritni* are *bihci*, *šuhči*, *čodđi*. In English, all these concepts can be compared with *rime*. The rime is defined when water vapor freezes into ice-crystals on solid surfaces such as road surface, car window or lawn (www.met.no). In the Sámi language there is a distinguishing difference between the concepts related to the rime-concept. These concepts are more accurate than the rime-concept because they show where the rime occurs: *bihci* is rime on the ground, *ritni* is rime on the trees, *šuhči* is frozen frost on trees and *čodđi* is an ice crust on things or rocks. *Ritni* occurs in weather that makes rime on trees with snow. Then the *rinádat* occurs, which reduces visibility. *Ritni* can occur as early as in the late fall, when snow has settled on the ground. In the early winter of 2008 there was a long period of 45 days with *rinádat* (rime period). In late October, there was *bihci* on the ground and the on the surface of the lakes there was a thin ice layer (Sám. *gavdon*). A few days later, there was winter fog (*murku*) and the day after there was *ritni*. According to meteorological data, during the period there was less than 50 cm of snow (red graph), with almost no wind and with low temperatures (blue graph). (Figure 12)

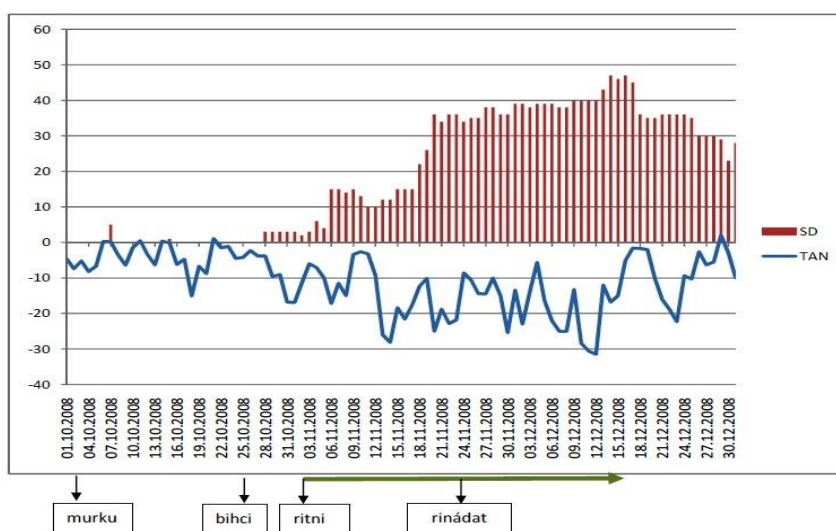


Figure 12: The *rinádat* period lasted for 45 days. In the graph the *SD* is snow depth and *TAN* is maximum temperature.

Ritni is very important for reindeer herding. When there is *ritni*, called *rinádat*, there are good conditions for reindeer. Reindeer can hide in a *ritni*-forest. This gives the reindeer opportunity to graze in peace and quiet without being disturbed because they are "invisible". For the reindeer herders *ritni* is not very good. *Ritni* impedes the work with the reindeer, because it is difficult to see and know where the herd and individual reindeer are, for example when collecting the herd or finding small herds (Herder Station 2).

4.4.5 Goavvi

Goavvi is a basic snow concept, which is not in everyday use, but which appears in connection with the effects of extreme weather event in winter. *Goavvi* is defined as extremely bad grazing condition with starvation, loss of reindeer and adverse impacts on herders' economy and organization. *Goavvi* is not used in describing "normal" bad winters, when snow concepts like *cuoŋu*, *čearga*, *ceavvi* etc. are used. The substance of the *goavvi*-concept is an image of extreme weather events reflecting changes in a system, in relation to structures, functions, and organization, which are caused by events that create the disaster, and subsequently adverse consequences. One of the first written reports about extreme winter grazing conditions resulting in the death of reindeer was published by Tromholt (1885). Surprisingly, over a period of 100 years, reindeer herders in Guovdageaidnu have experienced *goavvi* about 12 times, and the concept is also used presently among reindeer herders in Guovdageaidnu (Table 7).

Goavvi is caused by thick layers of ice and ice frozen in the soil: *jiiekŋa* (Eng: ice), *bodneskártta* (Eng: the ice is frozen into the vegetation) and *gassa muohta* (Eng: deep snow). Factors such as precipitation, wind, snow metamorphism and different ice layers build up inside the snowpack and may affect the degree of *goavvi*. These factors are important and influence the grazing conditions in late fall, in the transition from bare ground to snow-covered land.

Reindeer herders characterize adverse conditions in the winter in different ways depending on how great the consequences are for their reindeer and reindeer herding. These snow conditions are typically characterized as worse than very bad *guohtun*. Variants of *goavvi* are shown in Figure 13, related to the degree of *goavvi*. The length of the *goavvi* periode is reflected in the degree of the impact on the reindeer herd. The sub-concepts of *goavvi* show their relation to time and season, *goavvegiđđa* (Eng: *goavvi* spring) lasts one season, *goavvedálvi* (*goavvi* winter), lasts over two seasons, *goavve jahki* (*goavvi* year), lasts a whole year and *nealgedálvi* (Eng: starvation year), the worst-level condition (Figure 13).

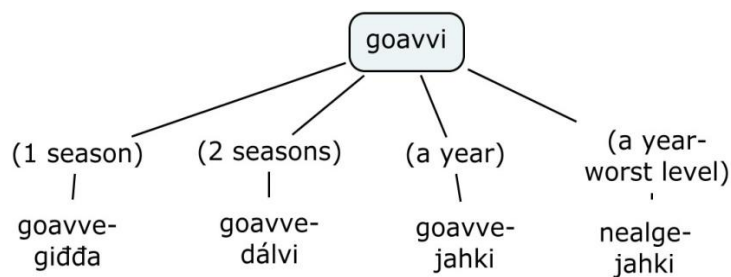


Figure 13: *Goavvi* concept with sub-concepts.

Goavvi-spring means a long spring, with a lot of snow and cold weather, and hardly a bare spot at all on the ground. A *goavvi* year means a long hard period, which last from fall to spring. Analysis of collected data shows that most informants relate *goavvi* condition to grazing in spring or late winter. None of the informants' related *goavvi* to the fall or late fall, which could be explained by the fact that bad grazing conditions in fall usually is manifested themselves later in the winter. A *goavvi* period can actually last until the snow has melted and there is bare ground. The *goavvi* conditions can occur over a large area, but may also be very local. When the snow conditions are bad, the reindeer will walk a around lot in search of food (Informant C19), and herders have to herd continuously day and night to keep the herd together. *Goavvi* denotes a loss of reindeer that impacts on the reindeer herding economy, organization, and herd welfare. All herders participating in this project reported that their herds were affected and reduced after *goavvi* and viewing *goavvi* periods in the light of

numbers of reindeer (official numbers) in western Finnmark, the number of reindeer was usually reduced after *goavvi*. One reindeer herder (Informant C28) explained that *goavvi* could be the reason for a large loss of reindeer (reindeer deaths), low calf growth for years after extreme weather events (Sám: *miesehis jagit*) owing to low milk production, and reindeer diseases. *Goavvi* usually have adverse effect on the energy expenditure of female reindeer, e.g. they may lose milk for production to new born calves and newborn calves might subsequently die according to informant C 28. According to one reindeer herder a *goavvi* year can have adverse consequences for the herd for at least five years after the event, (“*goavvi váikkuha 5 jagi ovddasguvlui*”), and the economic consequences of *goavvi* could be 30% less calves than in normal years, in other *siidas* even more (informant C28). Traditional knowledge indicates that female calves born in such years are negatively affected the next five years. According to Päiviö (2006), *goavvi* could also have implications for new patterns of migration in Sirkas siida.

An analysis of historical descriptions of extreme events in the reindeer herding community in Guovdageaidnu from the early 20th century to present shows different levels of *goavvi*. Examples of *goavvi* periods are shown in Table 7. Worst level of *goavvi* in Guovdageaidnu was reported in 1917/1918.

Table 7: Various *goavvi* –periods, including 1917/18 marked in yellow were characterized as starvation years (*nealgedálvi*), 1967/68 and 68/69 marked in red were *goavvi* years, and 1958-1961 and 1997 marked in green were *goavvi* spring

| Year | <i>Goavvi</i> -spring | <i>Goavvi</i> –year | Starving year |
|-----------|-----------------------|---------------------|---------------|
| 1907/08 | <i>Goavvi</i> spring | | |
| 1917/18 | | | Starving year |
| 1957/58 | <i>Goavvi</i> spring | | |
| 1960/61 | <i>Goavvi</i> spring | | |
| 1967/68 | | <i>Goavvi</i> year | |
| 1968/69 | | <i>Goavvi</i> year | |
| 1971 | Long spring | | |
| 1973 | Long spring | | |
| 1996/97 | <i>Goavvi</i> spring | <i>Goavvi</i> year | |
| 1997/98 | Bad spring | <i>Goavvi</i> year | |
| 1998/99 | Bad spring | <i>Goavvi</i> year | |
| 1999/2000 | Bad spring | <i>Goavvi</i> year | |

From the oral histories, which are generated by people’s memories of extreme grazing events, we can provide new knowledge and insights. An example of the resulting impact of extreme weather events is that of 1917/1918, which was characterized as “*nealgedálvi*” by a reindeer herder from Guovdageaidnu, born in 1909. That year the reindeer starved to death.

*Dat ii lean suohtas jahki. Dalle lei nu heitot ahte dat ii oba birgen ge, dalle šadde johttát gosa nu. Sii geat eai bieđganan oalát siiddaiguin, dat johttájedje dainna mii lei báhcán. Muhtimat bieđganedje ja nu dat dušše manne dat bohccot, muoraid mielde ja juohke guvlui. Doppe ii lean ealát.*⁵

He remembered that weather conditions and several periods of mild weather with rain followed until Christmas, which created many thick layers of ice in and under the snowpack. The snowpack became some dense that the reindeer were unable to break the ice and could therefore not reach the lichen through the ice layer, which was as thick as 10 – 15 cm.

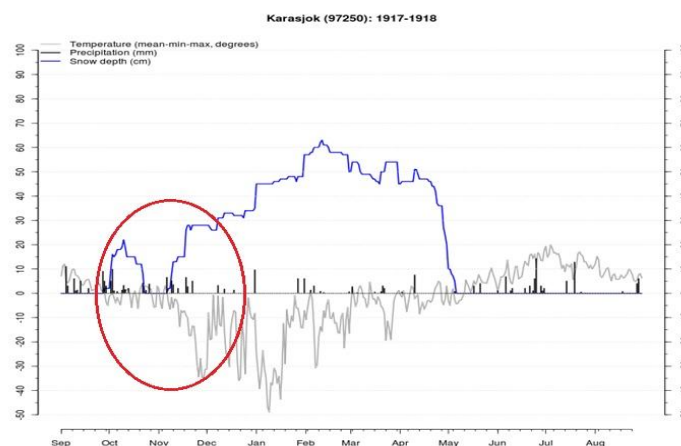


Figure 14: Using temperature, precipitation and snow depth data from Karasjok 1917-1918 can give indication and description of the conditions in Guovdageaidnu. (Vikhamar-Schuler et al., 2010a)

The historical meteorological data show the weather conditions in fall 1917 (Figure 14, red circle), which might explain the cause of starvation that year. In early October freezing temperatures and precipitation as snow, resulted in a snow depth of 20 cm. Subsequently there were some days with temperatures

⁵ Translated from Sámi: This was a terrible year. The pasture conditions were so bad that people were not able to rescue herd, and had to move from area to any place. Those who had not lost all the reindeer, moved with the herd that remained. Some could not keep the deer together, they spread completely. There was not *ealát* in the area.

above zero, when the snow melted, and finally froze again. Temperatures ranged between plus and minus degrees. The graph shows that the snow melted and there was bare ground from late October to early November, followed with heavy snow fall.

Johan Turi (1933) describes in 1910 the transition from bare ground to snow covered ground using some snow concepts and how these occur. According to Turi the weather conditions generally in the fall are very important for the grazing conditions in the winter.

“At that time, when the bulls are worn out, then it generally thaws, and that thaw is called golggonjacco (the debility thaw). And then you generally lose the herds because it is very bad weather, fog and rain, and when it thaws much there is bare ground in some places, and in other places the snow is left lying, and when it freezes, then that snow is turned to ice or, as it is called, bodneskardan (bottom crust), and it remains all through the winter just as it is at the time when the last thawing stop and the cold comes. But if the thaws do not spoil the snow, then it will be a good winter, unless there comes very deep snow, for the reindeer can get to the mosses even if the snow is fairly deep, if only there is a clean bottom, that is, no ice on the bottom. And it is at this time that the Lapps are afraid (wondering) what the winter will be.” (Turi, 1933).

This description, which is over 100-year-old, shows that the elements Turi pointed out as being crucial for *guohtun*, such as that *njáhcu* (thaw) and freezing temperatures can result in *bodneskárta*, is relevant today. This shows continuity in the perception of the content of the concepts, and the descriptions of factors that make such concepts.

4.5 Traditional knowledge about snow, adaptation and resilience thinking

The IPY EALÁT project recognizes that the ability of reindeer herders to cope and adapt to changes is based on traditional knowledge, which is embodied in the herders' specialized concepts in their language (Tyler *et al.*, 2007; Eira *et al.*, 2010; Maynard *et al.*; 2010; Magga *et al.*, 2011,a; Eira & Mathiesen, 2011, in prep). This section further discusses the response of reindeer herding communities in the face of extreme weather events (or natural hazards),

such as *goavvi* and other bad grazing conditions in winter through the lens of resilience thinking. Resilience can be shortly described as the *siidas* ability to recover after for example *goavvi*. Resilience can be defined in different ways, but one definition is the capacity of a system to absorb disturbance and reorganize while undergoing change, retaining essentially the same function, structure, identity, and feedbacks and it is about a system's flexibility in the face of change (Berkes & Turner, 2006). Resilient societies are those able to overcome the damage from extreme weather events. According to Gaillard (2006), extreme weather events are natural phenomena that pose a threat to people, structure and economic assets. Extreme weather events include among others, earthquakes, storms, floods and droughts, but have to be considered in local perspectives. The future negative effects of projected global warming on the snowpack and winter grazing conditions in Guovdageaidnu might possible increased effects of extreme weather event for reindeer herding. Extreme weather events and winter grazing conditions is discussed by Turi (1910, 1933). Snow concepts like *bodneskártá*, *bearta cuoŋu*, and *ceavvi*, all contain important traditional knowledge, is used to observe and monitor the snowpack also in times of extreme weather events in winter. *Ceavvi* is a snow concept used in Kautokeino on hard snow in spring (Eira *et al.*, 2010). Other regions, like some southern Sámi reindeer herding areas, have concepts that can have similarities with North Sámi. In south Sámi they use i.e. a term "tsievie" (denoting ice layer on the reindeer lichen; hard snow that bears small reindeer) (Laila Matsson Magga, 2012, pers. communication), that can correlates the north Sámi term "ceavvi". According to Turi (1933), who originally was from Guovdageaidnu, *Ceavvi* is a description of bad grazing conditions in winter.

"Tsævve is hard snow with a snow-crust underneath it, and, when the snow is of the consistency, then the reindeer herds spread widely in search for food, and then the Lapps can't hold the herds together."

The people struggling with such bad grazing condition are called *ceavvit* by Turi.

“They have begun to gather together the reindeer who have run all over the forests...reindeer are obliged by hunger to spread all over the forest in a tsævve-aar (hard-snow year), and when the tsævve Lapps took to tethering a bell-reindeer, the weakened reindeer came to out, and the folk began to feed them with tree-lichens and to watch them.” (Turi, 1933).

This could be an example of adaptation to bad grazing condition in winter.

Sámi traditional knowledge about snow is a vital part of the Kautokeino reindeer herders’ resilience thinking. Likewise, resilience thinking helps to evaluate hazards holistically (Hewitt, 2004; Berkes, 2007). Resilience deals first with coupled human–environment systems and contributes to a comprehensive vulnerability analysis by avoiding the artificial dividing between a physical and a social part of the system. It deals with the dynamics of response to hazards, and is forward-looking, helps to explore policy options to deal with uncertainty and change (Berkes, 2007). Adaptive responses to dramatic environmental change are often encoded in traditional knowledge Reinert *et al.*, (2009). There is increasing evidence that many traditional communities pass on from one generation to another experience and knowledge that can be critical in helping them to respond to extreme weather events (Hewitt; 2004 Berkes, 2007).

Based on historical data from reindeer herding, meteorological data and oral stories from old herders, it is possible to gain insight in to how the reindeer herding community coped and adapted during and after extreme weather event like *goavvi*. Such knowledge can be of importance to maintain high resilience in the reindeer herders’ pastoral system in times of projected climate change. All herders participating in this project reported that their herds were affected and reduced after *goavvi* and by comparing *goavvi* periods with the total numbers of reindeer (official numbers) in western Finnmark, see that the number of reindeer was usually reduced after *goavvi* (Figure 15).



Figure 15: Numbers of reindeer in western Finnmark from 1945 to the present. The blue line indicates the number of reindeer, the red bar in the graph marks goavvi years and the green bar marks goavvi-springs. (Official data from the Directorate of Reindeer Husbandry).

Extreme weather events, like *goavvi*, have probably occurred in western Finnmark, in time immemorial, regardless of the size of reindeer population, have effected on the grazing conditions in winter. One explanation of *goavvi* can be the North Atlantic Oscillation (NAO). NAO is a climatic phenomenon characterized by an oscillation of the difference between the air pressure at sea level over Iceland and the corresponding pressure over the Azores (Hurrell, 1995). Time series show how the NAO index might vary in a 10-year scale and affect the winter temperature in Scandinavia. It is mostly in late fall, winter and early spring that strong positive or negative NAO phase is prominent in Scandinavia (www.met.no), which is related to when reindeer herders observe bad grazing conditions. In the winter pastures in inland Finnmark air temperatures show large inter-annual variability, and this variation is partly correlated with the (NAO) ($R \approx 0,5$) (Magga *et al.*, 2011). Variation in the NAO index is shown in Figure 16.

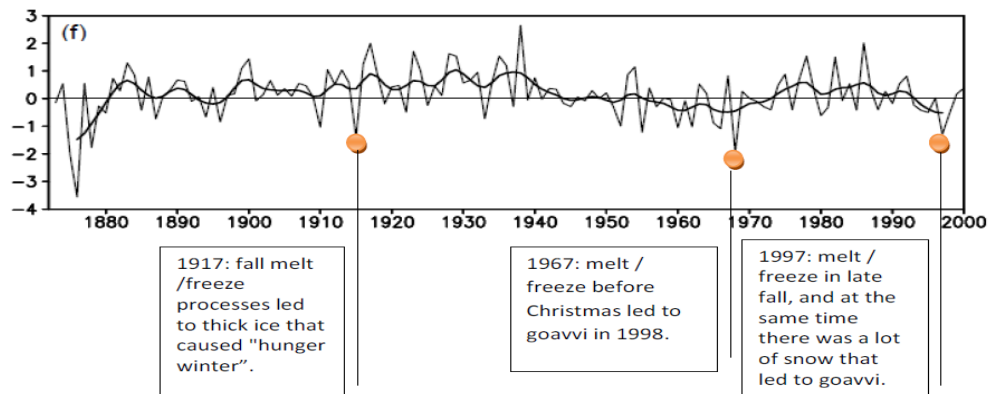


Figure 16: The NAO index variation in fall (1873–2000) and orange circles shows historical goavvi years 1917, 1967 and 1996 in Guovdageaidnu reindeer herding region, which is correspond to negative NAO phases (Prepared from JIANPING, 2003).

Many animal species throughout the Northern Hemisphere are influenced by NAO (Ottersen, G. *et al.*, 2001). A positive NAO index is associated with an increased westerly wind field, while negative NAO index is associated with weak westerly or even easterly winds in Scandinavia (www.met.no), but with hitherto unknown effects in western Finnmark. However, it appears that bad year with extreme grazing conditions in winter extreme weather event (*goavvi*) occurs after very negative NAO phase in the late fall. The common history of Sámi Reindeer Husbandry in western Finnmark indicate that the years 1917/18, 1967/68 and 1996/97 are typical *goavvi* years with starvation, loss of reindeer and negative impacts on herders economy. I suggested that these historical *goavvi* years in western Finnmark may be explained by a strong negative NAO index in late fall (Figure 16).

Based on reindeer herders' observation using snow concepts as indicator, the *Siida* communities use various methods to prevent the loss of reindeer. These methods also help them to maintain the herd and subsequently being able to recover from *goavvi*. I suggest that the ability of individual reindeer herders and *siidas* to recover from extreme weather event show high resilience to change using the traditional knowledge about snow in their daily language and communication. There are stories that reindeer herders could lose almost the whole herd in *goavvi*, but being able to recover and subsequently continue as before. According to Päivio, (2008), such bad years occurred in Sirkas in Sweden in the 1930ths. He shows in an example from Sweden that the *goavvi* years changed the *siida* organization of reindeer herding in an area and even that some reindeer herders started up with other activities like fishing. Resilience in the context of such extreme weather event is the measure of a community's or individual's ability to respond effectively to change. According to O'Brien *et al.* (2009) resilience thinking offers a new way of understanding complex adaptive systems and it can provide key insights into the evolution of the social contracts that underpin many systems of governance.

Reindeer herders indicate their ability to build their adaptive capacity by learning from previous extreme grazing events, and the use of several adaptive strategies is high. Adaptive strategies are the ways in which individuals, households, and communities change their productive activities and modify local rules and institutions to secure livelihoods (Berkes & Jolly, 2001). The herders use at least five different adaptive strategies 1) spread the herd in the grazing land and let individual reindeer themselves find to find adequate *guohtun* conditions. 2) Increase the mobility (Sám: *sirdit*) of the herd from one area to another, 3) migrate to the coast out of season and/or 4) provide additional feeding for reindeer with hay or pellets (Table 8). Furthermore, 5) Long term adaptation to *goavvi* includes the herd structure diversity and animal welfare (Oskal, 2000). These methods have contributed to the adaptive capacities of *siidas* in Guovdageaidnu following *goavvi*.

Table 8: Adaptative strategies during *goavvi* periods

| Year | Adaptative strategies during <i>goavvi</i> periods | | | |
|-----------|--|---------------------------|----------------------|--------------------|
| | To let the herd spread | Move from area to another | Migrate to the coast | Additional feeding |
| 1917/1918 | X | X | | |
| 1958 | | X | | |
| 1967/68 | | | X | |
| 1996/97 | | | X | X |

The management strategy for *goavvi* in 1917/1918 in western Finnmark was to let individual reindeer range freely, so that they could find food for themselves. The strategy was then to move to another area to find good *guohtun* where it was possible to break through the snowpack. In the late winter of 1958, the coping strategy was to move with the herd south-east in the region, to the area Jávrrášduottar, which was an area that was always kept as a supplementary grazing area in case of *goavvi* (Hågvar, 2006). In 1967/68, some *siidas* in Guovdageaidnu migrated in early winter to the coast, and the summer grazing area, while others kept the herd in the winter grazing area until summer. In 1997 the herders started using a new strategy for adapting to *goavvi*, which

included additional feeding as well as early migration to the summer grazing area. At this time it was not common to provide supplementary feeding according to one of the informants involved. In order to use these strategies in long term adaptation to extreme snow weather events and likewise to the future effects of climate change, the reindeer herding is dependent on flexibility of pasture use and control of mobility. This flexibility allows herders to adapt to climatic variation and to maintain resilience. Studies of the social organization of reindeer pastoralism (Turi, 2008), confirm that reindeer herding has developed an integral resilience for dealing with climatic uncertainty based on traditional ecological knowledge (Magga *et al.*, 2011a). Reindeer herders adapt constantly to change (Reinert *et al.*, 2009). Thus, traditional knowledge about variability and changes in the snowpack and the use of about 318 Sámi snow concepts, could build resilience locally to times of projected climate change. Reindeer herding might maintain high resilience to extreme weather events from the knowledge embodied in reindeer herders' language and through daily use of specialized language. During the past 50 years, reindeer herding has undergone changes (Eira, 1984; Saijets & Helander-Renvall, 2009), which may also have affected the language of reindeer herding. Older herders in this study recognize that herding practices changes quickly (J. Magga pers. Com 2003). Climate change will undoubtedly have significant environmental, economic, cultural and linguistic impacts on Sámi reindeer herding. Any breakdown in the language structure signals a breakdown of their conception of the environment, affecting the nature of knowledge and the world view passed on from the previous generation (Näkkälajärvi, 2009). There is a fear that the working methods, language and culture of reindeer-herding could be eroded, and thus the practical herding will also change. Kalstad (1999) states that if the specialist language of reindeer herding disappears from everyday use, it will adversely affect reindeer herders' specialist work. Language is an essential tool for culturally-appropriate encoding of knowledge. Traditional knowledge conservation therefore must pass

through the pathways of conserving language (Nakashima, 2000; Nakashima & Roue, 2002).

The decline in use of the language as the basis of herding knowledge could mean a change in the traditional management model, and possibly increased vulnerability. Adaptation to climate change is argued as being something that happens at the local level of reindeer herding: It will in future demand the training of local arctic leaders in long term sustainable thinking, based on the best available adaptation knowledge, both scientific and experienced-based traditional and local knowledge (Turi, 2009). Tailor-made education developed to strengthen herders' traditional knowledge, resilience, cultural and linguistic rights could be one way to maintain high resilience and to implement adaptive strategies in response to projected climate change (Bongo, 2010). It is believed that such adaptive strategies could reduce the vulnerability to climate change in reindeer herding in Finnmark.

5. CONCLUSIONS

In this interdisciplinary study, snow concepts have been linguistically investigated in relation to practical Sámi reindeer herding and climate variability and future projected climate change. Among the 318 (Appendix 1) snow concepts related to reindeer herding used by Guovdageaidnu herders, selected core concepts were further analyzed in the view of traditional use about different grazing conditions in winter and the physical characteristics of snow. The thesis also documents and discusses two ways of knowing about snow change and pasture availability in reindeer herding.

This study has shown that the reindeer herders' use of snow concepts is related to time, context, snow physics and the basic needs for reindeer herding when snow covers the ground in winter. Furthermore, these concepts are often dynamic because they are related to processes and conditions that changes

according to weather, time, and location (Article I). Findings indicate that these concepts should be understood in context of practical reindeer herding.

A multidimensional understanding of the snow concepts shows that some concepts are based on the physical characteristics of snow and can therefore be compared with international snow classification, while others have elements connected to the different herding strategies. Reindeer herders observe and manage snow from two perspectives: the snow physics and the ecology of herds in the winter grazing area, which reveals a holistic knowledge and view (Articles II, III).

A *siida*-based monitoring system, used in addition to interviews with herders, has provided an insight into the role of snow in daily herding. The data generated indicate the strategic and systematic use of grazing areas in terms of time and space. They also show the variability among the *siidas* in western Finnmark investigated in terms of snow conditions between years and between pasture areas. Every winter *siida* has its own unique grazing conditions, which makes it difficult to compare one *siidas* grazing conditions with those of others, and to make general conclusions (Article II).

Some basic snow concepts in reindeer herding, are complex categories, in the sense that a term contains and includes many factors simultaneously, such as information about snow, snow conditions, snow physics, weather, temperature, location, time and impacts of animals and humans (Articles I, II, III). These concepts are central for daily work with the reindeer, and constitute important parts for reindeer herders' traditional knowledge. Their importance is also expressed by the fact that they also involve sub-concepts, which includes further information about location, time and snow consistency. *Goavvi*, is just a such snow concept because it contains information about extreme climate conditions adaptation to climate variability and change and knowledge about resilience thinking and sustainability in reindeer herding. Some Sámi snow concepts mirror snow changes which are important for reindeer

herding. This is believed to be important for observing the future projected effects of a changing climate on reindeer herding. Sámi snow concepts are a part of the reindeer herding specialist terminology used in daily communication in practical herding. The snow concepts reflect the reindeer herders' traditional knowledge of the management of the herd on snow-covered ground and how herders deal with these complex systems using mental models and "rules of thumb" (Article II, III). This kind of knowledge has contributed to the survival of reindeer herding since time immemorial and will be essential in the future when reindeer herding is exposed to external influences such as climate change, loss of grazing land and effects of globalization (Article IV). Traditional knowledge is an important basis for the future cultural sustainability of reindeer herding. Further development of a monitoring system for *guohtun* can best be carried out through the use of herders' own terminology and traditional knowledge in order to support the *siidas* in building resilience locally.

This thesis raises concerns about the future use of Sámi reindeer herders' specialist language and traditional knowledge in mainstream Norwegian governance of reindeer herding. With a projected 8 degree increase in temperature in West Finnmark in winter (Hanssen- Bauer et al., 2011, in prep, one must also expect changes in snow and grazing conditions stressing the importance of daily use of and the knowledge in reindeer herders' specialist language in future. With the projected warming in Guovdageaidnu, some snow concepts might disappear in the herders' daily vocabulary, which is commonly used to day. A future sustainable adaptation of Sámi reindeer herding and reindeer herders to climate variability and future projected change must be able to handle uncertainties in nature. This requires different ways of knowing, combining herders' experienced-based knowledge with scientific knowledge. The Sámi language, knowledge and the use of pastures, show how the coupling of systems is manifested. Thus how herders and the environment are coupled. The study suggests that national adaptive strategies must recognize reindeer herders' traditional knowledge, and cultural and linguistic rights must be

included in adaptation strategies for climate change. It is therefore important to develop new social contracts between reindeer herders and society where reindeer herders' traditional knowledge and language are included.

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ARTIKKALAT

ARTICLES

DR.GRÁDA NUBBE OASSI/PART II

MIELDDUS/APPENDIX 1:

Sámegiela muohtaguoskevaš tearpmat, mat geavahuvvojit boazodoalus./The list of Sámi snow related terminology used in reindeer herding.

| Nr. | Tearbma | Definišuvdna | Klassifikašuvdna |
|-----|-----------------|---|---------------------|
| 1. | arvi | Čáhci mii bohtá almmis. | 1.b.3 |
| 2. | aškkas | Jiekŋa mii lea šaddan go čáhci bohtá eatnamis ja jiekŋu, dahje go jogaš dahje ája buđđosa nu ahte dađistaga jiekŋu. | 3.b.2 |
| 3. | aškkastit | Go čáhci mii bohtá eatnamis dahje jogas šaddá jiekŋan. | 3.b.2, proseassa |
| 4. | áidnet | Muohttit nu ahte jávkada luottaid. | 4.b.2 proseassa |
| 5. | áidu | Luodda johtti ealu dahje čorra maŋis. | 4.b.2 |
| 6. | áinnádat | Muohtán dan mađi ođđa vaza nu ahte luottat mat leat leamaš, leat jávkan ja ahte fas vuohtá ja ere ođđa luottaid boares luottain. | 4.b.2 |
| 7. | áinnehis muohta | Muohta mii ii leat lihkahallon, mas eai leat luottat. | 2.a |
| 8. | áinnehis oppas | Oppas mas ii leat fieskki, eai ge čiehkarat. Sullásaš doaba: čavdeoppas. | 4.c.2 |
| 9. | áinnestit | Veahá muohtestit nu ahte boares luottaid jávkada nu ahte sáhtá fas vuohtit | 4.b.2, proseassa |
| 10. | baldu | Jiekŋa jávrri dahje jogas mii lea suddagohtán ja de doddjodan nu ahte lea unnit osiide šaddan. | 3.b.2 |
| 11. | balva | Almmis balva (sáhtá omd. borggaid buktit). | 1. |
| 12. | balvaciehkki | Balvvat mat buktet dálkki. | 1. |
| 13. | balvadálki | Sevdnjes ilbmi, ja beaivváš ii oidno. | 1. |
| 14. | báhkka | Go beaivváš goardá ja ligge áimmu. | 1.b.1 |
| 15. | bávddastit | Čáhci loktana jieŋa nala. | 3.b.2 |
| 16. | bearta | Lea gaskadilli go ii leat bievla ii ge leat dálvi ge, muhtun saji bievla ja muhtun saji veahá muohta. Go lea leamašan veahá borga ja de bivvalis dálki, mii suddada veahá nu ahte rahpá bovdnaoivviid ja de fas galbmá. Dát lea čakča fenomena. Dalle | 2.a. bievla-muohta |

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| | | <p>ii leat buorre guohtun. Dát sáhtta váikkuhit dasa ahte boazu lea hiltadeabbo, dat ruvggohallá eambo. Dát ii leat oaidnimii iige mátkkošteapmái nu buorre.</p> <p>Čakčat lea leamaš muohtavahca ja lea bivaldan ja dat liegganan, dat muohta šaddá measta dego jieknan, hui rušas ja garas. Muhtun saji bievla ja muhtun saje veahá muohta. Lea gaskadilli mii ii leat goabbá ge, ii leat bievla ii ge leat dálvi ge. Dalle šaddá hirmadit guođohit go eallu hilbi. Boazu vázzá hirmadit dan muohttaga nalde, girjját eananbievla-dielkkuid, bovdnaoivviid mielde. Dalle ii leat buorre vuohttit luottaid. Čakčat, sáhtta maid leat čakčadálvi. Sullásaš doaba: girjebievla, muhto dán dadjet gidđat.</p> | |
| 17. | biedggus guohtun | Go ii leat buot sajiid guohtun. | 4.c.1 |
| 18. | biegga | Áibmu mii lihkada. | 1.b.2 |
| 19. | biegga-gaikkohat | Báiki gokko bieggalea dolvon dahje gaikon visot muohttaga eret nu ahte dakko lea meastta bievlan. Muhtin saji lea fas dakkár ahte ii beasa bodnái iige vuhtto šat mihkke luottaid. Báikkit gos sáhtta leat bieggagaikkohat, leat badjugit, várrenjuniin ja várreluohkain. Dat ii leat vuomis gal. Bieggagaikkohat sáhtta leat dakkár mas ii leat oba guohtun ge. | 1.b.2 |
| 20. | bieggat | Go áibmo lihkada ja bieggá juoga man sisa, omd lávvui, gohtái. | 1.b.2, proseassa |
| 21. | biegga-veađahat | Báiki gokko lea eanas muohttaga bosson eret, lea vuollelis, omd. vađain. | 1.b.2 |
| 22. | bievla | Dilli go ii leat muohta. | 2.a. (bievla – muohta) |
| 23. | bievladielku | Muohta suddan nu ahte lea bievla ihttán dahje muohtadilis go muhtun sajiid lea bievlan. | 2.a. (bievla – muohta) |
| 24. | bievlaealát | Go ii leat muohta (bievlan) lea nu ahte bievllat leat ihttán nu ahte besset bievllaid guohtut. | 4.c.1 |
| 25. | bievlasáiggut | Go bievlogohtá, de sáiggaga, dego čáhpoda dakko go bievla. | 2.a. (bievla – muohta) |
| 26. | bihci | Lea”asahis” muohta eatnamis nu ahte suoinniid ja eananšattuid leat veahá vilggodan. Dát lea árra | 3.b.1.1 |

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| | | čavčča, go lea bievla ja go bievlla nalde buolašta, de bihcu. | |
| 27. | bihcut | Vilggodahtta omd. eatnama čakčat, go ihkku lea galmmestan, muhto ii fal muohtán. | 3.b.1.1 proseassa |
| 28. | bivaldit | Áibmu rievdá bivvala guvlui go lea galmmas leamaš. | 1.b.1 proseassa |
| 29. | bivval | Go áibmu lea badjel 0°C; moadde gráda. | 1.b.1 |
| 30. | boara | Giddajiekŋa jávrris. | 3.b.2 |
| 31. | boares čiegar | Mii lea čiegaruvvon go lea áigi gaskkas (omd. mánu ovdal) go bohccot leat guhton, omd. čakčat. | 4.c.3 |
| 32. | boares fieski | Boares luottat. | 4.b.1 |
| 33. | boarragis | Giddajiekŋa lea boarragis, lea loktanan bajás jávrris dahje jogas. Dilli ovdalgo šaddá nállojiekŋa. Dalle doppe guolli bures. | 3.b.2 |
| 34. | boazu goaivu | Go julggiin muohtaga čađa beassá ealáhaga rádjá. | |
| 35. | boazu ráhpu | Go álkit beassá julggiin čađa muohtaga. | 4.c.1 proseassa |
| 36. | boazu roggá | Go šaddá veahá fámuid atnit beassat muohtaga čađa. | 4.c.1 proseassa |
| 37. | bodnečiegar | Čiegar botnis, eatnama vuostá árra jagis dahje maŋŋi dálvvi. | 4.c.3 |
| 38. | bodnegeardni | Jiekŋageardni botnis, eatnama vuostá. | 3.b.3 |
| 39. | bodnejiekŋa | Jiekŋa eatnamis jeahkála vuostá. Jus lea assás jiekŋá, de ii leat ealát. | 3.b.3/2.b.3 |
| 40. | bodnemuhta | Muohta eatnama vuostá. | 2.b.3 |
| 41. | bodneskártta | Jiekŋa, mii lea njuoska vahcan jikŋon bievlla vuostá, darvána jeahkálui, dakŋasiidda. Bievlan, jus veahá lea muohta boahtán ja de jorgala arvá nala ja de buolašta, de jiekŋu jeagil ja de boahtá fas borgá dan nala. Jeagil lea šaddan jieŋa sisa dahje jiekŋa galbmon birra jeahkála. Dákkár dilli gal lea measta katastrofa, danne go šaddá nu garas ahte boazu ii beasa bodnái, ii oaččo šat jeahkála. De gal billista. Dát dagaha dálvet rudneguhtuma. Čakčat/čakčadálvvi. | 3.b.3/2.b.3 |
| 42. | bodnesuossa | Vuolemus geardi muohttagis, mii lea jikŋon dahje suossan. | 2.b.1/2.b.3 |

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| 43. | bodnevihkki | Jiekŋa, skárta dagahan ahte bodni lea heitot. | 4.c.1 |
| 44. | bođaš | Jiekŋa gáddeguoraid dahje johkavuodus go geađggit leat jikŋon. | 3.b.2 |
| 45. | bođaščáhci | Bealle jikŋon čáhci. | 3.b.2 |
| 46. | bođašjohka | Johka mii lea galbmigoahtán ja báddagoahtán. Bohccot eai mana dákkár johkii. Dát sáhtta leat oahcin. | 3.b.2 |
| 47. | bođaštit | Jiekŋut gáddeguoraid. | 3.b.2 proseassa |
| 48. | borga | Go lea bieggá dalle go lea muohtadálki dahje dadjet maid dalle go lea muohtadálki iige bieggá. Sullálaš doaba: muohtaborga. | (1.b.3)+1.b.2 |
| 49. | borgá | Muohtti, dahje muohttit ja bieggá oktanagas. | 1.b.2 (+1.b.3) |
| 50. | buolaš | Dálvet lea buolaš, temperatuvrra dáfus lea galbmasit go galmmas, ferte leat measta galbmasit go -15°C áimmus ovdal go lea buolaš. Giđđadálvvi sáhttet leat idjabuollašat. | 1.b.1 |
| 51. | buoridit guohtuma | Dálkkit dahje temperatuvrrat váikkuhit nu ahte muohta lea dipmán ja nu lea heajos guohtun šaddan buoret guohtumin. | 4.c.1 proseassa |
| 52. | ceakko-suovdnji | Gassa muohttagis suovdnji. | 4.c.4 |
| 53. | ceavvalahtit | Go lea muohta šaddá dakkárin ahte guoddá. | 2.b.2, proseassa (III) |
| 54. | ceavválat | Sitkes muohta, guottádat, mii guoddá olbmo dahje bohcco go vázzá. | 2.b.2 (III) |
| 55. | ceavejassa | Lea giđđajassa. Ovdal mihcamáraid leat jasat nu ceavit ahte oažžu nu vánddardit daid mielde ahte ii oba čalgga dahje doddjo ge. Giđđat go jođát herggiiguin, de manat ceavejassaráigge go dat guoddá, lávejit dadjat ráido-jassan. | 2.b.2 |
| 56. | ceavvi | Lea garra bajildus muohta. Dat lea njuoska muohta mii lea lasmmihan ja de galbmon ja šaddan hui sitkadin, dakkár man čađa ii mana, ii báljo nagot ráigat. Dat lea guottáhat. Dalle bohccot vázzet muoraid mielde ja duoddaris mannet gerggiid mielde. Dalle lea heitot | 2.b.2 (III) |

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| | | bohccuide. | |
| 57. | ceavvut | Šaddat ceavvin. | 2.b.2 proseassa |
| 58. | ciekkadit | Dahkat nu ahte šaddá/duolmmasta/gahččá muohttaga sisa. | 4.d, proseassa |
| 59. | ciekkahat | Čiekŋalis luottat, dábálaččat luotta nalde. | 4.d |
| 60. | cikcet (čiehkara) | Dipmádit muohttaga. | 1.b.1. proseassa |
| 61. | coakci | Jiekŋa dahje muohta, mii ii leat gáljin, nu ahte boazu beassá vázzit nu ahte ii njalkkas. | 4.b.2 |
| 62. | cuokca | Jassa- dahje jiekŋageaidnu. | 4.b.2 |
| 63. | cuoŋu | Garra muohta, measta dego jiekŋa, mii lea šaddan go muohttaga lea liggen ja dasto idjabuolaš garradahtán nu ahte guoddá olbmo ja bohcco. Dákkár dilis lea buorre siivu, go dasa mii galgá vánddardit, dasa lea buorre. Muhto dasa mii bohccuid galgá guođohit, dasa gal ii leat buorre dát. Boazu ii beasa guohtut ja ii leat buorre ealát. Giđđat. | 3.b.3 (I + III) |
| 64. | čahcejođáhat | Muohta nu njuoskkas ahte ii šat doba ii ge dáđo sabehiidda dehe mielgasiidda. | 2.c, (IIIb) |
| 65. | čakčačiegar | Lea čakčat čiegarduvvon. | 4.c.3 |
| 66. | čalgat | Juolgi manná čađa muohttaga. | 4.d, proseassa |
| 67. | časkilit | Geahččat leat go luottat muohttagis. | 4.b.2, proseassa |
| 68. | časttas | Lea garra unna skálvváš, dego bárru. Biegga lea bosson ja fierahan muohttaga ja nie ráhkadan dego báruid dahje bovnnaid. Dákkár muohta lea alla eatnamiin, gáissáin, duoddariin, jalggain, ábiin ja jávrriid nalde, ja dakko lea heitot vánddardit, jus skuteriin vuodjá, de njuikkoda hirbmosit. Gokko bearehaga lea častas, dakko ii leat buorre guohtun. Časttasat dahket čeargga. | 2.b.2 |
| 69. | čavdeoppas | Oppas mas eai leat fieskkít, eai ge čiehkara. Sullásaš tearbma: áinnehis oppas | 4.c.2 |
| 70. | čavget (muohttaga) | Biegga garrada muohttaga. | 2.b.2, proseassa |
| 71. | čáđgi | Hui njuoska muohta. | 2.b.1 |

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| | | | |
| 72. | čáđgit | Veahá šlahttit (muohttit dahje arvit). | 1.b.3, proseassa |
| 73. | čeallut | Boazu njuike gassa muohttagis. | |
| 74. | čearga | Garra muohta, mii lea dušše bajil muohttagis. Dat sáhtta leat oalle assái, sáhtta mehtara asu. Biegga lea fieraha dan muohttaga čađat, ovttohit ja dekčon nu ahte maŋemus šaddá nu čavga ja garas ahte ii boazu goit goaivvo dan čađa. Jus leat bivvalat ja garra biekkat, de láve čeargat hui jođánit. Daid garraseamos čearggaid ii dipmát ii mihkkege ovdal go suddá muohta, muhto jus leat veahá dakkar dušše mii bajil lea, sáhttet dipmát jus guhkilmas buollašiid atná. Láve hui bahá šaddát čearga duoddaris, orddain, jávrriin. Dat sáhtta gáržžihahttit guohtuma. Dasa atno spáillit (varis boazu), mii časká čeargga. Vánddardeapmái ovdalaš áigge váikkuhii go herggiiguin vánddardedje. Dakko gokko lea čeargan, dakko lea lássen (heitot guohtun). Gasku dálvvi. | 2.b.2(I+III) |
| 75. | čelohat | Sadji gokko bohccot leat njuikon gassa muohttagis. | 4.b.2 |
| 76. | čiegar | Lea báiki gokko boazu lea garrasit guhton. Dákko lea muohta deakčasan ja šaddan nu garasin ahte dan ii bastte čađa. Báikkis leat guđohagat ja galbma suovnnjit. Dakko lea muohta garas, ja ii leat ealát ja nu ii sáhte dakko guđohit. Ferte leat muohta jus galgá šaddat čiegar. Unnán muohttagiin ii šatta čiegarin. Jus dalle čiegarduvvo, de láve ovddabeal juovllaid fas dakko sáhttit guđohit ođđasit. | 4.c.3/4.a.1 |
| 77. | čilvi | Dilli mii šaddá go bealle-bievllas seammá sajis jorahuvvo eallu. Čakčat. | 4.a |
| 78. | činus | Garra muohta muohtagierragis, mii lea deakčasan oktii, šaddan hui činusin. Dat lea dakkár muohta mii lea hui sávri, ii leat gal oalát čearga, muhto dat lea sávrris muohta, dat measta bealle guoddá. Dán muohttaga ii báljo beasa čađa, bohccui lea lossat guohtut, eai nagot goaivut. Činus gullá garra muohttagiid syklusai, | 2.b.2 (I) |

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| | | álggus lea činus, de joavggahat ja de čearga. | |
| 79. | čitnut | Garrat ja deakčasit muohttaga birra. Šaddá nu činus go lea hui bivvalin borgan nu ahte lea deakčasan čoahkkái. | 2.b.2 proseassa |
| 80. | čoahkkečiegar | Čiehkarat mat leat čoahkis, eai leat oppasdielkkut gaskkaid. | 4.c.3 |
| 81. | čoaltu | Muohta dahje jiekŋa galbmon jorbbasin. | |
| 82. | čoaskkis | Galmmas, galbma áimmu ja biekká dihte. | 1..b.1 |
| 83. | čodđálat | Njuoska borga, mii jiekŋu muoraide, čakčat dahje čakčadálvvi. Go dát gahččá, ja boahťá juoga man njeaiga, de galbmo dahje jiekŋu dakkaviđe. Lea issoras váttis oažžut dola čodđalahkain, galgá vuos suddadit jieŋa eret muorain, ruvvet ovdal oažžu buollát. | 1.b.3+1.b.1 |
| 84. | čodđi | Lea jiekŋa muorain ja geđggiin. | 3.b.1.3 |
| 85. | čuohkeboazu | Boazu mii ii leat beassan guohtut čuogi dihte. Dán áigge ii leat geavhusas dát doaba. | 4.d |
| 86. | čuohki | Dilli go guohtuneamat leat jikŋon. | 3.b.3 |
| 87. | čuorpmas | Jikŋon arvečalmmit. | 1.b.3 |
| 88. | čuorpmastit | Go arvečalmmit galbmojit ja šaddet jiekŋačoaltun. | 1.b.3+ 1.b.1 proseassa |
| 89. | dálki | 1) muitala makkár áibmu ja ilbmi lea. 2) garra biekkat ja borggat dahket heajos dálkki. | 1.a |
| 90. | dálvečiegar | Lea dálvet čiegarduvvon. Dákko lea muohta hui garas. Dán dadjet heajumus dási čiehkarin. | 4.c.3 |
| 91. | dálvvádat | Go leat dálvetemperatuvrrat ja dálvedálkkit mat almmuhit dálvedili omd. čakčadálvvi dahje ahte dálvi bistá guhká gidđat. | 2.a |
| 92. | dálvváiduvvat | Fáhkkestaga boahťá dálvi, gassa muohttagiin. | 2.a, proseassa |
| 93. | dálvvi vuodđu | Dálvevuodđu lea muohta eatnama nalde, mii lea galbmon nu ahte bisána. Dábálaččat álgá dálvet bures novempera, go dalle álgá dahkat dálvvi sihke jieŋa ja muohttaga ektui. Dalle oaidná lea go skárton ja sarton bodni. Sáhtta diedusge buolaš rievdadit vuodđu, muhto dušše smievrrudahttit. Ii leat bievlan šat nu ahte dat odđa vuodđu dahká. Makkár dálveálgu lea, váikkuha dasa movt ceavccihahťá bohcco dálvet. | 2.a |

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| 94. | deabardit | Vázzit hiljit ja gállit muohttaga (stuora hámehis gápmagiiguin). | 4.d |
| 95. | deamádat | Dakkár áibmu dahje muohtadilli ahte olmmoš ii báljo oainne dahje leat váttis oaidnit erohusaid muohtamáilmmis. Sullásaš doaba: geamádat. | 1.a (VI) |
| 96. | deamáidit | Gullo jietna go vázzá muohttaga nalde go lea sullii -10°C. | 4.d |
| 97. | deaškaluvvon muohta | Muohta dekčojuvvon čoahkkái. | 2.b.2 |
| 98. | dielko-oppas | Báiki gokko oppas lea dielkkuid mielde. Sullásaš doaba: suolo-oppas. | 4.c.2 |
| 99. | divttis muohta | Oalle jámmat garra čoahkkemuohta. | 2.b.2 |
| 100. | doajádat | Dakko gokko muohta doddjoda nu ahte čalgá go vázzá. | 4.d |
| 101. | doalli | Boares luodda gokko leat herggiiguin mannan dahje bohccot leat vázzán. | 4.b.2 |
| 102. | dobádat | Dakkár muohtasiivu ahte njuoska vahca darvána dahje galbmo gitta sabet- dahje reahkavuoduide nu ahte sabehat eai jođe. Dat darvána bahábut sabehii, mii lihkkasa ja ain bisána ja lihkkasa, bisána, go rehki mii čađat johtá. Geavahuvvo gidabealde go álgá bivvalis dálki ja go lea njuoskasit muohta. | 2.b.1 (IV) |
| 103. | ealát | Sadji dahje dilli gokko lea vejolašvuohta bohccos eallit, omd. muohttaga vuolde gokko lea jeagil, rássi jna. | 4.c.1 |
| 104. | eallojođáhat | Báiki gokko muohttagis lea luodda báhcán go ealuin lea johtán. | 4.b.2 |
| 105. | fiertu | Dilli go áibmu lea čielggas, go ii leat arvi/muohta ii ge bieggá. | 1.a |
| 106. | fieski | Luottat ja guođohagat; muohta mii lea deaškaluvvon go boazu lea guhton. | 4.a/4.b.1 |
| 107. | fieskkastallat | Go bohccot fitnet ovtta báikkis dahje olbmot guođohastet dakko. | 4.a.1, proseassa |
| 108. | gaikkohat | Báiki gokko bieggá lea bosson nu ahte lea hui unnán muohta. | 2.a, (I, III) |
| 109. | galbmin | Go áibmu galbmo. | 1.b.1 |
| 110. | galbmit | Lieggasit áibmu mii šaddá galbmasit. | 1.b.1 proseassa |

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| 111. | galmmas | 1) áibmu mii ii leat liekkas. 2) “muohta lea dahje ii leat galmmas”. Dás ii leat hupmu temperaturvrra birra, muhto dan ahte leago vejolaš muohttaga lihkahallat. Jus ii sáhte lihkahallat, de lea galmmas, muhto jus sáhtta, de ii leat galmmas. Varas čiegar/varas fieski ii leat galmmas. Go čiegar lea galbmon, de sáhtta das čuolastit bihtá eret. Guorbaeanan galbmo ovddemus, ovdal go jeageleanan. | 1.b.1 |
| 112. | gaskageardni | Garra jiekŋageardi, mii botke muohttaga go árabut lea leamaš cuoŋu ja dasto muohtán ala, ja lea báhcán garra geardi muohttaga sisa. Jus gaskageardni ii diima, muhto lea hui garas, dat gáržžida bohcco goaivunvejolašvuoda roggat. Sáhttet máŋga gearddi leat muohttagis. | 3.b.3/2.b.4 |
| 113. | gassa (muohta) | Hui ollu muohta. | 2.b.3 |
| 114. | gavda | Čáhecegierragis galbmon asahis jiekŋa. Hui asehis jiekŋa, mii ii guotte olbmo iige ealli. | 3.b.2 |
| 115. | gavdot | Čakčat go galbmigoahtá, de čáhcegiera galbmo. | 3.b.2 proseassa |
| 116. | gálahat | Báiki gokko lea gassa muohta. | 2.b.3 (IIIb) |
| 117. | gállja | Jiekŋa mas ii leat muohta nalde, mii lea nu njalkkas ahte ii leat coakci. | 3.a (IIIb) |
| 118. | gálljin | Njalkkas jiekŋadilli, ii leat coakci go vázzá/vuodjá. | 3.a (IIIb) |
| 119. | geaidnu | Gokko lea buorre vánddardit, sihke muohtaetnamis ja bievlæatnamis. | 4.b.2 |
| 120. | geamádat | Dakkár áibmu dahje muohtadilli ahte olmmoš ii báljo oainne dahje leat váttis oaidnit erohusaid muohtamáilmmis. Sullásaš doaba: deamádat. | 1.a,(VI) |
| 121. | geardi | Asehis garra muohtageardi, mii sáhtta leat muohtagierragis dahje eará sajis muohttagis. | 2.b.2 |
| 122. | geardni | Asahis jiekŋageardni. Go muohtagierraga njuoskada ja de galbmá, šaddá jiekŋavajahas muohtagierragii. Dát ii guotte olbmo; ovdal go moarru dahje ceavvu, dalle go muohtagiera lea garran, muhto ovdal go šaddá ceavvin dehe moarrin. | 3.b.3 |
| 123. | girjebievla | Gaskadilli go ii leat bievla ii ge leat dálvi ge, muhtun saji bievlan ja muhtun saji veahá muohta. | 2.a |

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| | | Giddat. | |
| 124. | girrat | Garra muohta. Heajos sabetsiivu, go varas muohta galbmo. | 4.d (IV) |
| 125. | girsi | Jienka-eanan dahje eanan mas lea jiekŋa. | 3.b.1.1 |
| 126. | goahpálat | Odđa njuoska muohta mii darvána dávviriidda/juohke diŋggaide. Sullálaš doaba: dobádat. | 2.b.1 (IV) |
| 127. | goaivvos-suovdnji | Olmmoš goivon suovnnji, mas lea muohttaga váldán suddadeami várás. | 4.d |
| 128. | goaivvis | Dakkár báiki gokko muohta lea dakkár ahte boazu nagoda goaivut čađa muohttaga. ”Dákko lea goaivvis”, ”Mii gávnnaimet goaivása”. | 4.c.1 |
| 129. | Goaivvos-guohtun | Go boazu beassá goaivumiin bodnái. | 4.c.1 |
| 130. | goalki | Áibmu lea jaska. | 1.b.2 |
| 131. | goapma | Dakkár skálvi mii skihččá olggos. | 2.a.1 |
| 132. | goapmaskálvi | Dakkár skálvi mii skihččá olggos. | 2.a.1 |
| 133. | goarrálat | Dálvemádidja mii manná doarrás luohkás. | 4.b.2 |
| 134. | goarveskálvi | Biegga ráhkadan muohttaga measta ceakko gomu skálvin, nu ahte dat measta lea heaŋggoskálvi. | 2.a.1 |
| 135. | goarvi | Ceakko, measta gomu ceahkki dahje eananravda, stuorit ja govddit go goapma | 2.a.1 |
| 136. | goavádat | Oppalaš dilli mii muitala ahte lea goavvi. | 4.c.1 |
| 137. | goavvedálvi | Goavvi mii bistá dálvvi. | 4.c.1 |
| 138. | goavvegidda | Goavvi mii lea giddat. | 4.c.1 |
| 139. | Goavvejahki | Heajos muohtadilli mii bistá olles dálvvi gitta giddii. | |
| 140. | goavvi | Earenomáš heajos guohtundilli mii dagaha stuora boazojámu ja negatiivva váikkuhusaid boazodollui. Goavvi ii adno čilget “dábálaš” heajos dálvviid, heajos guohtuma go lea omd. <i>cuoŋu, čearga, ceavvi.</i> | 4.c.1 |
| 141. | gohppot | Muohta darvána bikstasiidda. | |
| 142. | golggotnjáhcu | Njázut maŋábealde ragada. | 1.b.3 |
| 143. | gordnemuohta | Muohtačalmmit dego gortnit (seaŋáš). | 1.a.1 |
| 144. | guđohat | Báiki gokko boazu lea goivon muohttaga ja guhton. | 4.a |
| 145. | guohtun | lea sihke 1) dat maid boazu bargá go guohtu ja 2) | 4.c.1 |

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| | | dat man boazu guohtu. Boazodoalus adnojuvvo liikká eanemus guohtundili birra muohtan. <i>Guohtun</i> -doahpaga «lávejit geavahit go árvoštallet man álkit boazu beassá goaivumiin muohttaga čađa bodnái eatnama rádjái gos borramuš gávdno. Dát čilgehus geavahuvvo duššo muohttaga birra makkár dat lea, iige čilge borramuša birra ja dan dihte dat adno dušše dálvet.» | |
| 146. | guoldu | Biegga bossu muohttaga nu ahte ii oainne. | 1.b.2+1.b.3 |
| 147. | guottádat | Oppalaš dilli mii muitala ahte dál lea dakkár muohta mii guoddá. | 2. b.2,(IIIb) |
| 148. | gutnaguohtun | Guohtundilli mas muohta lea hui luotkkus, dego gutna. | 4.c.1 |
| 149. | heajudit guohtuma | Muohtadilli mii muitala ahte bohccui lea šaddan váttis beassat goaivumiin muohttaga čađa bodnái eatnama rádjái, gos borramuš gávdno. | 4.c.1 |
| 150. | hieibma | Veahá bieggá, nu ahte jur dovdo. | 1.b.2 |
| 151. | jahkas | Ollu muohta giđđadálvvi. Dalle ii leat buorre guohtun. | 2.a, (bievla – muohta) |
| 152. | jaraidit | Jietna, mii gullo go vázzá muohttaga nalde dalle go lea bivvalis dálki. | 4.d |
| 153. | jassa | Muohta, mii ii leat vel suddán; geassemuohta. | 2.a |
| 154. | jiehkki | Dakkár jiekŋa alladagain mii ii sutta. | 3.a |
| 155. | jiekŋa | Čahci dahje muohta mii lea suddan ja de galbmon. | 3.a |
| 156. | jiekŋagávli | Jieŋat gáddaguorain, omd. luovttat jikŋot. | 3.b.2 |
| 157. | Joavga | Gassa muohta vuomis maid bieggá ii boso eret. | 2.b.2 |
| 158. | Joavgat | Biegga bossu ja čohkke muohttaga ja nu dagaha gassa muohttaga (joavggahagaid) vassis báikkiide. | 2.b.2, 1.b.2+1.b.3, proseassa |
| 159. | joavggahat | Báiki gosa bieggá lea bosson, čohkken ja deavdán muohttaga rokkiide ja eatnamii, dahje dakkár báiki gosa čoggo ollu muohta. Dat lea dan vuolemus muohttaga nalde. Dat váikkuha dasa ahte dakko šaddá eambo muohta go dábálaš vadain ja seakka ealátbáikkiin. Dat soaitá nu šaddat ahte dáid dieváid ii guođo go joavgan lea. | 2.b.2 (I + III) |

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| | | Biegga ja buolaš sáhtta dagahit ahte joavggahagat šaddet čeargan. | |
| 160. | joavggas | Mii álkit jovgo go lea guoldu. | 2.b.2 |
| 161. | jodádat | Go siivu lea nu ahte sabet/reahka johtá. | 4.d (III) |
| 162. | jodáhat | Báiki gokko lea luodda mii báhcá go ealuin lea johtán. | 4.b.2 |
| 163. | ladjádís muohta | Suhkkes muohta mii ii leat dimis. | 2.b.2 |
| 164. | lasmmiha | Go muohta gahččá ja deaddiluvvo oktii nu ladjádit dego livččii njuvdestuvvon. | 2.b.3/ 4.d, proseassa |
| 165. | láfu bieggá | Hui bivvalis bieggá. | 1.b.2 |
| 166. | láhtehas (eanan) | Báiki gosa čoggo ollu muohta, ahte ii nagot bievlat. Dát lea goavvá čadnon. | 2.b.2 |
| 167. | láhttu | Luodda gokko lea čuoigan. | 4.b.2 |
| 168. | lávttas | Bealle njuoskkas. | 1.b.1 |
| 169. | levdnot | Go bittuid sisa manná muohta ja njuoskkada. | 4.d, proseassa |
| 170. | liehmu | Bivvalis dálki. | 1.b.1 |
| 171. | liekkas | Go lea liegga áibmu. | 1.b.1 |
| 172. | linádat | Muohtadilli (siivu) goas lea linis vánddardit. | 2.b.2 |
| 173. | lokša | Luodda (mii ii oidno), mii lea báikkis gokko bohccot leat mannan, ja go eará bohccot de dakko mannet, de hakset luotta (lovssa). Sáhtta lea sihke muohtaeatnamis ja bievlaeatnamis. | 4.b.2 |
| 174. | luodda | Muohtaga nalde oidno gokko leat vánddardan/vázzán. | 4.b.2 |
| 175. | luotkku | Goike, dipmá, geahppa muohta gitta bodná, mii ii guotte. Dalle go lea buorre guohtun, go bieggá ii leat billistan guohtuma. Dat lea dálvet ja gal láve čakčadálvve nai. Ii giđdat dette leat šat nu. Muhto čakčat dat lea eanas luotkomuohta. | 2.b.2 |
| 176. | mádidja | Geinnodat gokko lea buoremus vánddardit, sihke muohtaeatnamis ja bievlaeatnamis. | 4.b.2 |
| 177. | márahát | Báiki gokko leat govdadit johtán ealuin. Govda johtolat. | 4.b.2 |
| 178. | mierká | Geasset mierká. | 1.a |
| 179. | moarádahttit | Dan go moarádahkan baldá čoavjjehiid garrasit, | 4.d, (III) |

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| | | gidđadálvvi. | |
| 180. | moarádat | Oppalaš dilli go muohtagierragis lea asehis garra muohta, mii bealle guoddá olbmo dahje bohcco. | 3.b.3 (III) |
| 181. | moarri | Asehis garra, jikŋon muohtagiera. Dakkár muohta mii bealle guoddá olbmo dahje bohcco, muhto báikkuid čalggada. Go njázudišgoahtá danne go beaivet lea liggen muohttaga ja go de muohtagiera galbmogoahtá, mii de boahtá dan muddui ahte gosii guoddá, muhto ii dette guotte. Dat lea doajadatmuohta, masa eallit sáhttet nádjat julggiid. Boazu lea dalle árggit, ja dan dihte ii mana moarrin, dat vuordá dassá cuoŋuda. Jus don vuojehat, dat lea hui lossat mannat moarrin. Dákkár muohta lea gidđadálvve dahje gidđat. Gidđadálvve ii galgga čoavjjehiid garrasit baldit, go čoavjjet sáhttá reitot jus moaradahttá. | 3.b.3 (III) |
| 182. | moskkudálki | Dálki go lea hui suhkses áibmu, ollu balvvat. | 1.a |
| 183. | moskkudit | Balvegoahtit seavdnjadin. | 1.a |
| 184. | muohta | Čáhci mii lea galbmon áimmus ja mii de gahččá muohttaga hámis eatnama nala. | 1.a/1.b.3 |
| 185. | muohtaborga | Go lea bieggá dalle go lea muohtti dálki. | 1.b.2+1.b.3 |
| 186. | muohtačahki | Muohtačoaltu maid garra bieggá lea ráhkadan. | 2.b.2 |
| 187. | muohtačahki | Spábba maid muohttagis ráhkada. | 4.d |
| 188. | muohtačalbmi | Arvečalbmi galbmon áimmus. Go iešguđetlágan diliin galbmo, de šaddet iešguđetlágan muohtačalmmit. | 1.a.1 |
| 189. | muohtagiera | Muohtagiera (muohttaga bajuš). | 2.b.4 |
| 190. | muohtalat | Dilli go duos dás muohtá. | 1.b.3 |
| 191. | muohtádat | Go ii leat bievla, muhto muohta miehtá. | 2.a (bievla – muohta) |
| 192. | muohtti | Muohtadálki (muohtti muohta). | 1.b.3, proseassa |
| 193. | muohttiborga | Go muohtá, ja ii leat bieggá. | 1.b.3 |
| 194. | muohttit | Go muohtá. | 1.b.3, proseassa |
| 195. | muovlat | Čalgat gassa muohttagis nu vulos ahte ii beasa gosage. | 2.b.3, proseassa |
| 196. | muovllahat | Čiekŋalis ja gassa muohta, mii lea boagánradjái go čuožžu. Čiekŋalis gáláhat. | 2.b.3 |

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| 197. | murku | Dálvemierká. | 1.a |
| 198. | nállojiekŋa | Hui asehis gidđajiekŋa járvvis ja jogas. Nu suddan ahte jikŋii leat šaddan nálut. Dát lea hui rašes jiekŋa, ii gierdda maidege. | 3.b.2 |
| 199. | nealgedálvi | Jahki go lei nu earenomáš heajos guohtundilli, danne go eatnamis ja šattuid nalde lei assás jiekŋa. Dát dagahii ahte ollu bohccot jápme ja muhtumiin boazosápmelaččat sáhtte nohkko hallat. Dát lea oktii namuhuvvon, jagis 1917/1918. Gohčoduvvo maiddá nealgejahkin. | 4.c.1 |
| 200. | njáhcovieski | Fieski mii lea šaddan njáhcun. | 4.b.1 |
| 201. | njáhcu | Nu bivval ahte njuoskada muohttaga. Maŋŋel go lea borgan, ja de lea ligger fas muohttaga, de šaddá njuoska muohta. Dát gáržžida guohtuma. “Jus Hállemas-njáhcu ii boađe dieid beivviid, de šaddá heitot dálvi.” Sáhtta arvit dálvet goas ii galggaše arvit ja de bivvaldit nu ahte muohta njuoská ja go de galbmo, de sáhtta geartni ráhkada ja de šaddá botneskártta. Njáhcu lea čakčat/skábman, muhto lea dábbáleamos gidđadálvi. | 2.b.1/1.b.3 |
| 202. | njázudit | Šaddat nu bivval ahte njuoskada muohttaga. | 1.b.1, proseassa |
| 203. | njeađga | Biegga guoldduštan luottaidd badjel, nu ahte ii vuohte. | 4.b, (V) |
| 204. | njeađgat | Biegga guolddušta luottaidd badjel nu ahte luottaidd ii vuohte. | 1.b.2 (V) proseassa |
| 205. | njeađggadat | Báiki gokko luottat eai oidno. | 4.b, (V) |
| 206. | njunneguohtun | Go boazu sáhtta guohtut nu ahte dušše njuniin lihkahasta muohttaga ja de beassá jeahkála rádjái. | 4.c.1 |
| 207. | njuohpahat | Jiekŋa muohttaga vuolde. Go heargi/boazu ii oaččo coavcci go muohta lea jieŋa nalde. | 3.a |
| 208. | Oakti | Go duos dás arvá dahje muohtta. Arveoakti, borgaoakti. Davvedálkkit mannet ovttiid mielde. | 1.a |
| 209. | oavlluš | Gohpi masa bisána soavli. | 2.b.1 |
| 210. | obbadálki | Ollu balvvat almmis, muhto ii leat muohta/arvi. | 1.a |
| 211. | odda vahca | Aitto muohttan muohta. | 2.a |
| 212. | oppas | guovlu dahje báiki gos muohta mii ii leat duohtaduvvon, ahte omd. bohccot eai leat | 4.c.2 (I / III) |

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| | | duolbman dakko. Oppas ii leat nu olu sturrodagas (arealas) sáhka, muhto mainna lágin eallu lea guođohuvvon, omd. jus lea čoahkis, de duolbmá dieđusge eanet. 2. nu ollu muohta ahte lea váttis vánddardit. | |
| 213. | ratti | Luottat muohttagis, mat leat báhcán go hearggiin leat vuodján (orjániid birra) | 4.b.2 |
| 214. | ravdafieski | Guovtti ealu gaskkas fleski, dahje fieskegaskka. | 4.b.1 |
| 215. | rádno | Njoammel-luottat maŋŋálaga muohttagis. | 4.b.2 |
| 216. | ráidojođáhat | Luodda muohttagis, mii báhcá go ráidduin lea johtán. | 4.b.2 |
| 217. | rámso-oppas | Oppas mii lea rámssas iige ollis, mii sáhtá šaddan dan dihte go eatnamis lea skártadielkkut. Dát lea heajumus dási oppas. | 4.c.2 |
| 218. | ráššu | Galbma, čoaskka arvi dahje bealle borga. | 1.b.3 |
| 219. | Rievdat (balduid birra) | Go baldot lihkadit čázis. | 3.b.2 |
| 220. | rihttu | Muohta- dahje eananrihttu. Muohta mii lea luovvanan várregilggas ja fierran vulosguvlui. Sullásaš doaba: uđas. | 2.a |
| 221. | rinádat | Dilli go lea ritni muorain nu ahte lea váttis oaidnit. | 3.b.1.2 |
| 222. | ritnalat | Dakkár dálkesorta ahte muoraide darvána ritni. Go vel borgá daid nala, de šaddá rinádat. | 3.b.1.2 |
| 223. | ritni | Muohta dahje jiekŋalágan, mii lea davánan muoraide. | 3.b.1.2 |
| 224. | roavku | Ráigi jieŋa čađa jávrái, maid rávdnji lea borran. | 3.b.2 |
| 225. | rodde | Garra muohta, bealle cuoŋu, luotta nalde. | 2.a (bievla – muohta) |
| 226. | rovda | Garra muohtasiivu. | 3.b.3 |
| 227. | rudneguohtun | Lea muohtabáiki gokko beassá dušše muhtun sajiid bodnái. | 4.c.1 |
| 228. | rudni | Ráigi jieŋas mii lea járvvis dahje jogas. | 3.b.2 |
| 229. | ruohtahat | Báiki gokko bohccot leat ruohttan čoahkis. | 4.b.2 |
| 230. | ruokŋa | Asahis garra bastilis sarti muohttaga nalde, mii ii leat dette eatnamis gitta. Go bivvaliid njázuda ja go bieggá ollu, de dát doalvu vaza ja de báhcá ravda mii galbmo, mii de šaddá ruokŋan (garra | 3.b.3 |

| | | | |
|------|-----------------|--|----------------------|
| | | muohtagieran). Go dalle vánddarda, de dat skoarrá hirbmadit ja doddjoda. Ruoknamuohtan lea hui bahá ahte beatnagat juolggahuvvet go sarttis leat nu bastilis asehis ravddat ahte dainna sáhtá nájdat. Dát lea dábálaččat giđdat. | |
| 231. | ruosti buolaš | Go lea buollašit go sullii -25°C. | 1.b.1 |
| 232. | ruovdecuoŋu | Hui garra muohta, measta jiekŋa, mii lea šaddan go muohtaga lea leamaš liggen ja dasto idjabuolaš garradahtán nu ahte guoddá olbmo ja bohcco. Ruovdecuoŋun lea buorre vánddadit. Giđdat. | 3.b.3 |
| 233. | ruovdešalka | Nu garra muohta mii lea šaddan go leat áibbas čoahkes guođohan dakko dahje go lea vuddjojuvvon ollu ovttahat sajis. | 2.a/4.a.1, (I + III) |
| 234. | rusta | Liegga áibmu mii galbmo. | 1.a |
| 235. | ruvaš | Galbmadálkin galbma bieggá, maŋŋil njuoskalágan dálkki. Sullásaš doaba: vaššu. | 1.b.1 + 1.b.2 |
| 236. | Ruvgalit | Bohccot mannet maŋŋálaga, maid maŋis muohttagii báhcá ruvggastat. | 4.d |
| 237. | ruvggastat | Muohttagis luodda, gokko bohccot leat vázzán ovttaid mielde maŋŋálaga. | 4.b.2 |
| 238. | ruvggastat | Luodda muohttagis gokko eallu dahje čora lea ruvgalan. | 4.b.2 |
| 239. | sabádat | Lossa sabetsiivu buollašin, earenoamážit maŋŋil go buollašta maŋŋel go lea vaza bidjan. | 1. b.1, (IV) |
| 240. | sabetjođádat | Siivu go sabet johtá bures muohttagis. | 4.b.2 |
| 241. | salgat | Dilli go jiekŋa suddá dahje go ráhput eret jieŋa. | 3. b.1, proseassa |
| 242. | salggas | Mas ii leat jiekŋa. | 3. b.1 |
| 243. | saŋas | Goike, dipmá, luovos muohta. | 2.a |
| 244. | sarti | Muohta mii lea jikŋon eatnamii. Go njuoska dálki, bealle šlahti galbmo, sáhtá sarti šaddat skilžin (jiekŋašlubbun) | 3.b.1.1 |
| 245. | sartut | Go njuoska muohta galbmo. | 3.b.1.1, proseassa |
| 246. | savda | Hui fiinna arvi. | 1.b.3 |
| 247. | seakka (muohta) | Go ii leat nu ollu muohta, go ii báljo leat muohta. | 2.b.3 |

| | | | |
|------|----------------|--|----------------------------|
| 248. | seaknjut | Go muohta seaknju, de rievdada/seaknjuda eará muohttaga, omd. bodneskárta, geartni, gerddiid seanjážin. | 2.a/1.b.1+2. b.3/ 2.b.3 |
| 249. | sealas | Dilli go ii leat ritni muorain dálvet. | 3.b.2.2 |
| 250. | sealli | Ritni gahččan eret manjel go lea leamaš rinádat. | 3.b.2.2 |
| 251. | seanjašguohtun | Nu luotkku muohta, mas lea eanas seanjáš, maid sáhtá dušše čugget čađa ja dat manná hui geahppasit čađa. Dalle lea albma buorre guohtun. | 4.c.1 |
| 252. | seanjáš | Lea roavvalágan gordnemuohta, mii lea botnis, eatnama lagamusas, eará muohtagerddiid ja gertniid vuolde (boares muohta odđa muohttaga vuolde). Dát lea hui dipmá, smievre muohta mii jođánit mollána. Go dakkár muohta lea, de ii báljo čiegarduva ge vel. Dalle lea hui geahpas bohccui goaivut dahje ráhput ja nu lea hui buorre guohtun. Dákkár muohttagis lea ollu čáhci go dan suddada, ja dat suddá hui jođánit. Dálvet go buollašat leat veahá leamašan muhtin áiggi, de seaknju. Buollašat seaknjudit, muhto gidđat fas biekkat seaknjudit. Danne go ii leat veaháge gitta eatnamis, de lea dan geahpas lihkahallat. | 2.b.2/2.b.4 |
| 253. | sievlla | Njuoska muohta, muohtagierragis gitta eatnamii, mii lea nu dimis ahte manná njuolga čađa. Galgá leat oalle guhka leamašan njáhu, čađa liggen muohttaga, bivaldan ovdal šaddan sievllan. Gidđadálvvi/gidđat. Dalle lea heitot siivu ja lossat vánddardit, go sáhtá mannat gitta vulos eatnamii ja maid darvánit. | 2.b.1, (III) |
| 254. | sievlladat | Dilli go lea sievlla. | 2.b.1 (III) |
| 255. | siivu | muohtadilli nu ahte goastá lihkadit nu ahte seastá energiija ja nu ahte ii vaháguva. muohtadilli nu ahte sabet dahje mielggas johtá. | 4.d (III) |
| 256. | silkeoppas | Muohtabáiki gokko eai leat ovttage ealli luottat. Dát lea luotkku muohta, mii lea nu geahpas ahte dan ii leat eará go savdnjilit eret. Dát lea buoret go čavdeoppas. | 4.c.2 |
| 257. | sitkat | Muohttit finna vaza dahje njuoska muohttaga. | 1.b.3, proseassa |
| 258. | Sitkes muohta | Deaškes muohta. | |

| | | | |
|------|--------------|--|-----------------------|
| 259. | sittardit | Fiidnát guoldduštit, njeađgat. | 1.b.3, proseassa |
| 260. | skábmačiegar | Čiegar mii lea skábman čiegarduvvan. | 4.c.3 |
| 261. | skálvi | Stuora, alla garra muohtačoakkáldagat. | 2.b.2 |
| 262. | Skálvvas | Dilli go leat ollu skálvvit. | |
| 263. | skárta | Jiekŋa, mii lea galbmon gitta bodnái eatnamii gitta. Čakčat; vuosttaš muohta mii lea suddan ja de galbmo ja šaddan jiekŋan. Dát váikkuha guohtumii go jeagil lea jikŋon muohttaga vuolde. Dat dahká maiddái ahte eallu sáhhtá ruvggahallat. Sullásaš doaba: bodneskárta. | 3.b.3/2.b.4 |
| 264. | skártabodni | Asehis jiekŋa eatnamis muohttaga vuolde. | 3.b.3/2.b.4 |
| 265. | skáva | Asahis jiekŋageardi, mii lea veahá galbmon muohttagis bajil. Ferte leat njáhcu leamašan ovdal skáva šaddá. Dat šaddá go beaivet garra beaivvádat suddada muohttaga veahá ja veigái fas čoasku ja galbmo. Skáva lea cuokŋo álgu. Dát lea gidđat, muhto sáhhtá maiddái leat skábman. Jus dalle skávvu, de billista guohtuma. Dát váikkuha vánddardeapmái go dalle sabet govddida ja johtá; šaddá sabetjođádat. Sullásaš doaba: skávvi. | 3.b.3/2.b.4 |
| 266. | skávvi | Asehis jiekŋa muohtagierragis go lea šaddame cuoŋu. Sullásaš doaba: skáva. | 3.b.3 |
| 267. | skávvtut | Go beaivet garra beaivvádat suddada muohttaga veahá ja veigái fas čoasku nu ahte giera galbmá. | 3.b.3 (III) |
| 268. | skerdnjiidit | Máhku, čázis, mii lea muohta maid lea suddadan bádis dolas. | 4.d, proseassa |
| 269. | skilži | Jieŋat mat leat darvánan biktasiidda, vuovttaide. | 3.b.1.2 |
| 270. | skilžut | Jieŋat darvánit biktasiidda, vuovttaide. | 3.b.1.2, proseassa |
| 271. | skoabádat | Muohtadilli go gullo go boazu vázzá galbmon muohtagierraga nalde. | 2 (III) |
| 272. | skoalddas | Dilli go ii gávdno ii mihkkege muohtagiid, ja mii lea ovddabealde veađđama. Sullásaš doaba: veađahat. | 2.b.1/2.a |
| 273. | skoarádat | Jietna mii gullo go boazu vázzá. | 4.d |
| 274. | skoavdái | Go muohtageardi vuomis ja ábiin lea asehaš. Sullásaš doaba: spoatnái, muhto dat lea viidát. | 2.b.2 |

| | | | |
|------|-----------------|--|------------------------------|
| 275. | skoavddas | Dilli go lea unnan muohta, mii lea asehaš ja garas. | 2.b.2 |
| 276. | skoavdealát | Go lea ealát bieggagaikkohatskovddiin. | 4.c.1 |
| 277. | skoavde-guohtun | Dušše dakko guohtun gokko muohta lea aseheamos. | 4.c.1 |
| 278. | skoavdi | Asehis muohta, mii ii leat eatnamis gitta. Go lea unnán muohta ja bivvalis beaivvádatbiegga, de loktana muohta ja šaddá skoavdin. Dát lea gidđadálvve, duottareatnamis, vuomis, ábiin. Dadjanvuohki: Dál dat gal lea skovdon, go diesa goalgnjá ealu, de dat gal guođusta. Go skoavdi lea, de lea buorre guohtun. | 2.b.2 |
| 279. | smievrris | Muohta dahje jiekŋa galbmo garrasit (lea garas). | 2 |
| 280. | soavli | Muohtačáhci (čáhci ja muohta seahkalaga), mii lea suddan maŋŋil go leat leamašan nu bivvalat ahte muohttaga vuolde lea čáhcin šaddan. Dát čuohcá vánddardeapmái, go dasa ii ábut mannat go dat sáhttá leat vaikko man čieŋal bajil, dat sáhtte guokte goartila soavli doppe muohttaga vuolde. Go muohta lea álgán suddat ja dat suddagoahtá vuolil, de dan ii oinne. | 2.b.1 |
| 281. | sotnat | Muohta unnu, suddá dahje buolaš deaddá dan oktii. | 2.a, (bievla-muohta) process |
| 282. | spomas | Unnán dahje seakka luotkku muohta eatnamis dahje jieŋa nalde. Muohta lea dan mađe garran ahte bures goastá, muhto ii leat nu garas go čearga. | 2.b.2 |
| 283. | spatna | Asehis, galbma, garralágan muohta, dego ruokŋamuohta bajil. Dalle ii leat nu olu muohta. Dalle lea geahpas mannat. Dadjanvuohki: dat lea hui spatna, dál nu mannet dat bohccot, muhto olbmo dette ii guotte. | 2.b.2 |
| 284. | spulži | Jiekŋa muorain, diŋggain, gápmagiin. | 3.b.1.3 |
| 285. | spulžut | Go muorat, diŋggat, gápmagat jikŋot. | 3.b.1.3 proseassa |
| 286. | suddat | Muohta dahje jiekŋa rievda čáhcin. | 1,a proseassa |
| 287. | suddi | Go jávrris lea jiekŋa ja dakko gokko jieŋas lea ráigi. | 3.b.2. |

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|------|----------------|--|----------------------|
| 288. | sudđu | Liegga áibmu boahdá vuolihaga, eatnamis. | 1, proseassa |
| 289. | suolo-oppas | Oppasdielkkut, mat leat čiehkariid siste, sulástahttojit suolun. | 4.c.2 |
| 290. | suossa | Go čáhci galbmogoahdá jieknjan. Dássi ovdal go gavdo. | 3.b.2 |
| 291. | suossat | Jieknugoahhtit, ovdal go gavdo | 3.b.2, proseassa |
| 292. | suovdnji | Roggi muohttagis gitta eatnan rádjái maid boazu lea roggan go guohtu (guođohagat). Dadjanvuohki: Go suovdnji lea liekkas, de lea boazu dakko easka guhton ja goivon, ja mii mearkkaša ahte muohta ii leat garran dakko. Suovnnji doallat likkásin (doallat rabasin), go suovnnis jorret bohccot ja guhtot. Geahča čilgehusa “muohta ii leat galmmas”. | 4.c.1 |
| 293. | supmudálki | Go áibmu lea suohkat ja go ii oainne nu bures. | 1.a |
| 294. | suttadat | Dálkedilli mii suddada muohttaga | |
| 295. | suttis | Go leat suttit danne go ii leat ollásit jieknon, suttésája. | 3.b.2 |
| 296. | suvvi | Njuoska muohta. | 2.a.2 |
| 297. | šalka | Lea hui garra, rušša muohta, mii lea lihkahallon nu ahte lea galbmon ja garran eatnami gitta. Šaddá báikkis gokko lea eallu leamašan, gokko leat guođohan ovttaht dolddiid nalde nu ahte dat lea šalkaluvvan. Lea buorre vuodjit šalkka mielde, muhto čuoigat gal ii leat nu fávdnat go lea bahá doadjit sabeiid, čuoggasit dohko. | 2.a/4.a.1, (I + III) |
| 298. | šlahttá | Go borgá dahje muohtá njuoska muohttaga. | 1.b.3, proseassa |
| 299. | šlahtti | Hui njuoska muohtti muohta, measta arvi. | 1.b.3 |
| 300. | šlanzi | Njuoska muohta dahje njuoska dálki. | 2.a.2 |
| 301. | šolggiidit | Go soavlugoahdá, muohta suddá go lea hui goarddát. | 1. b.1, proseassa |
| 302. | šuoimir muohta | Rušša, roavvasit muohta. | 3.b.3 |
| 303. | uđas | Muohtauđas. Muohta mii lea luovvnan várregilggas ja fierran vulosguvlui. Sullásaš doaba: (muohta) rihttu. | 2.a |
| 304. | ulahat | Báikki gokko illá vuohttá, go leat meastta áibbas | 4.b.2 |

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| | | jávkkodan luottat go leat borgon ja njeđgon. «ulahagas vuohttit». | |
| 305. | ulahit | Vuohttit luottaid mat eai báljo šat dovdo. | 4.b.2, proseassa |
| 306. | vahca | Varas muohta, easkkabáliid muohtán. Vahcan vuohtta gosa boazu lea mannan. Vahca sáhtta dipmadit garra muohttaga. Boazu lea jálut vuolgit doarrás go lea vahca. | 2.b.2 |
| 307. | varas čiegar | Čiegar mii lea dakko gokko aitto lea čiegarduvvon. | 4.c.3 |
| 308. | varas fieski | Fieski mii lea aitto šaddan. | 4.b.1 |
| 309. | varas muohta | Vahca, dahje muohta mii aitto lea gahččan. Lea seammá go vahca. | 2.a |
| 310. | vaššu | Galbma bieggá dálvet. Sullásaš doaba: ruvaš. | 1.a |
| 311. | vazadat | Dilli go lea varas muohta, aitto lea borgon. Vazadahkan lea lossat vánddardit. | |
| 312. | veadahat | Báiki gokko lea unnán ja seakka muohta dahje muohta ii bisán, gokko veaddá, gokko bieggá doalvu muohttaga dađistaga. Báikkit gokko sáhtta veaddan leat dábálaččat vađat, jalggat, duoddarat, stuora jeakkit. Veadahat lea dakkár mas lea hirmat buorre guohtun ja hui buorre ealát. Sullásaš doaba: bieggagaikkohat. | 2.a |
| 313. | veadđat | Doalvut dahje bossut eret muohttaga dađistaga nu ahte ii leat šat muohta dakko. Dadjanvuohki: Dat lea veaddan; veadaí lávu birra; viesu birra veadaí buot muohttaga. | 1.b.2, proseassa |
| 314. | veattáhat | Báiki gokko leat bohcco/hearggi veaddán lávžžis gitta ja gokko muohta lea garragohtán. Gokko leat veattahagat, dakko ii sáhte šat čatnat hearggi. | 4.d |
| 315. | vuohtádat | Muohtadilli dakkár ahte muohttagis vuohtta luottaid ja sáhtta árvvoštallat makkár luottat leat ja goas dat leat šaddan. | 2.b.2 (V) |
| 316. | vuohttalit | Ohcat luottaid, časkilit, časkkahallat. | 4.b, proseassa |
| 317. | vuohttit | Oaidnit luottaid muohttagis. | 4.b, proseassa |
| 318. | vuojáhat | Muohttagis luottat, mat leat báhán dakko gokko leat ealu vuojehan. | 4.b.2 |

Miaddus/Appendix 2: informántalistu/Informantlist

| Informánttat anonymifiserejuvvon nummariin/ Informants anonymifisert and presented with a number | Sohkabealli/ Gender | Ahki/ Age | Guovlu gos lea eret/ The area informant is from |
|---|------------------------|--------------|--|
| c1 | d/M | 77 | O/W |
| c2 | d/M | 63 | M/M |
| c3 | d/M | 68 | M/M |
| c4 | n/F | 74 | M/M |
| c5 | n/F | 87 | M/M |
| c6 | d/M | 59 | M/M |
| c7 | d/M | 60 | M/M |
| c8 | n/F | 63 | M/M |
| c9 | n/F | 75 | M/M |
| c10 | n/F | 80 | O/W |
| c11 | n/F | 66 | O/W |
| c12 | d/M | 77 | N/E |
| c13 | d/M | 77 | N/E |
| c14 | n/F | 69 | N/E |
| c15 | d/M | 82 | N/E |
| c16 | d/M | 84 | N/E |
| c17 | d/M | 80 | O/W |
| c18 | d/M | 77 | O/W |
| c19 | n/F | 76 | M/M |
| c20 | n/F | 71 | M/M |
| c21 | n/F | 72 | O/W |
| c22 | n/F | 70 | M/M |
| c23 | d/M | 70 | N/E |
| c24 | d/M | 63 | M/M |
| c25 | d/M | 79 | M/M |
| c26 | n/F | 70 | M/M |
| c27 | d/M | 88 | N/E |
| c28 | d/M | 68 | O/W |
| c29-† | d/M | 80 | O/W |
| c30-† | n/F | 78 | M/M |
| c31 | n/F | 73 | M/M |
| c32 | n/F | 76 | M/M |
| c33 | d/M | 57 | N/E |
| c34 | n/F | 72 | M/M |

GENDER: n= nissonolmmoš/f= feamale, d= dievdoolmmoš/m= male; Guovlu/Area:
n=Nuortajohtolat/E=East zone, G=guovdajohtolat/ M=midle zone, o=oarjejohtolat/W=West
zone, † = jápmán/past

Miellidus/Appendix 3:

Dán barggu sámegeiela-engelastgeiela tearbmalistu/ List of Sámi-English terms used in this work

| Sámegeiella | English |
|--|---|
| 10-jagit, logi-jagit | decades |
| analysa, analiisa | analyse |
| artihkkal | volum |
| attaldat, gálggat | skills |
| autonoma | autonomous |
| áigeráiddu dutkan | time series study |
| áigodat | period |
| áimbui guoski | aerial |
| álggahii/álggaheaddji | initiative |
| álgobohtosat | early result |
| áarktalašguovllut | arctic |
| ávkástallan | exploitation |
| badjedoaaba | superordinateconcept |
| bargoneavvu, veahkkeneavvu, reaidu | tool |
| báikkegodde-vuđot goziheapmi | community-based monitoring |
| beaivválaš | real time |
| beaivválaš muohtagiera- ja áibmotemperatuvrrat | daily surface and air temperatures |
| bieggadeaddoerohusat | air pressure difference |
| biomággabealátvuohta | biodiversity |
| birravuodjinluottat | driving circle |
| boazodoalloguovlu | reindeer herding area |
| siiddaisidat-eamidat | reindeer managers |
| boazodoallu | reindeer herding, reindeer husbandry |
| boazodoalu fágagiella | specialist language of reindeer husbandry |
| boazonjenetsa | nenets in reindeer herding |
| boazovázzit | herders |
| bohccit | pipelines |
| buktitovdan | addressing |
| ceavzil, ceavzilis boazodoallu | sustainable |
| chukotka | chukotka |
| čadahit | carry out |
| čakčadálvi, skábma | late spring |
| čálekeahates njuolggadusat | rule of thumb |
| čilgehus | application |
| čilget | provide |
| čoahkit | set |
| datačoakkaldat | dataset |
| davvi atlántalaš osillašuvnnas | north atlantic oscillation (nao) |
| dálkkádatrivdan | climate change |
| dálveguohtuneanan | winter pasture area |
| dárbbut | requirement |
| dáta | data |
| deaddu | pressure |

| | |
|---|--|
| definišuvdna | definition |
| diedalaš, dieđa | scientific |
| diehtjuohkin | information integration system |
| dinga | fabrics (tøya) |
| diversitehta, máŋggatbealátvuolta | diversity |
| doaba | concept |
| doaba:doahpaga | concept |
| doabaskovvi | concept diagram |
| doabavuogádat | concept system |
| doahpaga dovdomearka | characteristic |
| doahpagasisdoallu | intention |
| doahpagaviidodat | extention |
| dovodmearkačoahkit | set of characteristic |
| dramáhtalaš | dramatic |
| ealát | pasture |
| EALÁT – dutkan, -goziheapmi, -diehtjuohkin, ja -almmuheapmi | EALÁT- research, -monitoring, -information, -outreach: |
| eamiálbmot | indigenous people |
| eanan-gokčon | land-cover |
| earuheaddjedovdomearkkat | delimiting characteristics |
| fágagiella | specialist language |
| fágaid gaskkasaš | interdisiplinary |
| fágaidrásttideaddji | interdiciplinary |
| fámudahttit | empower |
| fievrrideapmi | transmission |
| fuolastuvvan | concern |
| fuomášupmi, bohtosat | findings |
| fysihkalaš | physical |
| galbmin, buolaštit, čoaskkidit | freezing |
| gaska- (temperatuvra) | mean (temperature) |
| gaskamearri | average |
| gaskavuolta | relationship |
| gaskavuolta, oktavuolta | relation |
| gaskusteapmi (formidling) | dissemination |
| gaskkustit | information |
| gáiddusmihtideapmi | remote sensing |
| gáldu | inventory |
| gándin | inventory |
| geardi | layer |
| geavahanvuogiatvuolta | usufruct |
| giddageasi | late fall |
| golgi čáhci | liquid water |
| govus (gov.) | figure |
| gozihanvuogádat | monitoring system |
| goziheapmi | monitoring |
| gráfalaš čájeheapmi | graphic display |
| guhkesáigge guorahallan | time serie study |
| guhkit áigge | time series |
| guodoanbeaivegirji | herding diary |
| guodoheapmi | reindeer herding |
| guohtoneatnamat | pasture area |

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| guohtuneananmat | grazing area |
| guorahallan, árvoštallan? | assessment |
| guorahallan, dutkan | study |
| guovlu | okrug |
| gustot, relaterejuvvot | relate |
| heitot | adverse |
| heitot (guohtuma birra) | bad (about guohtun) |
| heitot, heajos | bad |
| heivehannávccat | adaptive capacity |
| heivehanresponsat | adaptive response |
| heivehanstrategiijat | adapting strategies |
| dárkilis govat | high resolution imagery |
| iešvuohta | feature |
| iešvuohta | properties |
| industriija ovdáneapmi | industrial development |
| jagiáiggit | season |
| jahkásaš | annual |
| jakutiija | yakutsk |
| jamála | yamal |
| johtolat | grazing zone |
| johttit | traverse |
| kalibrašuvdna | calibration |
| karakteristalaš | characteristic |
| klassifiserejuvvon | classified |
| kodifikašuvdna | codification |
| kompleaksa | complex |
| koordineren | coordination |
| kultuvrarastideaddji | intercultural |
| lássejuvvon guohtumat | “lock out” |
| lihcadeapmi | mobility |
| luonddudieda | natural scientific |
| luondduroasut | extreme weather events (natural hazards) |
| manuskriptahámis | in prep. |
| máŋggabealát | multitude |
| mearkkašupmi | meaning sense |
| mearkkašupmi | sense, meaning, influence |
| mearridit | determining |
| mihtilmas dovdomearka , dovddaldat | characteristics |
| mihtimas | typical |
| modealla | model |
| molsašuvvat, varieret | vary |
| molssašeaddji, molssašuddi | varied |
| molssašuddi, molssašuvvon | variability |
| molssašupmi | variation |
| muohtá/arvá | precipitation |
| muohttaga fysihkkastruktuvra | texture |
| muosehuvvon | disrupted |
| nišša | niche |
| njenetsa | nenets |
| nuppástuhttin | transformation |
| Nuppástuvvan, metamorfosa | metamorphose/metamorphism |

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|---|----------------------------------|
| oaidninvuogit | incidence angles |
| oarjjabealli, guovdajohtolat, nuorttabealli | zone |
| oassin | embodied in |
| observašuvnnat | observations |
| odđasit buvttaduvvon | reproduced |
| oktasašdoaba, árgabeaivválaš giela doaba | general concept |
| oktavuođas/konteakta | context |
| oktiigeassu, abstrákta | abstract |
| olmmoš-ekovuogádat čanastat | coupled human-ecological system |
| oppalaš geahčastat | overview |
| orru čájeheame, mearkašit, geažidit | indicate |
| paramehtar | parameter |
| pilohtaprošeakta | pilot project |
| polygonat | polygoner |
| portála | portal |
| radar analysa | radar backscatter |
| raššivuohta | vulnerability |
| resilieansa, dávggasvuohta | resilience |
| rievdameahtun | constant |
| rievdan | change |
| ruohtas | root |
| sadji, báiki | space |
| sáddejuvvon sisa | submitted |
| senariija | scenaria |
| siida | herding group |
| siida vuđot goziheapmi | siida based monitoring |
| sulaid meroštallan-čoakkáldagat | fuzzy set |
| sulaid meroštallan ipmárdus | fuzzy logic |
| suonjardeapmi | backscatter |
| tearbma | term |
| temperatuvra njiedjá ----loktana | temperature decrease increase |
| termokrona | thermocrone |
| thermokronat | thermokrons |
| tilgang - beassanvejolašvuohta | access |
| topografijja, duovdagat | topography |
| treanda | trend |
| tue duottar | tussock tundra |
| tussock rássi, tussock duottar | tussock, tussock tundra |
| valdobealit | key aspect |
| validašuvdna | validation |
| variátehta/variášuvdna, molsašupmi | variety |
| veahkkeneavvu, gaskaoapmi | means |
| voluma | volume |
| vuodđu | base |
| vuogádat | system |
| vuolledoaba | subordinateconcept |
| vuollegis/heajos čuovga | low illumination |

