

# Skálanes

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# Skálanes

Nature and Heritage Centre, East Iceland

## Abstract

This study focuses on Skálanes, an independent field centre and conservation site in East Iceland, as a case study set within a framework of successful modern eco-pragmatic sustainability transitions. It addresses complex environmental problems and the realities of applied research in a transdisciplinary action research context through the lens of a retroactively framed living lab. Using pragmatism as the underlying philosophy, and autoethnography as the key methodological framework, the study examines the three classic sustainability pillars of environment, economy, and society and provides the following outputs of: (1) a locally calibrated environmentally focused food consumption system at Skálanes, (2) a modernistic conservation policy in the Anthropocene and a philosophical conservation manifesto applicable for Skálanes and Iceland (3). It also includes (4) a founding director's narrative with analysis and reflections on the process of evolution of small-scale rural independent conservation niche enterprise. The results of the study are ambiguous, complex, and unorthodox, which is not surprising given that environmental and sustainability concerns seldom have simple solutions. Its conclusions encourage moderation, cooperation, and dialogue and proposes transdisciplinary approaches with optimistic pragmatism as a guiding philosophy. The study's relevance lies in the fact that very few living labs worldwide have had funding or operation for such a long time-span as Skálanes, making its story and impact relevant to sustainability research in the 21st Century.

## Copyright and Disclaimer

No portion of the work referred to in the thesis has been submitted in support of an application for another degree or qualification of this or any other university or other institute of learning.

## **Dedication and acknowledgments**

In the completion of this PhD thesis, I extend my deepest gratitude and love to my wife Rannveig Þórhallsdóttir and children: Kolbeinn Þór Nökkvason, Grímur Ólafsson and Sigrún Ólafsdóttir, whose immense support and understanding through this extensive research and their unintended and often unfair contribution in the evolution of my workplace is deeply and heartfully acknowledged. They have been my greatest motivation. As I delved into the evolution of my workplace for this study, their sacrifices and understanding have profoundly shaped both the process and outcome of my research. This thesis and the existence of Skálanes as an achievement is as much theirs as it is mine.

# 1. Introduction and Methodology

*“What a precious auxiliary imagination is to scientific thinking”.*

Kropotkin (1885). p,12

## 1.1 Autoethnographic Prologue

*The landscape is stark in the afternoon light with the signature crisp clear quality of a late September Icelandic autumn. The visual effect of the season is augmented due to a spell of a few calm and cold sunny days at 65.3N. A short respite before the winter's darkness and harsh weather. I am walking on a path which by then was already in place. Created by vehicle use and footpath erosion attributed to the people living there previously and guests frequenting this beautiful place called Skálanes. Cresting a low contoured hill, the cliffs come into full view. Gargantuan 6 km long slabs of horizontal basalt layers rising from the sea to a height of 640 metres. The North Atlantic Ocean hitting them bluntly with resonating crashes. Underneath the sea's surface, rich fishing banks which have been used for a millennium by local fishermen.*

*As far back as documentation exists, coupled with oral lore, this is a landscape laced with narrative, folktales, and history. Within it, human culture and its footprints are deeply embedded. During the summer, thousands of birds nest on the exposed vertical side cut of the magma chamber which solidified subterraneously, later split by lava intrusions into seven vertical segments which are locally known in Icelandic as Jötnarnir, “The Giants”. The cliffs are a safe habitual bird nesting area, with almost immediate access to a supply of feed for the growing chicks from the sea below them, some summers are so rich in catch that the young fulmars surpass their parents in weight in a span of just a few weeks, before shedding and moulting prior to jumping into the rising winds meeting the high cliffs.*

*But now, in September most of the birds have left and just the permanent residential fulmars remain in complete silence, gliding close to the solitary figure standing at the cliff's edge, possibly the last human to visit their home for the next six months. The year is 2005 and I am exposed to a transformative sense of immense responsibility. A few hours prior, with my family's financial support and help we signed the papers to buy this farm called Skálanes. 1250 hectares of shoreline, meadows, heath, rivers, and mountains along with these incredible cliffs. Thousands of nesting birds are found in the area, eiders, arctic terns, puffins, snipes, and ptarmigans. Herds of reindeer, dens of arctic foxes and marine mammals of all sorts breaching the water throughout the year. I've been here numerous times before, but this time my connection to the place is different. The landscape bears all its timeless geological weight upon and fixes my being in place. I know it does not care about me nor is there any acknowledgement. Created in massive volcanic basaltic lava flows, it has been here through numerous ice ages, and it owns itself irrelevant of human paperwork and official notary. But nonetheless there is a notion from somewhere that the land tolerates my presence and that I might have something to contribute on this piece of earth for the few decades of what a human lifespan is. A feeling of assigned duty and unavoidable responsibility. The wildlife and landscape demand something ambitious and benign which should also be shared with people. That they should be welcome, to have an opportunity to visit and be inspired, or at least have a chance to appreciate the land in their personal way.*

*Shortly after, a plan was conceived. To create an independent scientific field centre based on a "homemade" conservation management model drawn from the blueprints of my BSc. thesis in geography from the University of Iceland, written 2 years earlier about national parks in Iceland, and possible alternative policies. Implementing something which I later learned would be considered a modernist approach, for a site that would eventually generate different jobs to those which existed in my community at the time.*

*And it should be nice.*

*Born in 1978, the local town to Skálanes of Seyðisfjörður is my childhood home, a safe place, an industrial fishing town, accommodating an independent adventurous childhood, lots of seasonal sports and ample time to read books in the darker months of year. Annual summer stays at my grandparent's farm in the north, a tundra, a marginal agricultural site in the conventional Western context. A place where eider down collecting, netting arctic char in the lakes, hauling driftwood and all kinds of practical work and play(work) was done with an ever-rotating group of family: aunts, uncles, cousins, and siblings. A place where a sensible age to carry a shotgun for hunting was agreed to be 12 years old. A time when seal hunting for sustenance was considered a family pastime that should be enjoyed and shared with children. Where copious amounts of plastic from the combined industrial output of the NATO and Warsaw Pact countries along with their fishing fleets was collected in a constant eco warrior operation to keep our long shoreline clean and pristine. The plastic piled up into funeral sized pyres and torched in the spirit of the eighties to the delight of both children and adults.*

*Later in life I travelled, worked, and studied abroad and within Iceland, lived for a year inside a national park in Brazil which also incorporated a big town within its boundaries, worked for the Icelandic Board of Commerce stationed in Lisboa and later as a tourist rep in the Algarve in Portugal. Have been a member of multiple local municipal boards in East Iceland, am a licensed reindeer hunting guide, did a stint as a door breaker on the local volunteer fire truck and am on call for the local SAR team. Have lived in the town of Seyðisfjörður with my family, participated in restoring multiple historic buildings in the local community and in late December 2020 when a massive landslide of approximately 75,000 cubic metres caused by the highest precipitation event ever documented in the country demolished a big section of my hometown of Seyðisfjörður. I was assigned/conscripted/hired to set up and work with a crew of around 10 people for over 6 months in a personal and valuable items retrieval from the debris fields and site restoration.*

*But since 2005, founding and working towards making Skálanes a valuable asset for students, science, nature, and my community has been my main work and professional focus.*



## 1.2 Introduction

*“We need a theory of change that is less obsessed with unicentric structural change or faith in sudden ecological driven system collapses (or some mix of both). Instead, such a theory should be more focused on the efficacy of a multiplicity of incremental changes... and provide glimpses of certain kinds of desired futures, whether or not there are an increasing number of catastrophes along the way. We need to avoid both faith in techno fixes and the faithlessness of doom and gloom.”*

(Swilling 2020, p.6)

### 1.2.1 Purpose

This thesis addresses the complexity of environmental issues and their inherent ambiguity and complexity in uniform resolution. It is presented through an account of Skálanes, a site and an organisation which is studied as an accidental living lab, working on sustainability and conservation transdisciplinary action research with the underlying philosophy of pragmatism. It focuses on organisation, sustainability, conservation, and agency within the domain of the methods presented for this study in regard using Skálanes Nature and Heritage Centre as a case study. The approach, coupled with the use of autoethnography makes it a deeply personal expression of the values of just one person's version of the processes and findings presented. An unorthodox thesis in form, methodology and output.

### 1.2.2 Structure of the Study

The thesis unfolds as an exploration of Skálanes as it was initially conceived as a structured case study on economics, food systems, energy, and conservation, but dynamically evolving into a comprehensive autoethnographic retrospective living lab analysis. The thesis evolved its focus in the progress of its work as it investigates Skálanes' growth from abandoned farmland to a thriving conservation field centre, employing transdisciplinary methodologies such as autoethnography, action research, and pragmatism. The narrative delves into the complexities of the

living lab approach, comparing it to traditional experiments and highlighting its unique contributions to addressing contemporary environmental issues. The multi-layered and interconnected processes within the study emphasize a blend of objective and subjective perspectives, providing a valuable and personal lens into the challenges, successes, and transformative journey of Skálanes as a pragmatic and sustainable initiative.

In line with the structure of the thesis and the wide range of subjects explored, each chapter commences with a comprehensive literature review relevant to the specific topic. The initial aim of this thesis was to carry out a case study of Skálanes, a 1250 ha of abandoned farmland which in 2005 was turned into an independent scientific and educational field centre in East Iceland. The plan was to write four chapters on: economics, food systems, energy, and conservation through the three baseline tiers of sustainability (social, environment, and economy). These proposed chapters were supposed to assist in an objective manner to optimise the operation of the field centre, to lessen its local and global material- and polluting- footprint and the output was expected to provide quantifiable and “proper” scientific results. The small size, location, and scope of the operation with close to complete access to almost all operational data of physical inputs and outputs made it relevant as a case study subject. Early on, the work transformed into a wider inquiry of a personal nature, based on biased assumptions made by the author in the case of the perceived importance of food consumption as an environmental mitigation effort for and by Skálanes. With the first chapter finished, optimisation of food consumption using life cycle analysis (LCA) was found to have a much lower impact in the scale of useful choices for Skálanes as the conclusions from this chapter created different results than anticipated as the early outlook of the study was thought to have a bigger impact towards decreasing the environmental footprint of Skálanes than was learned through the process. A paradox. How and why had the author’s established assumption of food's importance as a high impact environmental mitigation issue caused a subconscious bias surrounding its relevance? Was it internal belief and values or external influence by media and social interaction with students, peers, and tourists through working at Skálanes? The food chapter and its initial findings was therefore what propelled the rest of the thesis into an evolutionary process of adjustment and a revised aim for the study and for what its academic significance

could be in a different and more constructive manner as an additional and relevant, innovative, and pragmatic output.

The study thus shifted its focus to sustainability transitions in the context of the operation at Skálanes as a retrospectively studied living lab. The story of its growth from an idea to its current operational state and mission made it ideal for the new methodological and theoretical approach of autoethnography, which is a theory and methodology of research and writing where the author narrates and analyses a personal account (Ellis et al. 2011). This is applied using a transdisciplinary approach, a method of understanding and managing interconnected challenges where existing problems or issues are studied. Using multiple scientific methods, involving the engagement of practitioners to reach the goals of perceived improvements (Brandt et al. 2013). These are combined with action research, a holistic process of changing from one state or condition in real situations to another through diagnosis and action complemented by studies on the effectiveness of the work done to improve and implement positive improvements of change by combining action and academic theory (O'Brien, 1998). Throughout, this is supported by the philosophical and methodological framework of the underlying reality of pragmatism at Skálanes, advocating for an active academic practitioner to participate in improving societal issues based on their personal past and values without a single truth or value being universally applicable. Knowledge being treated as a social construct and pragmatic academic work should support real life improvements (Dewey, 1931; Morgan, 2014). See Figure 1.1, page 12 for a visual representation of the structure of the study.

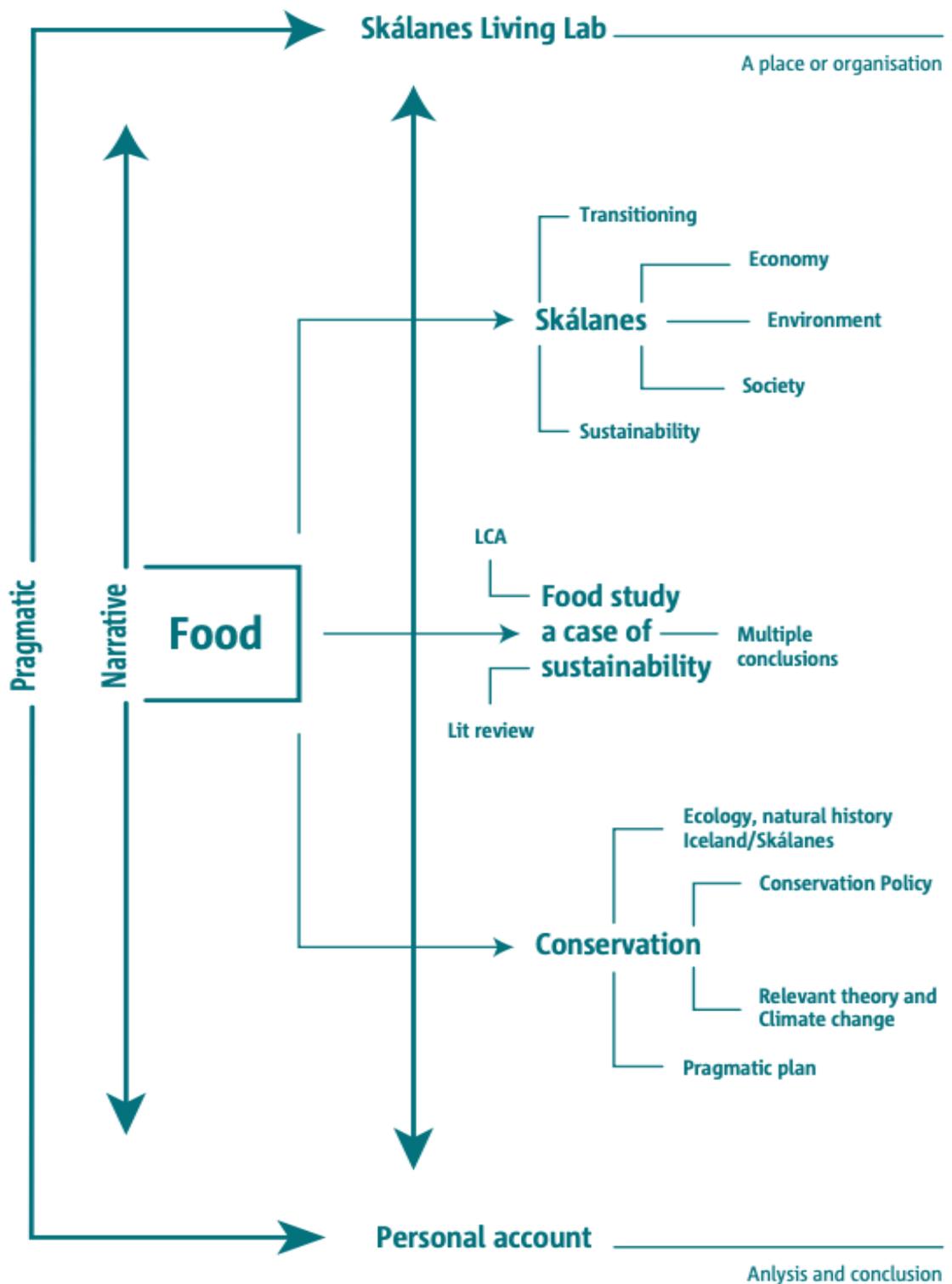


Figure 1.1. *The multi-layered and connected processes and theories applied in the structure and methods of the study. Pragmatism and the personal narrative are applied throughout the study as it addresses the separate chapters of food, conservation, Skálanes and autoethnography. It highlights how the focus on food*

*caused the subsequent change in methodologies and output on the path toward transitioning to an improvement in sustainable endeavours at Skálanes. It is important to consider that the connections and delineations between methodologies, topics and outputs of the transdisciplinary subjects are not always clear in the study, as the subjects are intentionally not organised in a linear fashion of output as they reference and support each other between chapters two, three and four in a palindromic fashion.*

Skálanes is a real world, long-term ongoing project with organisational change, development, and continuous improvement in mind as a living lab and an example of an entity that is subject to external factors which cannot be replicated in a lab experiment with a classical empirical positivist method. It was not set up as an intentional living lab during its founding but is instead being studied retrospectively through the lens of these methodologies. How does the living lab approach of Skálanes, as a real-world ongoing project, differ from traditional lab experiments and how does it contribute to addressing contemporary environmental issues, sustainability, and conservation through a transdisciplinary and collaborative framework? Living labs are usually focused on the spectrum of education, science and the ecological needs of society and nature and often based on collaboration where public, private agents, universities, and stakeholders employ transdisciplinarity while addressing gaps in knowledge or subjects. They are frameworks or examples of transitory arenas of change with collaborators, experimenting in governance where products, solutions and ways of living are tested as improvements to society and nature. They tend to cover a very wide range of subjects they focus on while sharing dynamic real-world embeddedness (Galway et al. 2022; Schapke et al. 2018; Coenen et al. 2011; McCrory et al 2020; Baran, 2019).

The belief in the usefulness of this work is grounded in the scientific theories used as methodologies as the work critically engages with contemporary environmental issues through a combination of objective and subjective approaches. I have the personal belief that problems have possible mitigating solutions, and that working on them with a mixture of knowledge, information, and getting out and getting dirty provides positive outcomes. This is reinforced and disseminated by Skálanes being a successful, real, pragmatic transdisciplinary

action initiated by myself as an agent of change for sustainability, science, and conservation. My personal connection throughout the project instigated the usefulness of autoethnography, and subsequent critical auto analysis. It shows through the study that engagement with various stakeholders and contemporary angles of inquiry are needed as many of the current environmental issues of the early 21st century are not site specific nor do they have historic analogues. Issues discussed here are global.

Simultaneously, an autoethnographic study of someone who is learning by doing, adjusting, and reacting to outside influences in a non-linear process, while observing and dealing with multiple feedbacks, systematically analysing, and narrating the diverse elements of the operation within the study's theories, methodologies, subjects, and outputs within a description of an entrepreneurial evolving conservation entity. An autoethnographic account as a director and founder of Skálanes, from the period of 2005 until 2023 examining the informed, uninformed, intentional, and unintentional cyclical processes of a living lab as per Heidkamp et al. (2021). This evolution has involved multiple internal processes and elements which did not move in tandem nor in a synchronised manner, often leapfrogging each other, moving diagonally and sometimes at odds with each other's interests. This encourages reflection on both the cycles of action and decisions made during the operation, allowing study of the experimental process, where errors were made, events interrupted, and lack of knowledge caused delays, all the while clashing with accruing successes, knowledge being gained and improvements.

Through applying autoethnography as a method through my personal journey of founding and working at running Skálanes since 2005, I utilise a combination of theories which are simultaneously normative and relativist. I create a personal, subjective narrative and analyse it through and within a study of food, sustainability, conservation, and personal and organisational agency. I identify challenges, processes and problems associated with past, current, and future evolution of Skálanes and constructive methods to deal with them. The study also narrates an important story of a place and a person with a mission of science, sustainability, and conservation. As objective nature is mute without our human subjective stories about it.

The study of Skálanes' past, present, and future operation is about real sustainable pragmatic action with tangible changes found using diverse indicators. All the while also studying the story and reasons based on my own perception, background, knowledge, and experience.

I argue that this is a valuable, unique, deeply personal, and novel case study of an organisational and personal journey in a reality of action with benign intentions and results.

### **1.2.3 Aims and Outputs**

*“Geographers investigate an unusually wide range of phenomena... although only environmental geographers try to combine them, geography offers both social-science and physical-science perspectives on nature, as well as humanities ... geographers employ more than one ‘paradigm’ or framework of analysis”.*

(Castree, 2005, p.29)

To form understanding and informed contemporary critical dialogue amongst scientists of conservation and sustainable land use, there is a need to embed it in local conservation work and case studies. Through this case study, we can investigate and address the often polarising and conflicting hegemonic approaches in academia and society to sustainability issues in the spatial context of Iceland. The scope of this work is not theoretically confined, since academic and associated ideological entrenched approaches appear to often downgrade possibilities of moderation and solutions. Used together, the theories and methodologies presented entail a study of many of the multiple scientific disciplines behind some of the “wicked problems” in modern conservation and sustainability issues. Problems which are often both coupled with quantitative values and subjective terms or ideas and thus demand multiple approaches of management and stakeholder engagement to be efficiently addressed. They are unambiguous, lack definition, and are vague as the rule more than exception, the actions taken modify these issues as opposed to “solving” them while their core problems are not unanimously agreed even upon by the stakeholders involved (Etzion et al. 2017). In this study some of these complex issues are considered in an analysis of some of the inner workings and development of an independent nature and heritage field centre from its foundation in 2005 until 2023. A small

scale rural independent conservation niche enterprise, narrated by someone who has been present there from the incubation of the idea to the present scope of operation at Skálanes.

The personal narrative used intermittently throughout the thesis is analysed and conclusions are drawn which pinpoint weaknesses, strengths, show processes, reinforce the philosophical stance taken and lastly create a manifesto for the management of Skálanes.

The significance of this study goes beyond the PhD thesis alone. The ongoing functioning of Skálanes plays a pivotal role as its outcome. This is achieved by engaging with over a hundred students and thousands of guests every year. The practical application of the study's findings takes place at a conservation site, where the research results are used to inform real-world conservation efforts, the adoption of sustainable land-use practices and dissemination thereof. The thesis thus acts as a foundational resource for the implementation and management of the site. This active engagement with the real world makes the practical operations at Skálanes potentially more impactful and pragmatic compared to the thesis on its own as an academic contribution.

The monograph's goals and outputs include the following:

1. A case study of environmentally focused food consumption systems at Skálanes, spatially calibrated, through the period of 2015-2017, with a focus on creating a model for improved environmentally sound diet by value driven choice prioritisation using life cycle analysis. Based on the consumption at Skálanes and thus relevant to Iceland and the North Atlantic.
2. The use of Skálanes as the framework of a successful case of modern eco-pragmatic transitioning in sustainability, a project based on the three classic sustainability pillars of environment, economy, and society. This work intends to encourage moderation and cooperation in dialogue in conservation in Iceland. Alongside this it will create a modern anthropogenic based conservation policy and a philosophical manifesto applicable for Skálanes and Iceland by virtue of ethical stance and conservation reasoning. It addresses conflicting and often polarising theories in conservation and their relevance within the context of the natural

history of Iceland and the issues created by ongoing climate change and anthropogenic land use changes.

3. An autoethnographic founding director's narrative, analysis, and reflections of the process of evolution of small scale rural independent conservation niche enterprise. An account of agency of someone who has been present there from incubation of evolution to the present state, framed within a story of Skálanes almost two decades in the making. Providing a unique and in-depth perspective on the establishment and development of a rural conservation initiative, adding to the academic discourse with a blend of personal expression and scholarly analysis.

4. A study on the realities of applied action research in a pragmatic transdisciplinary setting through the lens of a retrospectively framing Skálanes as a Living Lab. Offering valuable insights into the effectiveness and potential problems with this approach for conservation initiatives in rural settings. The autoethnographic reflections in the process on the site's development contribute to a broader understanding of transdisciplinary action research in real-world contexts.

#### **1.2.4 Personal Position Statement**

The writing of this thesis is based on the author's personal work, ambitions, biases, beliefs, ego, intellectual limitations, human faults, faulty memory, limited understanding of everything and data and experience collected during his work at Skálanes. It should be read with that in mind. I am also the affiliated managing founder of a private and independent enterprise called Skálanes, draw my salary from it and have financial commitments with it. I live in the nearby small community of Seyðisfjörður which is its economic and social background.

All the above objectively and subjectively affects the following work.

As it should.

## **1.3 Theoretical framework**

The philosophical background of pragmatism in this study involves selecting research methods and theories which are suited to the subjects and adapting or modifying the research plan it might need. Alongside this, autoethnography is a way of studying one's own experiences while reflecting on social, cultural, and historical contexts. The combination of these two theoretical methodologies in an approach for studying practical real-life situations is used and to analyse how individual perspectives are influenced by society while exploring personal experiences. These two theories are used throughout the study in tandem with other methodologies listed earlier but not always or necessarily all at the same time.

Skálanes is an inadvertent transdisciplinary action research-oriented living lab, founded out of assumed lack of regional data in the east of Iceland and a want for more diverse and anthropogenically influenced nature, which is inclusive of conservation work being carried out locally. Seeking to create collaboration with multiple relevant academic and business partners through its mission to improve these issues and pragmatically address the social, economic, and ecological realities of the site in rural East Iceland, including the nearby community of Seyðisfjörður. Initially acting as a conceptual project, striving towards its goal while seeking to find new combinations of solutions and knowledge, using feedback from experimentation which cannot be carried out in a formal lab setting but instead a real setting while adjusting to its mission. Through this, it combines existing and accrued knowledge through validation and in testing valuable innovative solutions in form, pattern, or practice to the overarching sustainability questions towards reaching its plan of operation (Baran, 2019).

### **1.3.1 Pragmatism**

As a rural and relatively isolated site, Skálanes has evolved from 2005 to 2023 without applying for typical academic or governmental funding coming from a policy of perceived independence. This has dictated the need to seek and apply any useful means to grow and evolve the organisation, the solutions found for

different issues we have faced have been utterly pragmatic and based on the parameters found applied in temporal, spatial, economic, and social context. I have an embedded belief in the merits of pragmatism as a method to getting things done. It is thus the philosophical foundation and framework of the thesis as a personal expression of a state of being, and in my view an important avenue for the creation of knowledge and results through action.

Pragmatism is both a philosophy and a methodology advocating for an active academic practitioner to participate in improving societal and real problems based on their personal past and values without a single truth or value being universally applicable. It assumes that knowledge is a social construct, and pragmatic academic work should support real life improvements (Dewey 1917; Dewey 1931; Morgan, 2014). It involves identifying problems to address and finding solutions to them with any combinations of all useful scientific methodologies, through that process the practitioner's values and experience might change with the results of the work being done with no or little concern for established science nor novel scientific dogma of any sort. A bridge builder for the engagement of scientists with society and nature unconcerned for any normative values in academia (Kaushik and Walsh, 2019). That the question asked, and any subsequent results matter more than a methodological paradigm, and the need for a singular approach to problem solving is rejected. A famous critique of the methodology states that using a machine gun would be a possible pragmatic approach taken to make a new opening in a wall for a new door. By virtue of pragmatism that is true, but even if something works it is not necessarily sensible as it advocates that personal experience is a vital part of pragmatism, someone used to make holes in walls would choose an appropriate method for that (Goldkuhl, 2012; Rorty, 1980).

A comparison found in Skálanes is the decision to create an international field and science centre and an independent conservation site and that funding, qualifications and facilities will be sorted out in the process. We might use a “machine gun” for solutions if that works but preferably other and better means. As stated by Morgan (2017), pragmatism is connected to action research in that acquired knowledge comes from a continuum of processes rather than a belief in the two mutually exclusivist opposites i.e., positivist and constructivist. It is a belief in research where subjectivity is the theory used in reflective in practical cycles of

engagement with the subject. Pragmatism has been criticised as a research method in terms of how to quantify its results, from being incompatible, a lack of repeatability of research and a misinterpretation of structural issues and that the results become the researchers' subjective narrative based on their worldview (Thompson, 1997; Feilzer, 2010). But as an answer, Ormerod (2006) offers that pragmatism advocates plurality as its response and that the personal, subjective and the acceptance of different perspectives or interpretations creates utilitarian outcomes including being more relevant as the normative values of scientific thinking is inherently irrelevant of any spectrum of science they originate from, if they have no personal values attached. That it is a bridge builder for integrating scientific and broader viewpoints on complex issues. This is especially true if pragmatic research provides findings which have an impact of the same constructed existing base of knowledge. Thus, pragmatism offers a platform for the exploration of those values (Ormerod, 2006).

### **1.3.2 Autoethnography**

*“If one thing characterises our time, it is the struggle over words, the power to define the world and its economy, the power to report and shape... That struggle is about deciding how the world is worded. Words create reality; owning words and the means to distribute them is crucial.”* (Magnason 2019, p.207).

Autoethnography is a method of research and writing where the author narrates and analyses a personal account (Ellis et al. 2011). In this thesis it is not the sole method, but part of a vessel for the journey being taken, applied in a hybrid manner with other methodologies and theoretical tools. This is a common approach within autoethnography. The focus is on interrogating Skálanes as an ethnographic subject through my own subjective positionality. It is a layered personal account using vignettes, cadence, epiphanies, and personal opinions of the author on Skálanes, its work, mission and manifesto as its subjects. Simultaneously lacing the thesis with quantitative data and relevant literature to topics framed in theory, human life, culture, expression, beliefs, morality, life, imagination, analysis, and presentation of findings, but through or with the researcher's voice or self as the narrative element (see McClellan, 2012 and

Spenceley, 2011 for similar approaches). Hayano (1979) emphasised that there is value to a researcher conducting and writing ethnographies of their own people, whereas in this study the step is taken further, into the self. Autoethnography is criticised for not being rigorous or analytical enough and that it degrades science to be emotional or opinionated, narcissistic garble. The counter argument is that it is meant to be disruptive of entrenched scientific methods as its subjects are often underrepresented or under threat and the output is meant to try to change the world for an improvement (Ellis et al. 2011). Thus, there is value in researching myself and Skálanes as part of a personal journey, writing a story throughout a thesis while using theory and scientific methods to help frame the inquiry, using a combination of micro analysis (the self/Skálanes) and societal or environmental macros (sustainability, agency, and conservation) (Denshire and Lee 2013).

Contextually, autoethnographies tend to reject the concept of social research as an objective, and neutral knowledge produced by scientific methods, characterised and achieved by detachment of the researcher from the researched. Autoethnography, in this regard, is *“a response to the alienating effects on both researchers and audiences of impersonal, passionless, abstract claims of truth generated by such research practices and clothed in exclusionary scientific discourse”* (Ellingson and Ellis, 2008 p. 450). I have to be as Lewin (1946) points out, ready to embrace myself and discuss my own values objectively in a spirit of appreciation of critically important issues, such as how to generate whatever changes in practice we wish to see can only be confronted by being personally immersed in the research (Coghlan, 2019).

By writing retrospectively in an evocative manner, transmitting results, selecting personal impressions and memories, I show and tell while seeking to address a wider audience than simply academia as a subject I am involved in a transformative personal cathartic process and self-critical approach. Creating a wider approach to science by analysing a personal account as a social and conscious act in research, utilising personal expressions of feelings, subjectivity and including ethical stances as being a contribution in meaningful research. Believing that the truths or facts of science are bound by the values in all research and by being transparent about that influence inherently (Ellis et al 2011).

### **1.3.3 Transdisciplinarity**

A transdisciplinary study is the understanding and managing of interconnected challenges where existing problems or issues are studied with multiple applicable scientific methods involving the engagement of practitioners to reach the goals of perceived improvements (Brandt et al. 2013). The output of transdisciplinary studies are sometimes internally calibrated for a compromise in output which conforms to the particular methods used, and the complex challenges or “wicked problems” they address. The success of a study is not necessarily dictated by a tangible goal, instead, there is a conformity of the use of academic literature, peer review and a group agreement of the criteria or indicators to be used, and the application of flexible integration of values, theories, and methods from more than one discipline (Klein, 2008). By default, often requiring methodologies and combinations which are new approaches to research (Lawrence and Despres, 2004), and often implicitly have a need for a time-consuming process to create output (Hering et al. 2012). A defined framework for transdisciplinary research does not exist, nor a common terminology in its output (Aronson, 2011) and the process can create new conceptually transcendent work where its practitioners often do not have a singular aim for a simple or clear conclusion when applied. The output, often a social construct based on the participants using mitigation and compromise in a shared decision-making process for predefined objectives based on feedback from the ongoing study/project which changes them (Klein, 2008).

In the case of this study, different disciplines are utilised for different feedback on each other whilst also an attempt is made to have them engage internally within reason with the intent of creating practical outputs. Emerging ecological changes, climate change, a personal narrative, adaptive management policy, the resource footprint of the operation and socio-economic context of its local community. All combine as a case of diverse subjects in transdisciplinary consideration of each other. To frame them together into a single “correct” approach to research and results is not the end goal as the disciplines needed are not all inclusively compatible with each other (Gibbons, 1999). Instead through the process of identifying addressable challenges, to frame the research of said challenges, generate useful output, categorise venues of real-world engagement by using simple accessible information dissemination to achieve significant

positive changes and lastly measure the impact of the whole enterprise of the study, if possible (Lang et al. 2012).

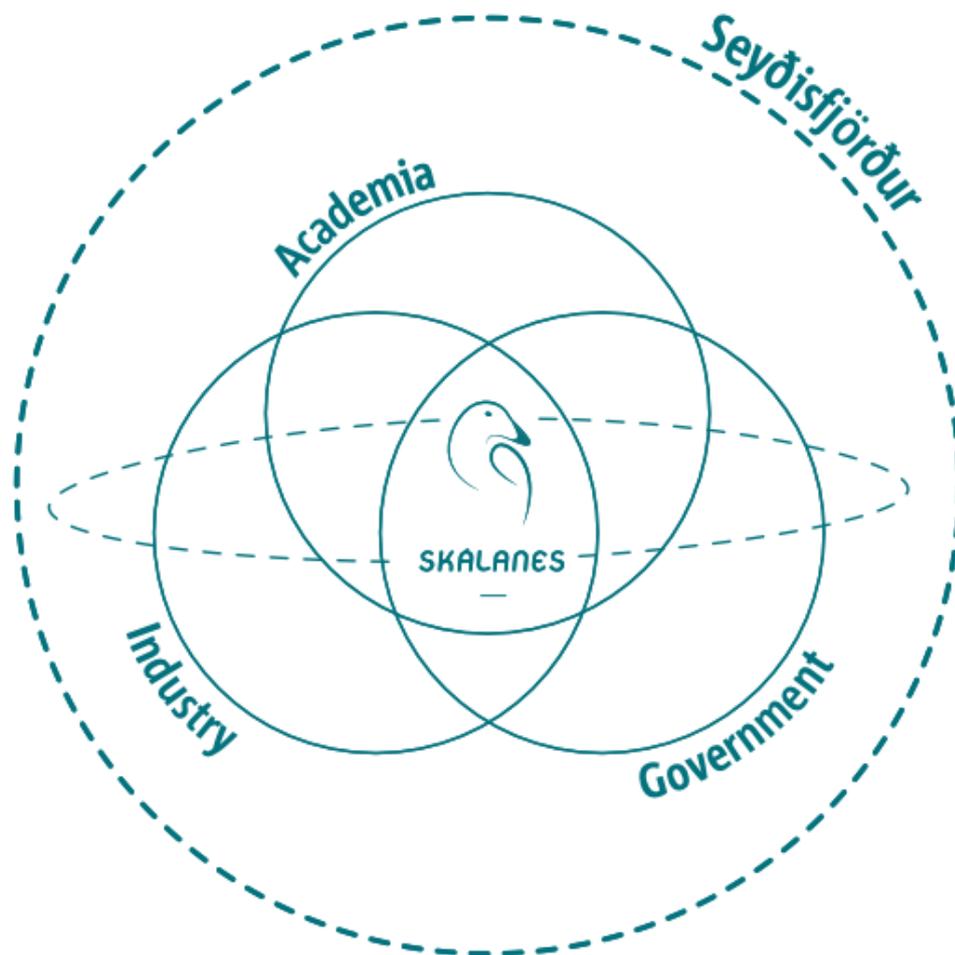


Figure 1.2. *The domains of society, economics, and nature sharing concern and influence in the local geographic setting of Skálanes which dictate its evolution. Adapted from Heidkamp et al (2021).*

Conceptual studies, which emphasise practical problem solving using reflective, personal engagement and real-world experimentation, are common within transdisciplinary theory (Brandt et al. 2013). Either as a reaction to the complexity of subjects and methods chosen or because they are outside of established scientific normative approaches including the personal subjectivity of the practitioners that apply them. As in pragmatism, the focus of transdisciplinary studies is meant to be engaging to real problems, as opposed to focusing on the impact they have in well-known outlets for academic literature. More on the engagement and outcome of the actual projects as they visualise a different

future/s (Fischer et al. 2012). Participation and collaboration with non-academic stakeholders are also often needed and welcomed as they are necessary to achieve practical improvements as a result of the study. The researcher can also become a part of their own subject beyond professional academia as it incorporates their personal subjectivity and dispositions (Rigolot, 2020 quoting Steiner, 2015). The purposes of this thesis are to integrate transdisciplinary work on the needs and inputs from society and academia with the realities in the world. This should leave academic normative paradigms behind, actively dealing with real world complexities, which cannot be replicated, in a lab setting and in the context of sustainability including the need for multiple inputs and perspectives from science, nature, society, and economics (Der Knaap, 2022).

#### **1.3.4 Action Research**

Employing action research in conjunction with pragmatism, autoethnography and transdisciplinarity to cover the multitude of subjects and temporal and spatial frames of the thesis aligns logically with the complex realities in studying the operation of Skálanes. Action research is a holistic process of changing from one state or condition in real situations to another through diagnosis and action. This is complemented by studies on the effectiveness of the work done to improve and implement positive improvements of change by combining action and academic theory (O'Brien, 1998). Creating a spiral of steps, each of which is composed of a circle of planning, data collection, action and fact finding about the results of the action (Lewin, 1946). There is not an objective criterion of what is supposed to be measured, nor standards to objectify the results nor of its success. It is an engaging approach aimed at societal improvement. Producing only academic literature as output is deemed to be insufficient and impersonal, it should be a learning cycle (Fear et al. 2006). An interventionist pro-active participation approach, if not it is not action research but to both act and create knowledge or theory about that action as it unfolds. The principles which guide action research is what makes it unique (Winter, 1989), therefore it is not a discipline but an approach to research (Coghlan, 2019; Brydon-Miller et al. 2003) with a focused emphasis on the praxis rather than theories as per Aristotle (Lather, 1986), of something that is done and not what is only studied (Avison et al. 1999).

As it addresses complex real-life situations, problems and issues facing its practitioners, its use in research is made academically relevant as its practitioners should try out their theories in real situations and real organisations, to help analyse and implement positive change (Avison et al. 1999; Brydon-Miller et al. 2003; Lewin, 1946) and they should be explicit about the nature of their research process from the beginning, including all personal biases and interests (Lewin, 1946). Avison et al. (1999) emphasise that qualitative research can explain the inner workings of organisations such as Skálanes because organisations are often fuzzy and messy as they are made up by people who work in them. The human inputs and outputs which drive their process are not data or predictable processes, differentiating from adaptive management in conservation as action research often includes a wider scope of subjects, involving for example socio-economic topics to a greater degree. The theory of action research advocates being open to changes and modifying for future actions in theory, method, and reality. On the other hand, a weakness with the method is its inherent localism, involvement, political stance of participants and lack of “results”, it does not do well with boundaries as in transdisciplinary research; thus, it is academic heresy. But it is practical, optimistic, and concerned with achieving real outcomes and aims to create desired change (Brydon-Miller et al. 2003; Susman and Evered, 1978). Applying action research for case study in conservation, site, and organisational evolution within sustainability while mitigating the anthropological impacts in nature are covered in this study, all standing independently on their own merit within academic parameters but also all being subjects of human action/research in this thesis.

### **1.3.5 Living Laboratories**

A relevant spatial application of pragmatic, autoethnographic, transdisciplinary action research on sustainability within this study are living labs. These are locations where there is work carried out on sustainability research in a real-world setting, such as Skálanes. A place where the perceived problems and solutions co-evolve in the process of working on them, often in a very messy, non-linear progress of incremental solutions, supporting its application of a study of components of the temporal development of Skálanes as an unintended living lab as per Heidkamp et al. (2021). These labs are usually focused on the spectrum of

education, science and the ecological needs of society and nature based on collaboration where public, private agents, universities, and stakeholders employ transdisciplinarity, addressing gaps in knowledge or subjects. Creating frameworks or examples of arenas of change with collaborators, experimenting on governance where products, solutions and ways of living are tested as challenges to society and nature. They tend to focus on a very wide range of subjects, while sharing dynamic real-world embeddedness (Galway et al. 2022; Schapke et al. 2018; Dekker et al. 2019; McCrory et al. 2020; Baran, 2019).

Living labs include civil/user stakeholders with participation of business, government and academia in an idealistic approach that might not necessarily meet the expectations of all collaborators to the perceived performance. It involves deconstructing a problem to evaluate it and come back with a plan for action to improve upon it as the self-evaluation process improves upon the understanding of previous collections of knowledge and its association with the social influence upon the researcher, helps to re-engage with the study subject with fresh approaches (Crotty, 1998). The perceived value in living labs is in mixing transdisciplinary subjects within a sort of tension between differing participants from sectors that have varying outlooks and needs in the process. They align all of them within a living lab project that is usually complex, contributing to creating tangible novel products, dialogues or ideas which are tested out in a real-world setting where conventional scientific practices would not be able to reproduce them (Nguyen and Marques, 2022). Galway et al. (2022) point out that there is a bias towards living labs being focused on mainland European urban settings and a lack of emphasis on rural subjects and qualitative social science/studies, giving precedence to this thesis as a Nordic rural transdisciplinary study involving natural sciences and quantitative data being a valued addition as a scientific output.

Living labs such as Skálanes are places where users, researchers, and other stakeholders create novel solutions, and services for society (Galway et al. 2022; Schapke et al. 2018; McCrory et al. 2020). They contribute to sustainability both ontologically and epistemologically. Ontologically, they embody a sustainability perspective by considering the needs of users in a context of an issue to improve upon (Schapke et al. 2018). Acknowledging that sustainability is not a universal concept, but it is spatially, temporally, economically, and culturally

applicable in context to needed improvements. Living labs encourage the participation of locals and stakeholders outside of academia to participate in addressing problems, as they can provide useful insights on how to address sustainability challenges which are of concern and addressable by them (McCrary et al. 2020). Epistemologically, living labs promote participation and collaboration to generate knowledge, aligned with the principles of sustainability (Heidkamp et al. 2021). Recognising that sustainable solutions require the engagement of a range of stakeholders with diverse knowledge and experiences to create meaningful solutions, it is relevant to keep in mind though that the culture of an organisation and its members has a lot to say about how issues and projects are viewed and addressed. Transdisciplinarity is a collaborative approach that involves different disciplines, stakeholders, and communities working together to solve complex problems (Jahn et al. 2012). Living labs apply transdisciplinarity in sustainability studies by bringing together academics, scientists, and users from different fields to create and test new products, services, and solutions in specific places (Brandt et al. 2013). A collaborative approach which integrates different perspectives, specialities, and skills while encouraging innovation which is democratic and sustainable. It is an important part of living labs, allowing for the integration of multiple perspectives for solutions that are effective and sustainable. While on the other hand pragmatism is a philosophical approach that emphasises the practical application of ideas and theories in real-life situations (Dewey, 1931; Brandt et al. 2013). Living labs embody pragmatism by providing a novel platform for testing and refining useful innovative solutions in real-life contexts. This approach allows for the evaluation and adaptation of solutions based on feedback from users, stakeholders, and the environment (Kaushik and Walsh, 2019; Leminen, 2015). By trying solutions in real-life they generate a realistic and a pragmatic approach to innovation and agency to change that is grounded in the needs of real people. Living labs connect to transdisciplinarity and pragmatism through collaboration, co-creation, and practical application in real-life contexts. Transdisciplinarity is important for diverse perspectives and knowledge, while pragmatism emphasises the importance of testing and refining ideas in real-life situations. Both contribute to living labs as platforms in the creation of more innovative collaborative, effective and sustainable solutions.

There is never a perfect solution to the issues addressed through action research and pragmatism, instead they seek to find venues of improvements. Thus, there is not a need to create overly sophisticated methods and outputs in this thesis if they are not useful. This is a sentiment shared by Susman and Evered (1978) who stress that action research is useful where positivist methodologies are not applicable. This being a transdisciplinary study of an organisational living lab utilising autoethnography, it needs to be grounded in something more than being nice, constructive and community minded as it can easily turn into “self-help book” rhetoric (Fear et al. 2006). Fear et al. (2006) conclude that a schism exists in studying organisational science between reality and academia. This stems from too much emphasis on positivist science and that action science can step in to fill in the needs of real-world issues. The author being the architect of both the user interface or public image of Skálanes and its manager, provides unique insights on its process, feedback effects and paradoxes. This access is not often or easily available to outside researchers, and allows a study of its biotic elements, ecology, applied science, agency, short- and long-term goals, finances, local community, policies and so on.

Feedbacks from actions intended to ameliorate issues can create new questions, focusing on improving situations and scenarios through implementation of actions and reflecting whilst being mindful of feedback of any sort is thus the normal modus operandi (Gilmore et al. 1986). The timeframe of some real and perceived action cycles in the operation of Skálanes can sometimes be assumed to span beyond a single human lifetime while others are almost spontaneous. Thus, there is a mix of the immediate, daily, yearly, or 5-year action cycle vs ones which have not even announced themselves spanning centuries of ecology and evolution of the organisation’s mission. Etzion et al. (2017) work on robust action in sustainability transformation focuses on leading with the notion of ambiguity and nonlinear progresses in small scale initiatives which might lead to larger scale outcomes. They mention that case studies of successful projects lead by (robust) action are relevant and important empirical subjects of research. Currently the added element of the long-term build-up of Skálanes and its growing capacity means that its work has developed, and the output and mission is becoming ever more focused on becoming an agent of transition for changes and understanding.

Lastly as David et al. (1991) point out, there are numerous books published on the subject, which might be because action researchers have a long and complicated output due to the method in question as is the case with this study. Living labs output in the general context of sustainability studies has been steadily growing. A search in Academic Search Premier for “action research” AND “sustainability” gave the following numbers of publications.

1995-2000:	3
2001-2005:	13
2006-2010:	63
2011-2015:	125
2016-2020:	204
2021-2023:	132

This shows that Skálanes, within the framework of a living lab, is amongst the pioneering sites, as they hardly existed as a discipline in 2005, the founding year of Skálanes. Also, McCrory et al. (2020) mention that a significant number of the living labs studied in their paper had funding for less than 2 years of operation. It is questionable how much useful output can be expected from such a short timeframe. The need for living labs / TARs across a longer period is expressed by Der Knaap (2022, p.490) who states *“projects normally stretch out over a longer period, often years. Furthermore, a project gets continuity in student activities together with a growing familiarity and social bonding as very important aspects in input of feedback and of ideas related to many aspects of the project and with the latest insights from academia”*.

The fact that Skálanes has grown in every aspect of collaboration, theory, and output without any substantial local governmental funding (usually applied in the context of living labs) and that it is still ongoing, coupled with its comparatively very long period of operation makes its economical set up, spatial setting and temporal scale an interesting, novel, unique study subject.

## 2. Food

### Spring

*The winter is on its last gasp. A strong warm wind is melting the snow, churning up the loose drifts on the peaks and sending them airborne in multiple snow cyclones set against the rays of the low sun. It is bathing the coastal upland mostly covered by crowberry and some low shrubs of dwarf birch, everywhere in the periphery of my vision there are fields of budding lupine, a non-native plant which has been highly successful in colonising certain niches in Iceland. It is very prominent in parts of Skálanes. Am inspecting a bouquet of broken kittiwake eggs left on a big flat stone, a sacrificial site? Most likely the raven has had a claw and a beak in the matter. The macabre expressive art of the Arctic spring, visceral manifestations of gluttony and death, everywhere in sight. The reality of all living beings in their daily struggle.*

*A display of joy and play by some of the calves from the overwintering herd of reindeer. The native angelica and introduced lupine started to sprout last Friday and the reindeer have been grazing on it for just a few hours. This first fresh feed in months filled with nutrition affects the animal's behaviour immediately for the better. In a few weeks they will start to gradually migrate vertically uphill, following the receding snowline as they feed on the fresh nutritious budding plants. By late June, a healthy hike will be required to find them in the mountains above.*

*Hundreds of terns woke us up early this morning with a cacophony of their shrieks. The annual spring and summer choral experience outside the house on the abandoned fields of the farm where they nest. By the cliffs the fulmars squabble and argue perched on the sheer terraces, fighting each other on the water's surface over food. Despite their petty confrontations the birds are flying poetry of glides, shallow dives, and bursts of powerful wingbeats.*

*This is their kingdom.*

*The day progressed with presentations on reindeers, Arctic research networking, sustainable energy transformation of the east of Iceland, drone lidar and electromagnetic sensors, sampling of microorganisms through DNA colonising pre-glacier covered land and ancient DNA extraction in archaeology. The conference ended with a participatory workshop on outdoor education. The evening socialising culminated in a sweat/sauna by the shore while diving gannets decimated a small shoal of fish close to the water's edge. A couple of seals swam alongside me as I walked alone back to the house, ever so curious of the solitary figure traversing the shoreline. Once back on the gravel car track, a forlorn single honk from a swan gliding close by. As it banks left out to sea crossing the small bay a feeling of forlorn love accompanies it, like it was calling in vain for its missing partner. Skálanes on its peak performance days is a thundering experience bordering on the ridiculous. The 24-hour day is just a few rotations away. Soon birds, whales, sunlight, reindeer, students, guests, and dear friends will meet in this ectoplasm fondue of ideas and reality. The house welcomes us and waits patiently knowing it will rest yet again come next winter.*

## 2.1 Introduction

The use of life cycle assessment (LCA) in food studies clearly demonstrates the difference between the environmental impacts of various food types (Kauppinen et al. 2010). This study's novelty lies in the context of Iceland's geography, and it being close to 100% powered by domestic renewable electricity for housing, industry, and infrastructure (Samorka, 2019). As such, many traditional ideas of energy conservation, such as energy efficient household appliances, LED light bulbs, charging of electric cars, refrigeration, cooking, central heating, and building insulation are mostly unrelated to greenhouse gases (GHG) emissions in Iceland. This means that in Iceland, whilst it may be economical and energy saving, commonly presented ideas such as turning off lights, unplugging and saving central heating are non GHG saving and only marginally related to carbon emissions.

How these parameters translate to food consumption is questioned in this chapter, emphasising energy and its overlap with the 21st Century environmental concerns focusing on a micro-food system located at Skálanes Field Centre. It covers food consumed there and provides a detailed summary of food, its inherent energy use and emissions in Icelandic and North Atlantic context. A scenario of an alternative local food production and acquisition food system is considered for a comparison to a typical store-bought western diet, continuing to a life cycle assessment of the energy used for the on-site food consumption in the years 2015-17 measured in megajoules (MJ) per kg of food types. This is used to study how different patterns of purchasing and operation of Skálanes affect annual energy use, concluding with an evaluation of the impact of food consumption as a sustainability concern for the organisation within the parameters described.

A dialogue at Skálanes about food, food production, food ethics and diet has been ongoing between resident students, researchers, and staff since the start of its operation. A variety of informal vegetable growing, wild plant harvests, hunting, fishing, and livestock trials have been carried out on site with varying success. Being responsible for the diet setup and all bulk purchases for the operation since 2005, at some point around 2014 a personal assumption formed that the diet practised by the generation of Icelanders born in the early 20th Century could be a good compromise of dietary needs or wants and

environmentally sound food purchasing. The diet in question consists of lamb, fish, bread, butter, cream and other dairy, potatoes, and turnips, mostly locally sourced. This is then added to by contemporary additions which did not exist in Iceland in the early 20th Century, including readily available domestically grown vegetables from geothermal greenhouses such as: cucumbers, peppers, tomatoes, and salads. This assumption of using an adapted Icelandic 20th Century diet was subsequently identified through literature review being supported by Carlsson-Kanyama et al. (2003 p. 307), who found that *“Diet Low (MJ) is quite energy efficient ...the food patterns of an older generation accustomed to herring, small amounts of meat and a lot of tubers”*.

When considering food consumption, it needs to be kept in mind that consumption in one place is simply a substitute for any other venue of daily human nutrition that would occur anyway. For example, if someone consumes a meal when they travel, they would still have consumed a meal somewhere else. However, the sheer volume of food provided through planning and policy of relatively few business entities catering to a huge portion of the world’s population means that the choices made at the catering level of food consumption matter (Gössling et al. 2011). As a former guest house and a student/staff kitchen, Skálanes has the same potential of diet choices, an analysis of the site's pattern of supply and consumption can provide guidelines for future improvement.

Renewable energy systems and the conversion from carbon fossil fuels to renewable energy will be instrumental in stabilising GHG levels in the atmosphere (Carlsson-Kanyama et al. 2003; IPCC, 2023). Energy options which are low GHG emitters such as wind, hydropower, solar, thermal and nuclear all exist as replacement options for the current carbon-based system to power our food systems and more (IPCC, 2021). As these sources continue to replace the current carbon reliant energy used for our food systems, the question and importance of how much MJ input a KG of any food needs becomes less relevant to the associated carbon footprint. This approach of studying for gradual practical implementations of quantifiable approaches for positive change is therefore in line with the general pragmatic action-oriented research philosophy of the thesis, as food produced and consumed within renewable energy systems has a diminished GHG emissions. Progressively understanding which food items are produced using renewable energy will become more important as opposed to focusing

mostly on their current carbon footprint. By analysing and compiling the energy used for foodstuffs consumed at Skálanes, a produce/supplier/consumer applied method is created that can contribute to improvement focused on multi-tiered efficiency. Informed decision-making can thus instigate change in food systems by mechanisms of supply and demand. Assuming the drive for renewable energy continues and eventually fossil fuels are phased out of the primary stages of food production and supply chain, there will be a completely new set of parameters to consider. As GHG emissions become negligible, many factors which are mostly omitted in studies will grow in relevance. Generally, they include culture, belief, traditions, personal preferences, defiance of authority and the intrinsic values associated with food (Garnett 2014). Additionally, only comparing the MJ or GHG of different food groups does not necessarily translate to diet as food items are priced differently, have different nutritional values, and vary in degrees of appeal to different people as a palatable meal component.

The proportion of world energy use for food is quoted as around 14-20%, with the combined effect of food production, and all other agricultural land use amounting to 14-30% of total world annual GHG emissions (Carlsson-Kanyama et al. 2003; Virtanen et al. 2011; Nemes, 2009; Clune et al 2017; Woodhouse et al. 2014). The variability in these numbers is due to different methodologies, parameters, data, and scope of these studies but they all show the relative effect of the food system in comparison to other human activities for energy and GHG. However, Weber and Matthews (2008) note that a large part of the GHG and MJ impacts of food production in LCA studies are often omitted, including emissions from soils, manure management, seasonal variations of same produce, packaging, and storage needs.

### **2.1.1 Goals and Scope**

The goal for this study is not to create a new “best” methodology, it is about producing tangible results for practical improvement regarding food consumed by all guests and staff at Skálanes as an exercise in pragmatic action research. Food consumption is the result of a process involving production, packaging, transportation, storage, retail distribution, purchasing and cooking. Every single step of this process has multiple inputs and outputs in forms of chemicals, energy,

materials, work, money, and all have environmental impacts. At Skálanes, food is consumed in disproportionately large quantities for a location of its size because it hosts students, staff, and tourist visitors through the summer months. Establishing guidelines about which food products to use and their inputs in the context of sustainability and trying to minimise negative impacts is important for reaching an improved mode of operation, and to attain increased food sustainability. This is achievable by the assumption that systematically decreasing the energy needed of consumed foods is a general improvement, and the gradual reduction in the use of high impact food items will result in a decrease in the environmental impact of the site and its operation. Using existing scientific methods and site-specific solutions to reduce the negative effects of these inputs immediately is easily attainable and a worthwhile effort.

### **Objectives**

1. To assess the local food network and produce a literature review of what food systems entail on a wider spectrum, with the intent of studying regional variables in a quantifiable and qualitative manner.
2. To produce a measure or quantification of food consumption at Skálanes from 2015-17 which can be interpreted or implemented in Iceland at any scale for a positive change, and to a degree to a larger geographical region i.e., the North Atlantic.
3. To provide the knowledge, tools and information for food consumers and producers to be able to make environmentally conscious choices.

### **2.1.2 Scalability and Application**

Ideas and information with regards to food sustainability apply differently between parts of the globe, meaning that scale and location of food production and consumption need to be considered to ensure relevancy. Spatially, the study covers a wide spectrum of scales from the micro-scale (Skálanes), of food consumed within a single kitchen, to the meso-scale (Iceland/North Atlantic), of relative calibrated differences and conditions, to the macro (Europe/world) of

applicable and main trends. For example, a fully encompassing food LCA is impossible to create as soils can release and/or bind gases at different rates depending on the time of day and there are large geographical disparities of environmental effects of growing sites of same food items, and issues surrounding the importance of transportation, quality, and nutrition persist (Edwards-Jones et al. 2008). As a result, there is a limit to the amount of detail included presented here and in all LCAs, where a study stops being useful for real world applications.

There is little peer reviewed literature available on environmental food related LCA's specific to Iceland or other North Atlantic nations. Most publications which do exist are "grey" and focus on LCA surrounding fisheries, aquaculture, livestock, dairy, and vegetables (de Vries et al. 2015). As a result, the indicators produced in this study can be used in the future as benchmarks based on practical knowledge and knowledge generated. Holman (2009) points out that the intangible benefits from sustainability indicators such as community participation, raising awareness and promoting "nature" are important but should not be the only benefits of the process. A middle ground between a technocratic and participatory solution is ideal with the addition of focusing on the actions of policy makers. He also discusses work by Keirstead and Leach (2007), who propose a sustainability indicator program to help implement policies through agencies used to working in a target driven environment - eliminating over ambitious and or ambiguous projects.

It is important to keep in mind that mitigation efforts need to be set to regional and local conditions with specific targets. This allows easy navigation of trade-offs and the ability to focus on efforts that benefit the environment and society (Poore and Nemecek, 2018). A large-scale meta-analysis study such as by Clune et al (2017), where the GHG values of a wide range of food types from all over the world are collated, would be an ideal approach for understanding the GHG emissions of Skálanes and Iceland's food system. However, Clune et al (2017) omit air transportation from their study, and their values of food related GHG emissions are based on mostly GHG emitting energy grids, which is not the case in Iceland. Thus, the scale and focus on location chosen as an approach is further reinforced, as results are meant to be specific to Skálanes and to a lesser degree in the North Atlantic.

## 2.2 Background and Literature Review

### 2.2.1 Sustainability and Food

The Brundtland Report's (Brundtland, 1987 p.41) definition of sustainable development provides a reasonable approach and a timeless set of guidelines: *"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs"*. The United Nations food and agricultural organisation (FAO) definition of food sustainability has followed the times and trends of contemporary ideologies from the original declaration in 1987 and includes a wider mandate and a disparate set of concerns. *"Sustainable diets are those diets with low environmental impacts which contribute to food and nutrition security and to healthy life for present and future generations. Sustainable diets are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair, and affordable; nutritionally adequate, safe, and healthy, while optimising natural and human resources."* (Silvenius and Bar, 2018, p. 211). But as Schöner et al. (2012, p.120) point out *"There is no such thing as a sustainable product, but products can be more sustainable through continuous improvements over time"*.

Garnett (2014) emphasises that the human values which drive the decision-making processes in addressing food system sustainability are: efficiency orientation, demand restraint, and food systems transformation. They go on to suggest in their study that the values themselves need more independent research focus for sustainability efforts to be successful. This is a concern supported by Rapley et al. (2014), who state that decision making processes are driven by people's value sets even when presented with contradicting clear scientific findings, suggesting that consumers need individually tailored messages and or solutions. This highlights the need for science to address diverging consumer world views, while simultaneously trying to reach those individual demographic segments with optimised information on the effects of their food consumption choices. They conclude that the diversity of society and the individual human psyches means that there is not a single solution nor message that fits all (Rapley et al. (2014).

There is intense interest in food systems, and both consumers and farmers must tackle disparate issues such as: fair trade, nutrition, environmental impacts and animal welfare through their choices and interaction with food. This interest and the search for better or alternative solutions has often been associated with the lack of solutions provided for consumers and farmers by the conventional worldwide agricultural industry (Winter, 2003). A common presumption regarding food systems in society is that alternative food production and distribution is inherently more sustainable simply based on its definition. However, a growing body of critical research which addresses this generalisation points out that the overall picture of alternative solutions being more sustainable is not as clear as previously thought. Conversely, some of the assumed positives of economic impacts, sustainably farmed products, labour rights, impacts on local communities are actually negative (Forssell and Lankoski, 2014; Coley et al. 2009). According to Sonnino and Marsden (2006) it is a misconception to view alternative and conventional food networks as entirely distinct from one another. Rather, there exists a variety of competing agri-food geographies that are constructed upon different sets of quality and commercial conventions, as well as varying degrees of horizontal and vertical embeddedness. As Edwards-Jones et al. (2008, p.272) state *“Natural scientists may argue that it would be almost impossible to develop a scientific dataset which would enable formal testing of the hypothesis that local food is better than global food...the large volume of data needed to enable all locality...for all relevant variables. - Social scientists may not be surprised that reductionist natural science cannot resolve the local food debate, as for many consumers the attraction of local food do not relate to the measurable differences in its embodied energy or nutrition status, but rather they relate to sense of place, trust, and experience.”*

This does not mean that the beneficial effects of alternative initiatives do not exist, only that the assumption that everything falls universally into place simply by being labelled alternative, local, organic, or fair trade etc is being questioned. It is also not a claim that conventional methods are better, or do not need critical approaches. Food systems are inherently complicated. An economical example of the complications can be seen in biodiversity certified products. Sites such as coffee plantations which base their operation on less financially viable methods depend on the premium of their produce to account for the money lost in applying

less intense practices (Heidkamp et al. 2008; Gobbi 2000). In that way, alternative food systems or labels can also change value chains and potentially redistribute work away from others, creating more expensive items which are out of reach for lower income customers and catering to the more financially secure parts of populations (Forssell and Lankoski, 2014). For example, organic farms have lower yields than conventional farms and are less profitable when compared with conventional farms in Germany. But it should also be noted that some organic farms are not simply driven by just profit and yield, but instead by issues such as reduced stress in lifestyle, perceived nutritional improvement of produce, and bio services. Thus, the goal is instead for the farm unit to produce enough income on top of these other points of focus (Nemes, 2009). To truly understand these competing pressures, the configuration of the power underlying the social, natural and economies of food systems have layers of structure and need to be investigated.

To understand sustainability, it needs to be robustly questioned. Is it really a contribution to a cause, a vision, or an intentional or unintentional entrenchment of regimes already in power narratives, no matter how benignly they are intended? If so, it means that we potentially attribute definitions and or our actions as an afterthought. As Boer et al. (2016) explain, consumers are often biased towards environmental ideals which are usually not based on data that prioritises the best choice for GHG emissions, land use, pollution, and animal welfare. A consumer may believe that consuming local food is a high impact environmental choice, whereas according to Boer et al. (2016), becoming vegetarian is seven times more effective, dwarfing the choice of consuming local food. But the choices of changing personal food consumption for environmental reasons are complicated and very much dependent on the individual's environment and social beliefs. Boer et al. (2016) show that 6-12% of the UK and Netherlands population are interested in, or think they are already practising, environmentally aware food consumption and proposes that these might be "the already converted" segments of the population.

This therefore suggests that broader communication is needed to help notify and convince the remainder of people into making informed choices about food consumption for the benefit of the environment. Reinforcing this further, Schöner et al. (2012) state that to create more sustainable products, stakeholders across the entire value chain need to be included in the discussion, with end

consumer products also kept in mind and when consumers change their buying patterns according to information presented to them the food industry reacts according to the rules of supply and demand. Thus, the message from academia and other relevant stakeholders needs to highlight the high impact choices, to better inform people's choices. Pressing the point further, Edwards-Jones et al. (2008) surveyed residents in southern England, demonstrating that most participants considered food made in the same county as their country of residence as "local produce", irrelevant of actual food miles. The results also supported the consensual notion that local food is on average; safer, purer, and more natural, while imported food lies on the opposite end of these spectrums. However, the argument for the benefits of local food consumption falls flat when the fact that every location is local for someone is considered. Consumer impressions that local produce is of higher quality and nutrition, and inherently more organic in nature than food items arriving from the "outside" has been conflated, and research has shown that this is a misconception. The ideological conundrum is that these notions are often based on localism and sympathy for local farmers (Winter, 2003). But the consumer might feel a closer association with the food they consume if there is a direct interaction with the farmer or supplier (Hinrichs, 2000). The perceived proximity or embeddedness, which is often positively related to environmental reasons, might be more closely related to social ties, and the modification of the connection people have with food. Thus local, organic food is often not better for the environment as it is often portrayed, but instead a socially constructed example of market economics or niche. Apparent embeddedness, authenticity and the traditional notions of local agriculture inherently reinforce those values, but they have come under scrutiny, with some attributing them more to defensive localism than actual sustainable agriculture (Winter, 2003), questioning the widespread assumption both in the public and within academia of the local food production being better (Hinrichs, 2000). In the past when there have been different historical periods of perceived economic crisis such as the great depression, there was still demand for fine wines, caviar, and quality spirits. This reinforces the notion that power and privilege to choose what to consume lies with the educated middle and upper class (Hinrichs, 2000). There are potentially elements of market segmentation at work, where individual preferences associated with alternative pathways of food consumption are driven

by the social identity of the consumer, which may be irrelevant if the assumed alternatives are in any way more environmentally benign.

The transportation of food products is also extremely complex to quantify, making it impossible to state as a universal rule if local produce is better or worse. But through a meta-analysis of the literature as variable spatial scales and individualistic LCA methodologies can instead be applied (e.g., Edwards-Jones et al. 2008; Carlsson-Kanyama and González, 2009; Clune et al 2017). None emphasise the impact of food transportation in their studies, considering it a minor addition to the whole sum. Others point out that the concepts of local food and food miles have become widely known, approachable ways for people to assume that local food is the solution. But when carbon emissions of food miles are included within LCA's, they demonstrate that the localisation of food production can lose its advantage due to inefficiency in production relative to more favourable sites in a location further away (Coley et al 2009). Iceland is favoured with rich fishing grounds, but a cold climate and it has implications for what it excels at (and does not) when producing food. This reinforces the conclusion that purchasing the most geographically local produce *per se* does not mean the lowest environmental impact. When the distance travelled for an individual purchase for local food exceeds a certain limit, bulk transportation becomes a better environmental method of getting products made in optimal conditions to the consumers' tables (Born and Purcell, 2006). In relation to operational food use at Skálanes, the optimisation of the choices made is dependent on location of production, the product in question and emerging transportation policies and technologies. Instead of solely focusing on the scale or location of food enterprises, and the assumption that small, somehow certified, or local is always better, the question should be: what is the impact of the overall production? As transportation and farm machinery is still predominantly GHG emitting, choosing local food does not always reach much farther than beyond simply patriotic localisms (Winter, 2003).

But in the case of Iceland there are distinct differences from other studies. Few papers or reports were found to apply conversions which were useful to Iceland, including geographical location and resultant long-distance transportation by plane or ship needed for importation, and the almost 100% renewable energy source. All these aspects would need to be researched and the findings published to make a conversion from the MJ to plausible GHG estimates for a local food

system like Skálanes. As a result of this, the size of the uncertainty in converting to GHG would be simply too large to consider as a meta-meta-analysis of meta-meta-data. But the MJ content in previous food consumption at Skálanes is a simple and valid indicator to assess the current MJ use and relative environmental impact and a useful tool to adjust quickly and in a quantifiable manner for a more sustainable approach.

### **2.2.2 Food and Greenhouse Gases**

Due to the inherent inseparable relation between energy use for food production and greenhouse gas emission it is necessary to consider the general picture in literature on this subject. Utilising metadata analysis from over 1530 studies and 139 authors, Poore and Nemecek (2018) state that the world supply chain of food is responsible for 26% of GHG emissions. Adewale et al. (2016) propose that 25% of global GHG emissions can be attributed to agriculture, forestry, and other rural land uses. Similar results have been demonstrated elsewhere, with food systems and agriculture proposed to be responsible for 19-29% of total anthropogenic GHG impacts (Sandstrom et al. 2018). All these studies clearly state that the impacts of the lowest impact animal products typically exceed those of vegetable substitutes, but Allen et al. (2018) argue that different catalytic chemical properties or the halving times of different climate greenhouse gases are not accounted properly for in the methodologies of the IPCC and thus these claims are slightly overrepresented. Allen et al. (2018) suggest that the agricultural GHG emission is less severe than previously thought, and that the accrued CO<sub>2</sub> values in IPCC methodologies do not account for methane and nitrous oxide, which are prominent short lived as compounds from meat and dairy production. But Poore and Nemecek (2018) emphasise that animal-based food production uses 83% of the world's farmlands, emits 58% of food systems GHG, while providing only 37% of the protein and 18% of calories.

Poore and Nemecek's (2018) study advocates that transitioning to more environmentally conscious diets such as vegetarian or vegan has large potential climate impacts. As such, replacing animal-based diet items with nutritionally equivalent vegetable options is the most effective way to improve the emissions associated with food consumption in the EU. A different study found that ruminants use almost 50% of the world's agricultural land FAO (2018), compared to the

previously stated 83% (Poore and Nemecek, 2018). De Vries et al. (2015) state that the global livestock sector of agriculture was responsible for 18% of GHG emissions (vs 58% in Poore and Nemecek, 2018) through combustive fuel use, deforestation, methane emission from manure and digestion of ruminants and nitrous oxide from use of fertilisers. This discrepancy in the numbers is of note, as there can sometimes be a degree of contradiction in literature on food, a subject which is addressed in the conclusion of this chapter. It is also worth emphasising that the parameters of GHG, relative land use, or nutritional breakdowns are not within the LCA MJ/kg methodology used in this study. But it is a strong indicator of where the largest improvements can be made, by moving to more vegetarian or flexitarian diets, or simply consuming less meat as a personal choice. Such a decision is an attainable environmental mitigator, especially if the redundant farmland from less livestock use would be used mostly for carbon fixing or the provision of ecosystems providing wildlife habitats.

However, to set the stage in this study and a part of its conclusions and a breakdown of our mental entrenchment of food's importance in context to GHG mitigation. The following statement is emphasised.

*“...given the substantial constraints for emission reductions in the food systems it might be cost-effective to seek even deeper cuts in other sectors”* (Hedenus et al. 2014, p. 88).

## **2.3 Iceland-Nordic Food Systems**

For the geographical study area, comparative data (and findings) are scarce, although some studies exist from Swedish, Norwegian, and Finnish literature. Supporting this notion, in a widely cited meta-analytical study on food LCA's (Clune et al. 2017), 3355 papers were identified, of which 1000 were assessed as relevant to that paper. Of these, none were from Iceland and very few from the Nordic countries. In addition, relevant Nordic literature was in their respective languages and therefore not a viable source of reference for the study. However, the Nordic countries have a common food culture and production system,

stemming from similarities in their climate, geography and history, and the fact that they all adhere to the same EU regulations applicable to food. As with anywhere, in the Nordic countries the topography, climate, soil etc dictate what can be grown locally, and the subsequent environmental impacts of the food production system. Growing food sustainably and reliably relies on these conditions (Silvenius and Bar, 2018). As farming is dependent on local conditions it utilises animal and plant stock which are acclimatised to the conditions. This requires lower energy inputs for the output and is generally a better approach for the sake of the environmental impact (Silvenius and Bar, 2018). That stated, in Iceland as in other places, technological innovations and associated new venues of resource utilisation can alter this dramatically. For example, hi-tech automated geothermal greenhouses and massive aquaculture projects are a reconfiguration of existing infrastructure, with the addition of new technological processes, allowing for new novel methods or increased production which are less dependent on earlier production parameters.

Iceland's national culinary culture and history is rooted in its geographic location as an island in the North Atlantic, isolated from interaction and commerce during the early to late Middle Ages to mainland Europe (Júliusson, 2018). Food scarcity and deadly famines were common, and the local populace at times depended heavily on hunting and gathering activities from whatever sources where available (Júliusson, 2018; Kristjánsson, 1980). Species of wildfowl and mammals commonly associated with the diet of native people of the Arctic such as whales, seals, guillemots, puffins, and other seabirds are part of the historical and traditional Icelandic diet (Einarsson, 2022; Kristjánsson, 1980). Currently Iceland is dependent on international logistical networks for import and exports, the country currently produces 53% of its annual food calorie consumption. Almost all meat, fish, and milk are domestic, whereas only 10% of vegetables and fruits and only 1% of cereals are domestically produced. At present, food calorie energy use for food production is in a surplus compared to the domestic need for nutrition, with excess being exported as fish (Prime Ministry of Iceland, 2022). This demonstrates that Iceland has a capacity for a 100% domestic diet of mostly just fish, the surplus is traded, and other food ingredients are imported.

In the short-term, the national food system is resilient to international carbon energy supply disturbances but less so in longer term projections (Prime

Ministry of Iceland, 2022). The greatest improvement to a long-term national sustainable domestic food system would be a change in machinery and transportation systems from carbon fuel to domestic renewable energy such as electric and biofuel powered ships, machinery, and transportation. As currently on average Iceland only has about 90 days' supply of carbon fuels for food production and all other activities based on these energy sources. The other main change would be a large-scale project to lessen the need for imported fertilisers through a system of nutrient recycling (Prime Ministry of Iceland, 2022). This report also emphasises the uniqueness of contemporary Icelandic food systems, represented by the fisheries and geothermal greenhouses which vegetables year-round in season utilising renewable energy.

At present there are no studies which accurately use a LCA that is calibrated to individual MJ components in Iceland's food system. Nor do any studies explore how this would differ to other countries, because of the unique renewable set up of the national grid and the massive industrial fisheries. Domestic processing, storage, refrigeration, cooking and to some degree even waste management is 99% from renewable energy sources (Samorka, 2017). Thus, international values for MJ and GHG are not compatible with Iceland food items, due to long distance transportation of imported goods versus locally produced within a renewable energy grid. There has been some work on Icelandic food production with LCA's which has been undertaken for production stakeholders including the national association of sheep farmers, the fisheries industry, aquaculture association and the national association of vegetable growers. These reports use fewer parameters than in this study based on Skálanes, such as omitting, transportation, packaging, and cooking in their analysis. Their value as credible or useful for this thesis being marginal. However, a number of studies and reports (Hallsdóttir and Gíslason, 2017; Ragnarsson and Augustsson, 2017; Eyjólfsdóttir et al. 2003) are used to calibrate values used in the LCA analysis for this study with the intent to demonstrate possible national differences of Iceland as a food system to the averages of the world.

### **2.3.1 Geothermal Energy**

Geothermal energy is abundant in Iceland, with the first documented instance of using warm soil to grow potatoes from 1850, and geothermally-heated

greenhouses being used from 1924 (Gunnlaugsson et al. 2003). Geothermal greenhouses produce a substantial number of fresh vegetables including salad leaves, tomatoes, cucumbers, and peppers, and is the second most important use of geothermal energy in Iceland after domestic space heating (Gunnlaugsson et al. 2003). Despite this, there is still a need for 90% net importation of vegetables and 99% of fruits to satisfy the domestic demand in quantity and diversity of produce (Prime Ministry of Iceland, 2022). Irrelevant to being based on renewables, its production is still based on energy used for the purpose of this study. Icelandic geothermal greenhouses are producing energy intensive food, but the conversion rates matter in the context of GHG output. In Finland, greenhouse production of tomatoes with renewable energy generates 370 kg of CO<sub>2</sub> per ton, cucumbers 335 kg of CO<sub>2</sub> per ton, and 59 kg of CO<sub>2</sub> per ton for salads (Silvenius and Bar, 2018). They also state that similar greenhouses using non-renewable energy sources produce up to 3260 kg CO<sub>2</sub> per ton of cucumber - close to an order of x10 magnitude more when compared to renewably grown cucumbers. Additionally, the environmental impact of local products is case specific in the Nordic countries due to their low population densities and long transportation distances (Silvenius and Bar, 2018). Therefore, any generalisations of the MJ and GHG input or output for local products should be only done after careful consideration. In horticulture worldwide, geothermal energy is widely used in greenhouses, and it has substantial environmental benefits compared to conventional energy solutions (Ragnarsson and Augustsson, 2017), even with the input of geothermal energy Iceland's location in the peri Arctic means that in the winter there is not enough solar radiation for plant growth, and in the summer, climate can be a limiting factor for plant growth. To adjust for this lack of sunlight, artificial lighting is needed to keep greenhouses productive for long parts of the year (Gunnlaugsson et al. 2003). The lamps have become more productive and have shrunk in size and as a consequence their need for energy has also diminished and in 2006 it was expected to drop by 50% until 2011. Given that new lamp designs would be put in use which also contribute to indoor heating, even with geothermal energy available nationally at low costs, Icelandic vegetable growers struggle to compete with produce from abroad and the associated lower salary costs and natural conditions more favourable to the plants used (Gunnlaugsson et al. 2003; Ragnarsson and Augustsson, 2017). In summary, whilst the Icelandic vegetable growing industry

has created a year-round subtropical indoor growing facility, there is a constant need to develop higher levels of technological application in order to remain competitive.

### **2.3.2 Conventional Agriculture**

There is a considerable emphasis within the Icelandic government on supporting traditional practices of sheep and dairy farming both in legislation through import taxes (and bans) coupled with direct and indirect subsidies for farmers and rural regions. Data on agricultural production is focused on these established sectors of meat and dairy production (Statistics of Iceland, 2023). This stems from the fact that until recently outdoor vegetable and grain growing has been a negligible part of food production, providing 10% and 1% of the national vegetable and grain needs respectively (Prime Ministry of Iceland, 2022). A couple of decades ago growing barley in southern Iceland was considered experimental, even by the farmers doing it and made headlines in national media if they even tried it irrelevant of their success (Magnússon, 2018). The combination of the geography, resources, climate, history, and low population density has contributed to a terrestrial food production system emphasising animal proteins. But in the last decades with a warming climate a growing number of farmers and landowners have started to grow vegetables and grain in higher quantities. In 2017, the combined weight of all meat production in Iceland from sheep, cattle, horses, poultry, and pork was 31,500 tons. No data was found on domestic vegetable or grain production (Statistics of Iceland, 2023).

### **2.3.3. Fisheries**

Fish stocks worldwide are threatened by overfishing and climate change (IPCC, 2019). In 2015, 33% of marine fish stocks were being harvested at unsustainable levels; 60% were maximally sustainably fished, with just 7% harvested at levels lower than what can be sustainably fished. Since 1974 the world has tripled the amount of overexploited fish stocks. In FAO (2020) and a UN report, (2019). A substantial part of Iceland's economy is centred around commercial food production through fisheries which in the year of 2016/17 the issued national quota was a little over 321,000 tons of fish, of which 312,000 tons were caught (Directorate of Fisheries, 2019; Statistics of Iceland, 2023), ten times more than

terrestrial animal protein produced. The population of Iceland on the 1st of January 2017 was 338,000 people (Statistics of Iceland, 2017). Divided by every Icelander in 2019 the annual consumption of ungutted fish per person would have to be 950 kg or 2.6kg on a daily basis just to consume the annual catchments, thus the majority of it is exported. The fisheries amount to a considerable amount of the Icelandic GNP and the revenue from it has contributed to bring Icelandic society to the stage of current western living standards since commercial fisheries established in 1850's (Sigurðsson,1992).

Fish has a lower environmental impact than animal protein sources from locally conventional farms (Nidjam et al. 2012; Tilman and Clark, 2014; Hilborn et al. 2018). Eyjólfsdóttir et al. (2003) completed an LCA analysis of cod caught in Iceland to analyse its environmental footprint. They found that 70% of energy spent on catching, processing, and transporting cod was diesel oil and that 400 g of fillet cod equated to 0.65 litres of diesel fuel. The Icelandic fishing fleet has undergone massive renovation since 2010, and the industry claims it has achieved around 45% decrease in oil use (Statistics of fishing industry, 2022).

For comparison in the LCA work in this study, Baltic cod is listed as a high energy ingredient by Carlsson-Kanyama et al. (2003), the study used as a baseline in this chapter with a MJ/Kg value of 105MJ/kg vs a much lower value for the converted Icelandic value of 27,15 MJ/kg of Icelandic cod based on (Eyjólfsdóttir et al. 2003). They mention that in their LCA used in their study does not include other environmental impacts from Icelandic fisheries such as use of seafloor for bottom trawling and the effects on fish stocks and ecosystems, thus underestimating the magnitude of environmental impacts by overemphasis of oil use as the sole environmental indicator. But those impacts are not calculated either in Carlsson-Kanyama et al. (2003).

## **2.4 Skálanes Food Production Trials**

At Skálanes a diverse range of food production, harvesting, gathering, fishing, and hunting has been carried out on a small scale. Several personal observations from the author are made in this part of the chapter regarding those on-site trials. As such, these results are not based on strict empirical methods but are qualitative

observations which are presented in the chapter and are important for referencing, understanding, and evaluating possible applicable food scenarios.

For several years, the food production at Skálanes was active as an experimental smallholding farm operation, with informal trials aiming to provide some ingredients for consumption on site. This was not done with careful consideration of optimisation in mind of how much yield or harvest would make a difference to the actual needs of the site. More like grappling with possibilities, the outcomes based on these trials would create experience and know how. The smallholding experiments were based on non-mechanical inputs since the plan was to only identify which vegetable varieties to grow and animal species to keep for a useful harvest in case of eventual meaningful production on site.

### **2.4.1 Conventional Farming of Plants and Domesticated animals**

Since 2005, Skálanes has experimented with growing a variety of vegetables and raising livestock in a smallholder approach, with the intention of establishing which plants and animals could be used for a local food production system. This was done for a variety of reasons such as interest in farming, food, revenue/savings, culture, and aesthetics, but mostly to seek out realistic replacement options from the stock of food bought in store. Due to its climate and soil, the site has a limited set of options of vegetables to grow which could provide a nutritionally sound diet. The volume produced turned out so meagre that the applied organic permaculture mixture methodology used can at best be called gardening and idyllic looking. Organic production can lead to lower yields on average and the environmental impact for the products can rise due to that and local food with low food miles is not always a better solution if the food being produced and sold is not optimised for the growing conditions (Forssell and Lankoski, 2014).

The meaningful useful output of conventional agriculture on site was the visual effect of vegetable gardens and the mostly free-range animals, instilling a feeling of a 1950s farm. At the same time in the neighbouring town of Seyðisfjörður, multiple individuals grow potatoes with conventional methods of farming, using imported fertilisers and get a considerable harvest each year. Livestock has different needs, and they were found to have mixed compatibility

with other functions on site such as impact on nesting birds, vegetation, and visitor experience.

The following list shows what has been utilised and or attempted so far in the wider context of conventional agriculture.

- **Cattle:** A couple of mixed breed Galloway/Icelandic cows, each with a calf, were bought in April 2011 to be left to roam the hills for summer. Previous inhabitants from the period of when the site was a family farm had stated that in the 1940s their cows had kept to the hills and stayed away from the farmhouses, raising their calves and growing fat over the summer. Based on this it was thus decided to let the cows in 2011 roam free without an enclosure - a supposedly animal friendly approach. The summer of 2011 turned out to be unseasonably cold and plants sprouted extremely late. The lack of grazing meant that the cattle had to be supplemented with bales of hay purchased from a neighbouring farm and their nutrition was also reinforced with protein pellets. This was due the fact that they were milking for their calves, and it was considered in the interest of the animals to supplement the hay diet for the benefit of cows and calves during this cold and wet summer. The combination of the lack of fresh plant growth and human feeding led to the cows becoming conditioned to stay around the house and wait for the next feed from the humans, resulting in accumulation of manure and general disarray from these big animals knocking things over, breaking up the garden, and damaging outdoor decks. Later in the summer/autumn when feeding conditions had improved and the cattle started to stray further from the house it became evident that the sparsely vegetated area offered very little shelter for the animals as the seasonal low fronts with high winds and cold rain started to come in more frequently. The lessons from this were that for animals this big and strong, specific and adequate facilities would be needed to keep them. There was no time nor funding for improvisation on the spot to deal with issues related to the cattle at the time. Preparations and investment in the right facilities would be needed if cattle would ever be considered back on site.

- **Chickens:** A local breed of Iceland hens have been making on and off appearances on site through the years. They are bought as chicks from a local breeder in the spring and reared for their eggs and contribution to keep the vegetable beds insect free. They overwinter with a local chicken farmer and sometimes return the following spring. The approach is completely free range, with a hybrid turf/timber shed as their shelter. The productivity of the hens measured by egg production is questionable, since apart from low output they use the neighbouring fields to proudly hide away and incubate their eggs making it extremely difficult to find them fresh. Once incubated, this natural tendency they have for hide and seek adds a regular new batch of chickens to the mix of chickens at the site. As a result, their contribution to the kitchen is close to none under the present breeding policy. Currently their only function apart from eating insects in the vegetable plots is the possibility for visitors to interact with and or observe free and almost feral chickens and their chicks in an idyllic farm setting.
- **Pigs:** 2009 was the first summer of keeping pigs at Skálanes. Initially they were introduced to see if their destructive rooting behaviour could be harnessed to accelerate the succession of plant species within plots of the introduced and invasive Alaskan lupine. Piglets were bought from a farmer in April/May every year and kept in an enclosure with a pig house over the summer. There they were fed with grain pellets and any food leftovers from the house. This activity is the most successful of all the trials since they convert all food scraps to meat and just need the supplementary pellets in the later part of the autumn once they become too large to be fed solely from the house/kitchen. Their effect on the lupine is seasonal at most since pig enclosures that have been disused from pigs are covered in lupine the following years. But their presence has had an obvious positive effect on visitors who are in contact with domestic pigs in a landscape setting. This activity will be continued intermittently in the future. Their meat is also a considerable addition every autumn as individual carcass weights are usually over 100 kg.

- **Domestic Ducks:** From 2012 to 2015 domestic ducks from a local duck farmer were brought in once the snow thawed. Early in the summer the ducklings were mostly confined to their heated shelter, once they grew bigger, they started a free-range life close to the house, being fed from a small feed silo. The initial idea was to raise enough ducks to saturate the local food market with non-wild duck meat, with the intention to spare the local wild populations. However, this activity was visually detrimental since the ponds used are next to the house are limited in size, trampling and faeces was quite evident. More recently, just a few are reared some summers and their meat is a part of the Christmas presents to the staff.
- **Potatoes:** Potatoes were grown at Skálanes for 12 years in a row with limited success. Harvests from potato growing trials on site have shown that the soil is too low in nutrients without modification of its chemical composition, with nitrogen and phosphorus deficiency preventing a useful harvest. Some years the ratio of planted to harvested potatoes was a 1 kg input to 1.1 kg output, a net gain of 100g excluding other inputs in the system such as physical work, tools, and vehicle usage. Quite a lot of effort was put into growing them, creation of plots and all kinds of organic remedies have been tried to improve the fertility of the soil (e.g., chicken and sheep manure, seaweed composting, kitchen compost), all without noticeable results of improved harvest or plant growth. 2017 was the first time an input of store-bought fertiliser was added sparingly to a few potato trial plots, the harvest increased to a ratio of 1 kg planted input to 5 kg harvested. For context, Adewale et al. (2016) found that in a small organic farm in Washington State, potatoes had the highest carbon footprint of all plants grown there, due to high fuel use of the tractor at the farm to plant and harvest them. On the other hand, other plants grown at that respective farm did not match the potatoes in carbohydrate input as a dietary item.
- **Kohlrabi/Carrots/Turnips:** Some trials have been done with growing kohlrabi, carrots, and turnips over the years in small batches. The individual plants harvested in the autumn seem to be on average half the size of those bought from other domestic sources. Based on the experience with

the potatoes a suggestion is made that artificial fertiliser and improved shelters might improve the harvest.

- **Spices:** A kitchen spice garden was planted in 2012 and is quite productive. It is mostly based on plants such as chives and thyme that naturally do well in Iceland and has no exotics from southern latitudes.
- **Salads:** From 2005 to present there has been quite a variety of different salad leaves planted, some years they have hardly grown at all from their transplanting size, in other instances, the growth seems to have been concentrated at the very end of the autumn when the least number of people needed to be fed. Kale has been by far the hardiest and most productive.

### 2.4.1 Arctic Foods

Ziegeler et al. (2021) point out that the western diet is replacing local or historic diets, and that academic literature on food LCA's is being produced in these same western cultures and that those studies mostly neglect or ignore possibilities of the sustainability of alternative diets to theirs and do not account for the cultural or animal welfare and economic dimensions of producing and consuming food outside their sphere. In Ziegeler et al. (2021) they conduct a comparative study on LCA and the GHG emissions of seal hunting in Greenland vs importing of pork and chicken from Denmark. This comparison is highly relevant for this thesis in the context of wild animals, wild foods and what could be harvested legally within the local region of Skálanes. Sea mammals such as seals, dolphins and whales which can and are harvested sustainably and in some places on the planet are culturally relevant as a source of food. The dietary adaptations and food culture of a part of the population of Iceland resembles in some ways the native people of the Arctic (Fumagalli et al. 2015; Kristjánsson, 1980). Hunting and killing of land or sea mammals is often stigmatised and widely frowned upon in the west due to moral concerns, whereas that same sentiment grows thinner regarding factory based agricultural animal protein production in the same countries (Ziegeler et al. 2021). According to Ziegeler et al. (2021), the worst case GHG LCA scenario for seal

meat is 4.5 kg CO<sub>2</sub> per kg of meat, mostly from the use of fossil fuel based outboard engines. Minke whale meat is 1.9-2.1 kg CO<sub>2</sub>/kg meat compared with at least 12.27 kg CO<sub>2</sub>/kg meat for poultry (Ziegeler et al. 2021; HNA, 2008; Mench, 2018; Spinka, 2017). As opposed to farmed animals, those in the wild do not need artificial industrial input, only to be harvested sustainably. The question is of meat in general and how humane the killing of an animal is in the wild (Hemsworth, 2018).

## 2.4.2 Hunting, Fishing, and Gathering

The land and sea have a bounty of fowl, fish, eggs, reindeer, berries, and a good number of useful tasty wild plants. These food items are time consuming to acquire but culturally important and are the “terroir” (or taste of the land) of Skálanes. Different types of birds and plants can be locally harvested sustainably, but not in quantities to supplement the annual carbohydrate or protein needs of Skálanes. The only exception would be the possibility of 2-3 sustainably legally harvested reindeer, line caught fish or harpooned dolphins (legal for personal consumption). These foodstuffs would go a long way to providing the need for meat/protein. In 2017 the meat and fish purchased for Skálanes weighed 330 kg. A healthy mature stag provides up to 60 kg of meat off the bone and good cod weighs at around 5 kgs unfileted. Whilst the species in this section are unfamiliar for household consumption in most western nations, it can be said they are simply a manifestation of geographical differentiation and can be classified as opposite to the norm of the majority (Ziegeler et al. 2021).

- **Fishing:** The fishing grounds around Iceland are managed by the Icelandic government through a shareholder quota system for commercial fisheries but for private consumption everybody is allowed to fish as much as they deem sufficient for domestic use. The fishing grounds close to Skálanes are extremely fertile in a seasonal context. Cod, haddock, mackerel, herring, and other fish species have a seasonal stay just off the shoreline. When seaworthy boats have been available there has always been a considerable number of fish which has been caught. Within the legal framework of Iceland, Skálanes could (with a moderate amount of investment) be

completely self-sustaining in fish for the research and field centre aspect of the operation. Local fish for every meal (breakfasts included) is doable. This would be legal, sustainable, low impact but monotonous as a diet.

- **Wild berries:** There is an abundance of crowberry and bilberry from late July every year. There has not been any organised attempt at picking any substantial amounts on any of the years of operation. The potential is there but it is not an economic activity that can justify paid staff leaving other tasks for this.
- **Wild edible plants:** A variety of sorrels, angelica and scurvy grass grow wild around the site and could be picked and or used to greater amount than for curiosity's sake only but the same applies to these ingredients as the wild berries that it is not an economically viable activity to collect these plants.
- **Eggs:** Guillemot, arctic tern, kittiwake, eider, and greylag eggs are all part of the local bird fauna and collecting eggs from these species is common in Iceland. There are traditions regarding some of these activities to mitigate the negative effects of this activity. The nests are usually not completely cleaned of eggs or in case of single eggs laying species, egg collectors only partially visit the colonies. This activity has been completely laid off since 2005 due scientific studies of these populations of birds. This could be done in singular instances and then only as a demonstration but is not plausible to practise as a food supply item in the context of a busy research and teaching facility.
- **Reindeer:** Reindeer were introduced to Iceland in the 18th Century as an attempt to diversify the food supply and options for Icelanders so they could become reindeer farmers akin to the Sami of Scandinavia. They are currently only found in East Iceland, and due some staff being licensed hunting guides supervising the local cull, 2-3 reindeers could be added to the larder every year. That would be sustainably sourced extremely local

meat but also very expensive as the price of a tag is high compared to other more consumer available store-bought meats.

- **Wildfowl:** Puffins, geese, ptarmigans, some ducks, guillemots, and fulmars are all species which are legal to hunt for food in Iceland. This is something like the egg collection and has completely stopped at Skálanes since 2005 to not affect any species counts and or times series but could be done for demonstration reasons if needed.
- **Seaweed:** There is seaweed by the beaches which can be harvested for human consumption but the quantity of it is not enough for an operation beyond the curiosity of its taste. 3D vertical farming might be an option to consider study for a multispecies of seaweeds and molluscs.

### 2.4.3 Alternative Food System at Skálanes

As stated earlier a scenario of an alternative local food production and acquisition food system for Skálanes is considered here as a comparison to a typical store-bought western diet. Historically, Skálanes was a farm, producing food for the residents via sheep farming and fisheries. In the population census from the parish of Dvergasteinn in Seyðisfjörður in the period of 1703 to 1920 the residents ranged in numbers from 3 to 37 people. It is highly likely that it was completely abandoned intermittently due to repeated reduction in population for reasons such as epidemics, climate fluctuations and natural disasters. The ecological repercussions of the inhabitation are mostly unknown, but the considerable and widespread soil erosion evident at all altitudes in the landscape suggest an unsustainable resource extraction and use in farming practices. An anecdotal observation from an individual living at Skálanes in the early part of the 20th Century gives an indication of the living conditions. They said *“every day, all year was just about food and making sure we had something to eat. The house was always damp and cold. We did not get visitors”*. Whilst those living there historically were basing their diet on mostly carbon free inputs, the previously mentioned soil erosion and socio-economic comment by people living there makes it clear that it was far from being sustainable in our 21st Century context.

The farming experiments mentioned in this subchapter are relics of the practices of the previous inhabitants, and a continuation of a story spanning a thousand years of sheep, dairy, fishing, and later potatoes. Based on the local conditions and the experience from the food production trials so far, and other available wild and local resources, it is theoretically possible to provide a diet composed of food harvested on site and or produced within a radius of 30 km through a combination of farming, hunting, gathering, and fishing. An alternative food system with eggs, beef, lamb, dairy, barley, potatoes, and some vegetables grown or purchased directly from nearby farms providing minimal transportation distance for these items. Supplemented by locally grown potatoes, a few pigs in the field, 2-3 carcasses of reindeer, legally hunted 2-3 dolphins or seals, a substantial catchment of fish caught off the shore from Skálanes, assortment of wild plants and berries to make the food more palatable. This option has very few spices, no sugary beverages, no fruits, limited number of vegetables and a low level of food diversity. It requires a farm and harvesting plan of work and production based on the seasonal fluctuations of growing times, harvest times and hunting seasons, all coupled with different storage methods required to keep things edible until they are needed. Local knowledge of growing, fishing, foraging, and hunting is needed and a dedicated work for a substantial time through the year to utilise the opportunities of harvest and the seasonal food ingredients available. Some transformation of the local area would be needed, either with arable fields or high-tech greenhouses for it to be possible to grow potatoes on a scale needed to supplement the diet with carbohydrates. Actions and inputs of; ploughing, tilling, harvesting, processing, and storing food, chemical inputs, fuel, machinery and building materials would also be required for this production system. Edible plants and tubers in this optional scenario would also need added nitrogen and phosphorus, both of which are low in the soil on site creating the need for the addition of fertilisers in the context of agricultural cultivation. The alternative is the use of plants which can process nitrogen out of thin air such as lupine, which is found all over Iceland, management of this plant is in some cases utilised in crop rotation at farms to supplement or replace the use of fertilisers - green manure (Magnússon, 2018). Conditions for air drying cod outdoors in Norway are particularly good and energy efficient, as a preservation method which does not need energy as input (Silvenius and Bar, 2018). This applies to Iceland

too and could easily be done at Skálanes utilising long lined cod caught just off the shoreline from the house and thus saving the resources needed for packaging and refrigeration. The local game stock of reindeer which need annual culling would be another addition to the diet here. There is some literature from Scandinavia concerning farmed reindeer who received feed supplements and are harvested in the agricultural sense of things. But Silvenius and Bar (2018), state that research concerning game products needs development, and mention that driving distances to and from hunting should be considered. This is negligible in the case of Skálanes since the animals are hunted within a single day's hiking distance from the house.

The resulting diet would not adhere to a classical western dietary orthodoxy, but still be nutritionally sound, if monotonous. Some investment in machinery and facilities would also be needed to accommodate the practical setup for the consumption requirements, which in 2017 amounted to 11.4 people eating every day at Skálanes. This dietary option is possible, and could be environmentally friendly in the energy, environmental impact and GHG context. But it still needs a completely unique, mostly non-scalable, and non-transferable food system LCA to analyse and validate. It is therefore suggested that the local food system should only contribute to food consumption at Skálanes in the most non-invasive way possible, reducing the negative effects of running a food “production” system in deficit for the sake of stakeholder tokenism, focusing on mitigating practical inputs and outputs versus the “sense of the place”. Such an option as presented here, is not included in the analysis or study of Carlsson-Kanyama et al. (2003) but is relevant here for local/rural Iceland.

Contextually in the case of starting to transform parts of the landscape partially towards agricultural uses Phalan et al. (2011) cover two basic approaches: land sparing and land sharing. Land sparing is when food production is intense in defined spaces with less regard to eco diversity services and then other “wild” sites which are thus spared completely from farming. In contrast, land sharing is an attempt to create a mosaic of biodiverse areas which are also productive in food production. Their study shows that for the species used in their study, that land sparing is a better option for enhanced biodiversity. The species most susceptible to habitat disturbance are the ones needing mostly “pristine” habitats. Thus, omitting farming from specific sites is a better solution for species

protections since they had higher populations in the case of land sparing and as the mission of Skálanes is to be nature reserve and a field centre, therefore agricultural practices are better delegated to sites and farms already geared towards those functions.

## **2.5 LCA of the Skálanes Food System and Findings**

### **2.5.1 Life Cycle Assessments (LCA)**

Life cycle assessment (LCA) is a comprehensive approach used to assess the environmental impact of a product throughout its entire life cycle. LCA compares the environmental impact of the product to a functional unit, which is the primary function of the production system expressed in measurable terms (Boer et al 2016; de Vries et al. 2015). Food and drink are responsible for between 14% and 30% of world consumption in energy and GHG as previously stated. But due to the variation of methods, scope, data, and scale of food LCA's, using them to compare one food product to another can be difficult, or confusing even when within the same product category (Aronson et al. 2011). Despite this, there is a consensus on the weighted difference of different food items in specific parameters such as MJ or GHG. There is little need here to clarify exactly how different studies categorise apples to apples when the focus is instead on the inherent relative differences between vegetables, grains, fruits, meats, and dairy. Food supply chains and their environmental impact are often presented as the use of fossil fuels and its associated GHG emissions, to a smaller degree, but mostly anecdotal are concerns over such things as water use, fertilisers, pesticides, refrigeration, transport, packaging, and land use (Woodhouse et al. 2014; Weber and Matthews, 2008). Within LCA's, the primary production stage is often quoted as the main impact driver and secondary ones are often underplayed. Waste and packaging are usually omitted from the LCA, even though they are known to have large impacts just by themselves (Weber and Matthews, 2008). The diverse literature on LCA and food usually suggests ways forward in trying to lessen the impact of our actions on the environment, their generated conclusions are incompatible. The methodologies differ, and many authors express the sentiment that a universal approach for LCA studies would be ideal with everyone applying

the same method simultaneously. Due to the range of possibilities in the application of LCA research topics the below list provides a cursory idea of the diverse range of processes and the issues around finding the correct LCA to apply. The actual findings or methods are not actually relevant to this study, the focus should be in the diverse acronyms and different approaches take in LCA studies.

- Adewale et al. (2016) apply an economic input- output LCA for food studies.
- Virtanen et al. (2011) use PLCA (partial LCA), GHG and carbon footprint in a study on an organic farm.
- Font et al. (2014) propose to assess how technological changes affect classical consumer demand with the use of IPAT equations with LCA or IPAT-LCA.
- Michailidou et al. (2016) address the environmental effects of tourism in a case study of a touristic site in Greece utilising LCA combined with Ecological Footprint Analysis EFA, Environmental Indicators EI's and lastly adding Multi Criteria Analysis MCA. An authentic EFA-EI's-MCA-LCA.

This list could go on to fill a complete thesis on meta-analysis and a literature review of food LCA's. For example, Clune et al. (2017) cite 369 published papers on food GHG LCA's which fitted just their system boundary in a meta-analysis to present useful data for consumers to base their choices on. This and other similar studies attempt to produce models using incomplete data in a real-world situation which have countless variables. Additionally, these studies are always improving on previous work using newer data. The available literature reflects this and the massive undertaking in trying to conceptualise such a complex issue as food.

Numbers and quotes in LCA's regarding food systems can also be misleading even when quantifiably correct or true. For example, the often-quoted monumental water volume use of production of different food items is not empirically wrong, such as the 6000l of water needed for 1 kg of pork (Schöner et al. 2012). The volume of water is correct, but it does not consider that using this water is not necessarily affecting its uses "downstream". It only becomes an issue if the water use is located where it is a scarcity and it is impossible to apply it for a variety of uses. Case and space specific approaches are therefore vital, and

further reinforce that growing and producing food in accordance with geography and climate usually works best. Sustainable food production is also based on underlying values which are not fully understood and cannot be addressed solely by limited quantitative parametric approaches in LCA's. An example can be that broccoli has an input of 20 MJ per kg in Carlsson-Kanyama et al. (2003), the same as chicken meat sausages. The use of this functional unit of MJ dictates a skewed interpretation if instead one compares for example the nutrition, ethical or environmental impacts of these food types. Similarly, not all sustainability impacts are registered in LCA's since they cannot easily quantify issues such as animal welfare, fair trade, unsustainable harvests, social justice, and fair wages to name a few (Schöner et al. 2012).

To make informed decisions about the environmental impact of a product, it is not enough to focus solely on one aspect, such as its global warming potential or carbon footprint. The European Environment Agency (EEA) evaluates at least 11 environmental impacts across six main categories, and as research progresses, the number of impacts assessed is likely to increase. It is important to consider diverse parameters and assess multiple impact categories, including energy consumption, resource consumption, emissions to air, water, and land, land use, toxicity potential and risk potential. By taking a comprehensive approach and considering all relevant factors, it is possible to make more informed decisions about the environmental impact of a product. As noted earlier, different approaches to LCA's are not mutually exclusive of one another, they represent a spectrum of ideas and innovations in food systems development, overlapping and differently applicable in their individual spatial context. Technology, values, and society are intertwined in a complex manner and reducing anything to being the only solution is a simplification of the issues being studied with their embedded values. The values which Garnett (2014) refers to as the "good life", where the roles of technology and relationship with nature is the fundamental role in that. Garnett (2014) emphasises that LCA's can be used as useful tools to reach across different notions of these value sets to help inform decision and policy making. However, as Edwards-Jones et al. (2008) state, there is currently no research that has fully measured and plotted all the environmental consequences resulting from the production of fruits and vegetables at a local, national, or global level. Such an undertaking would be a substantial challenge, and while it may be

valuable for governments, it is uncertain how consumers and producers would respond to such a vast amount of data. Simple and clear messages based on LCA analysis work best, for example showing that depending on the functional values, the GHG emissions between meals of the same caloric content can vary by a factor of up to 9 and in nutritional value up to 4 (Carlsson-Kanyama and González, 2009).

Despite the complexity of food production, lack of data and disparate methodologies applied to measure the environmental impact of food services, it is still possible to gather meaningful information to inform the economic sector and the public with general guidelines for improvement (Gössling et al. 2011). Currently most of the papers found focus on the physical end of the spectrum, analysing outputs and how to minimise them in the future. But it is still important to keep the functional units of different LCA in mind to avoid any comparisons which are not based on the same approach and methodology. As LCA's are diverse and do measure different parameters and Carlsson-Kanyama and Faist (2000) state that quantitative data regarding food is sometimes difficult to come by and partly since it is sometimes aggregated and estimated by various methodologies and through secondary data sources. For example, it is a methodology which does not often involve nutrition in diet as a value compared to food's diverse environmental impact. Collins and Fairchild (2007) suggest that the environmentally optimal diet is not necessarily nutritionally sound nor palatable and while Clark et al. (2022), confirm that this is correct in some cases, but state that there is a general correlation in that most nutritionally sound diets are also better for the environment. LCA's are also a simplification of more complex realities and their values are average as shown by de Vries et al. (2015) who state that fish is difficult to study with food related LCA's since the methodology was not originally designed for the study of fisheries but land-based agriculture. Missing parameters from fisheries include fuel consumption, overfishing, pollution, and seafloor ecosystem degradation not being accounted for. Lastly Carlsson-Kanyama and Faist (2000) studied usage of diesel in farming of different types of crops (wheat, rapeseed and potatoes) and found that internally the carbon fuel use vs harvest is best for potatoes. However, simultaneously the harvest of potatoes in the study varied from 0.0047 to 0.014 litres of diesel per kg of harvested potatoes, a

variation of a factor of around x3 for a “simple” potato. This highlights the complexity of the data sets and the application of their findings.

### **2.5.2. Data and methodology**

For this study, the data from all food invoiced purchases and the number of people consuming these foods at Skálanes from 2015 to 2017 was compiled. These years were selected as they were the only years for which all disparate suppliers were able to provide reliable invoices. The years also represent a change in the operation at Skálanes as the guesthouse operation was permanently closed at the end of the season of 2016. The data are therefore able to provide pertinent information relevant to this period and shows a change between 2015/16 and 2017.

All food type categories from Carlsson-Kanyama et al. (2003) were set up in a spreadsheet (see appendix). Then, each individual food purchase made by Skálanes was added to the relevant food category, noting total weight. These were separated by year, to allow for year-on-year analysis. Items were grouped together from the list of ingredients with corresponding MJ value from their study (e.g., different brands of white bread and varieties of salads and different types of yoghurts). These compound yearly weighted food quantities were then multiplied with their individual MJ values and lastly divided by the personal day units (PDU's) for an average value in each year as per figure 2.1. This involved a considerable amount of manual data input as the invoices could not be accessed at their source except as pdfs. Figure 2.2 shows the final composed worksheet. Food items which were not in Carlsson-Kanyama et al. (2003) data could be grouped into two main categories. Composite items such as vegetable burgers, pesto and biscuits etc. had to be given values based on common recipes for such items. The other missing items were several vegetables, which were grouped with similar items existing in the spreadsheets, root, leaf, tubers, and spices. As a fixed rule, if there was any doubt over how to categorise or choose a recipe of a food item, the higher energy option was always selected to account for the long transportation distances to and from East Iceland.

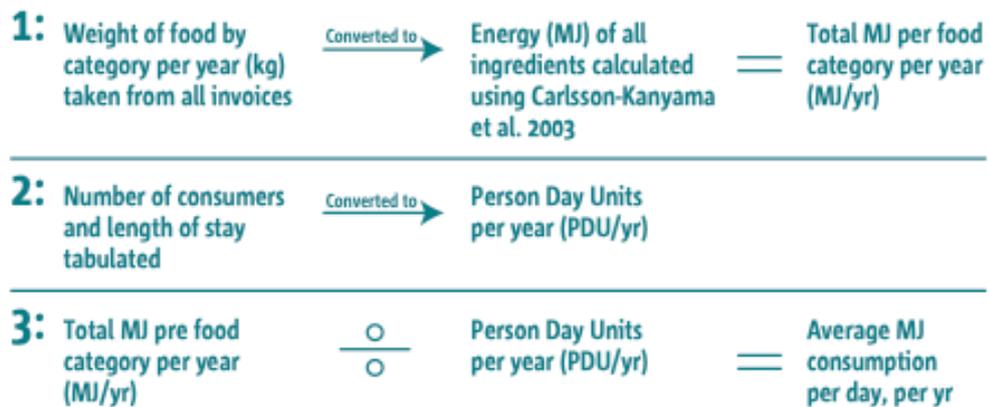


Figure 2.1. Data handling process, the categorization of diverse food items offering a values representative of the ones found and used for comparison in Carlsson-Kanyama et al. (2003).

To normalise the data and allow comparison between individual years in regard to sustainability concerns and consumption patterns, a person day unit in a given year was calculated. This was done using the Skálanes central guest house booking system, which was queried for the number of overnight staying guests, invoices for all services rendered in regards to day visitors which received food, the organisational calendars used by the staff during the operating season of each year (in case of any observations noted down or non-electronically traceable food sales), the staff shift schedule, and also email correspondence with different groups of students and academic staff.

All these disparate data sets were added to the spreadsheet and given values for the number of meals they would consume as a user category for Skálanes, ranging from a single meal to a full board. These food consumer types were grouped into four categories: students, staff, day tour visitors, and overnight guests. Their numbers were added up in these categories and given values for the number of meals each type would on average consume in a day. Students and staff had a value of 1 since they were present from morning to evening and consuming equivalent to 3 meals a day, overnight guests received a value of 0.66 since they usually checked in before dinner and had breakfast (or 2 out of 3 meals), and lastly the day tour visitors only get a buffet of Icelandic pastry and

bread with Nordic style condiments were given a value of 0.33 representing one meal. These values were used to calibrate and calculate the PDUs for each year to adjust for different compositions of consumers. It allows all PDUs to be combined to give a total value of PDUs for each year, which can then be divided by the total MJ content of the same year. Whilst the PDU data do not provide a complete listing of each single individual's exact daily consumption, PDUs are a useful approximation. However, it should be considered that Skálanes is geographically isolated and 15 km from the nearest place where food can be consumed. Therefore, all the food bought and included in the data was delivered to the field centre, and was consumed there, thus there is an ability to compare between the years to provide a close to absolute indication of the general food consumption patterns.

The methodology applied in the analysis of data is a partial LCA limited to inherent energy use, enhanced with qualitative and mixed elements from the thesis' theoretical approach, and is a conceptualization of data and input from the operation. The functional unit of the study is MJ per kg of produce. This is based on Carlsson-Kanyama et al (2003), in which they aggregated and presented the MJ per kg of over 300 different fresh and cooked food items for Swedish households. Their calculations include farm production, drying, processing, storage and transportation to a retailer and storage, preparation, cooking in households and commercial energy inputs. They do not include associated machinery, buildings, packaging material, waste treatment, transportation from retailer to consumer and dishwashing. Producing an inventory of the MJ content of a few food items in Sweden allows a conversion to the Icelandic diet, and more broadly across Scandinavia. It is therefore assumed that the individual energy levels of food items are the same in this study as provided by Carlsson-Kanyama et al. (2003). As stated by Carlsson-Kanyama and Faist (2000), processes are expected to become more energy efficient with time. It is therefore assumed that the energy input relative across all the individual food types inventoried by Carlsson-Kanyama et al. (2003) should follow the same trend relative to their location, since improvements in transportation, refrigeration, packaging are applied sector wide once available (Silvenius and Bar, 2018). The baseline food categorisation for this project was made in Sweden in Carlsson-Kanyama et al.

(2003), there were several difficulties in transferring its values directly to Iceland. For example, a substantial portion of the vegetables used in Iceland are domestically grown in geothermal greenhouses, meaning that the energy used for their production is extremely high, but it is based on a 100% renewable geothermal and hydro energy. However, the vegetables are GHG intensive due to the geothermal activity associated with their energy input and are artificially pumped full of CO<sub>2</sub> to promote plant growth. As no studies were found to apply a correction for this variation in production from Iceland, the values from Carlsson-Kanyama et al (2003) were used. The results here will therefore represent aggregated estimates based on literature found to be applicable in the geographic setting of the thesis as MJ is a useful indicator for the study as these values can be easily transferred to KW use in the context of energy use and need for food consumption. As a result, the methodology has a solid long-term foundation across food, transportation and the energy needs of facilities within the system boundaries of the study.

Due to the lack of research into Icelandic food systems, the MJ LCA methodology is the baseline approach currently applicable to the study. Current literature exists on Scandinavian food systems and GHG, showing that energy intensive foods are also GHG intensive (Carlsson-Kanyama et al. 2003; Clune et al 2017). But to apply more complex methodologies for data which does not exist or is not readily available for the Icelandic food system is not justified at this stage since the study is small in scale. This further reinforces the notion that sustainable solutions need to be tailored for specific geographic locations instead of applying a one size fits all approach for the whole planet. In some cases, a conversion could be carried over into greenhouse gas emission based on the food types and their production, which is done for the reports on national inventories of GHG (Carlsson-Kanyama and González, 2009).

Based on a review on literature on food systems, especially what could be found on Nordic food systems from Oort and Andrew (2016) and (Eyjólfsdóttir et al 2003). Carlsson-Kanyama et al. (2003), for example, shows an extraordinarily high MJ value for Cod from the Baltic Sea which is not challenged in this thesis. But those cod values are based on extensive use of carbon fuels to trawl long distances for a meagre haul in overfished Baltic waters. In the case of the waters off Norway and Iceland the cod stocks are not as depleted and thus the energy

used for catching there in represents that. Icelandic cod is converted to an alternative value of 27,15 MJ/kg filleted fish. Eyjólfsdóttir et al. (2003) calibrated using (Oort and Andrew, 2016). Aronson et al. (2011) put Nordic salmon at average 29,15 MJ/kg, but state specifically that energy values of food in LCA that the variations in values are dependent on scope and metrics of the studies used. Beef is listed as having a MJ energy input of 75 MJ per kg in Carlsson-Kanyama et al. (2003), but that is a singular approach to only meat being the product of cattle, comparatively it is noted in Oort and Andrew (2016) that when a culled Norwegian dairy cows LCA input is spread between meat, calving and milk production in its LCA its input from its meat is recalculated in their study to an alternative value of 26 MJ per kg.

### **2.5.2 Results of LCA Analysis**

The following results from the consumption model presented are close to absolute values, as the data used from Skálanes is from a closed system of supply and consumption. In contrast, Carlsson-Kanyama et al. (2003) use household consumption which does not add MJ values from offsite consumption. The consumption at Skálanes is converted into PDUs (personal day units), representing the day values of yearly 24 hr consumers resources brought into the site, which is geographically isolated with no or very little offsite food consumption by its users. The results for 2015, 2016 and 2017 from Skálanes are based on the operation of a guesthouse, field centre and a destination for day visitors. All the guests consuming meals, planned, purchased, and mostly prepared by staff during the period studied. It is important to keep in mind that presented in these results is the MJ energy per kg in the LCA of the foodstuffs, not nutrition, and the relative ratio of weight to food within the context of MJ with nutrition in mind is neither applicable nor the focus of this study.

2015	
PDU	3115
Total weight of food (kg)	4508.93
Total cost of food (ISK)	3125638
Cost per PDU (ISK)	1003
Food weight per PDU (kg)	1.45
Standard MJ Values	
MJ per kg of food	20.68
Daily personal MJ	29.93
Total annual MJ	93224.64
Calibrated Values	
MJ per kg of food	17.67
Daily personal MJ	25.58
Total annual MJ	79682.64
2016	
PDU	4010
Total weight of food (kg)	5519.48
Total cost of food (ISK)	3660020
Cost per PDU (ISK)	913
Food weight per PDU (kg)	1.38
Standard MJ Values	
MJ per kg of food	20.08
Daily personal MJ	27.64
Total annual MJ	110842.99
Calibrated Values	
MJ per kg of food	16.14
Daily personal MJ	22.21
Total annual MJ	89058.19
2017	
PDU	4172
Total weight of food (kg)	3555.99
Total cost of food (ISK)	2600114
Cost per PDU (ISK)	623
Food weight per PDU (kg)	0.85
Standard MJ Values	
MJ per kg of food	18.61
Daily personal MJ	15.87
Total annual MJ	66191.41
Calibrated Values	
MJ per kg of food	16.93
Daily personal MJ	14.43
Total annual MJ	60187.81

Table 2.1. Summary of data from the food LCA of Skálanes for the years 2015-2017. Full data can be seen in the appendix.

The inputs are based on values used by Carlsson-Kanyama et al. (2003) for Skálanes. This includes the cumulative weight and costs of the food ingredients consumed at Skálanes, coupled with averaged daily intake per person as per the PDU parameters presented in Table 2.1. This results in the following total MJ value of ingredients: 93,225 MJ in 2015 consumed by 3,115 PDUs; 110,843 MJ in 2016 consumed by 4,010 PDUs; 66,191 MJ in 2017 consumed by 4,172 PDUs (Table 2.1).

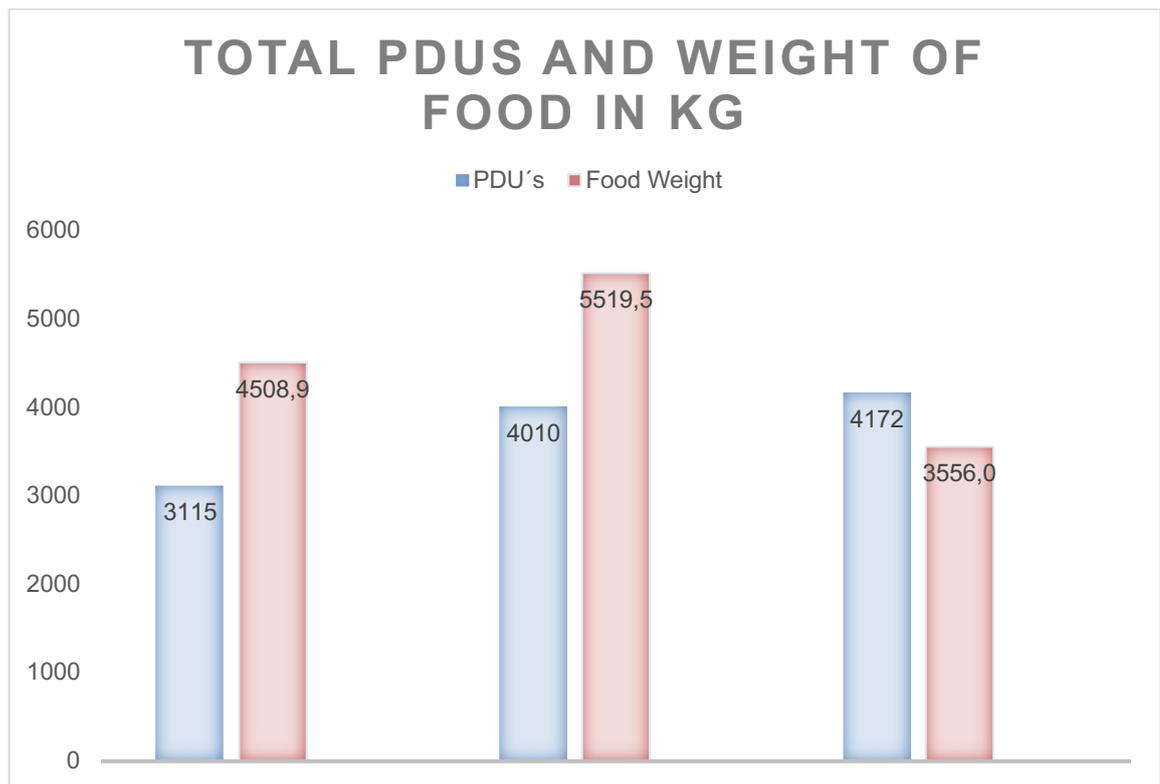


Figure 2.2. Total annual PDUs and total weight of food in kilograms for 2015-2017.

As shown in Figure 2.2., the weight of the food items across the respective years was considerable. This total weight and volume of supplies, alongside the logistical process of ordering, purchasing, collecting from supply depots, and delivering to Skálanes, and the subsequent waste disposal to the local recycling centre, is a relevant environmental concern. Some of these inputs are built into the MJ quoted for each food type. However, others are not, for example, the packaging of food items, which can have substantial energy needs, material input and waste treatment. As a result, these values must be treated as a minimum. When comparing the weight and PDUs (Fig. 2.2), 2017 has the highest number of

consumers but also the lowest weight of food items delivered, suggesting a clear improvement and increase in efficiency, with associated environmental benefits.

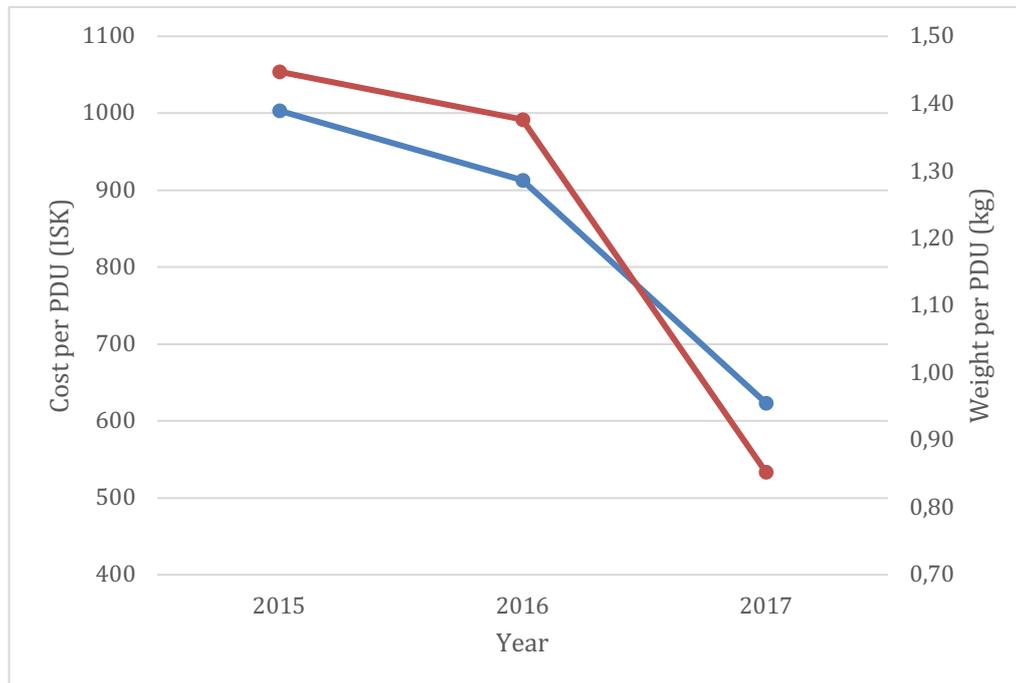


Figure 2.3. Food cost per PDU in ISK (blue line) and food weight per PDU in kilograms (orange line) for 2015-2017.

Figure 2.3. shows that both the cost and average weight of food consumed per PDU has reduced progressively from 2015 to 2017. Between 2015 and 2016 a relatively modest, 10% reduction in both was observed, whereas from 2016 to 2017 a larger reduction of 32% in cost, and 38% in weight was seen, again suggesting a clear improvement in performance.

The financial aspect of solely the purchase of the food is considerable, with costs of 3.1 million ISK in 2015, 3.7 million ISK in 2016 and 2.6 million ISK in 2017 (Table 2.1.). It should be noted that this cost does not include costs of coordination (transport of food) mentioned previously nor cost of facilities or salaries. As a rough rule of thumb for operational costs these numbers can be at least doubled for the real amounts inherent in this part of the food operation.

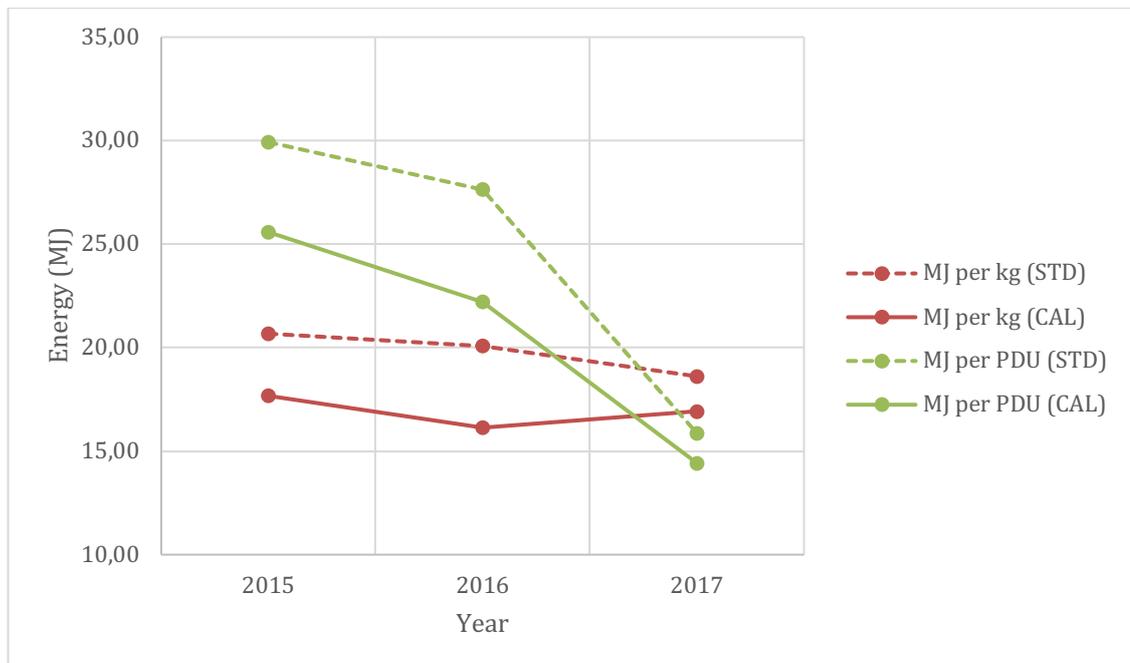


Figure 2.4. MJ per kg of food for standard values (dashed red line) and calibrated values (solid red line), and daily MJ per PDU for standard values (dashed green line) and calibrated values (solid green line).

When the MJ per kg of food is considered as in Figure 2.4 (red lines), the difference between years is less obvious in comparison to weight and cost (Fig. 2.3). This is evident across both the standard and calibrated values. However, it is important to separate the MJ values from nutritional value, and keep in mind that between 2015 and 2017 the actual total weight of food per PDU dropped by 41%. This demonstrates that it is important to consider different relative values such as weight and costs to MJ of individual food groups. These need to be placed in the context of an overall diet, otherwise Figure 2.4 would suggest very little improvement in the diet across the years studied. When MJ per PDU is considered (Fig. 2.4., green lines), a similar trend to the cost and weight per PDU (Fig. 2.3) is observed. A reduction of 7% or 13% is seen from 2015 to 2016 (for standard and calibrated values, respectively), with a larger, 43% or 35% reduction in MJ per PDU from 2016 to 2017 (for standard and calibrated values, respectively). Together with the previous data this evidences a dramatic improvement between 2015/2016 and 2017, and a trend is starting to appear in the consumption pattern of food at Skálanes. It is also worth emphasising that all values are below the median intake value from Carlsson-Kanyama et al. (2003) of 33 MJ per person per

day and in 2017 close to the lowest value found in their study of 13.3 MJ per person irrespective of parameters used in the calculations.

However, one of the intentions of the study was to attempt to calibrate values which might be relevant to Iceland compared to the ones based on (Carlsson-Kanyama et al. 2003). When lower values for cod (Eyjólfsdóttir et al 2003) and beef (Oort and Andrew, 2016) are applied (as presented in the methodology chapter), a change in the average MJ consumption per person per day to 26.6 MJ in 2015; 22.2 MJ in 2016; 14.4 MJ in 2017. The difference they exhibit as part of the sum of the total food consumption for every year shows that the results of applying them are marginal even if they represent a reduction in food items which had high MJ values. When compounded with all other items and averaged they have visible but minimal effect.

The trends demonstrated by the diet at Skálanes show an improvement as energy use for food decreases between 2015/2016 and 2017. These changes were implemented unintentionally, and without planning. Energy use at Skálanes registered at below medium in 2015 and 2016 and very low in 2017 compared to the Swedish median value of 33 MJ per kg. All years included are calculated from considerable amounts of food weight, across 11.4 daily consumers on average in 2017. The effect of dairy and meat is visually clear in Figure 2.5 as a change in diet towards more flexitarian appears, as all food categories except “miscellaneous” are at lower levels in 2017 than 2016. The lower values in 2017 highlight that, in a diverse and large operation a consistently low energy diet can be achieved. By 2017, standard value MJ per PDU decreased by 47%, calibrated value MJ per PDU decreased by 46%, standard value MJ per kg of food decreased by 11%, calibrated value MJ per kg of food decreased by 7.5%, kg of food per PDU decreased by 41.5%, and cost per PDU decreased by 38%. Together, the data shows a definitive trend pointing towards increased food consumption efficiency in all values. This subsequently translates to; less waste, less packaging, improved cost control, decrease in logistics and transportation. The calibrated values of 14.4 MJ per person for 2017 are remarkably low and are just marginally higher than the lowest measured value of 13.3 MJ found in Carlsson-Kanyama et al. (2003).

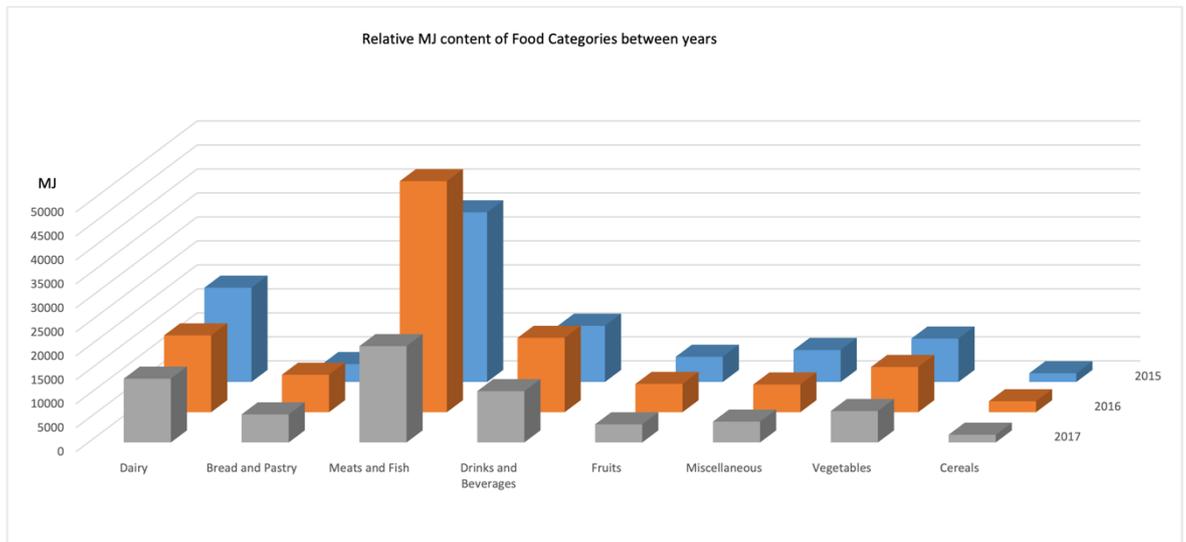


Figure 2.5. Relative MJ content of different food categories from 2015 to 2017.

At the beginning of the chapter, I highlighted a personal assumption that “the diet practised by the generation of Icelanders born in the early 20th Century could be a good compromise of dietary needs and environmentally sound food purchasing. The diet in question at Skálanes consists of potatoes, barley, lamb, fish, bread, butter, cream, mostly locally sourced within Iceland. This is partially supported by the findings of Carlsson-Kanyama et al. (2003) who found that *“Diet Low (MJ) is quite energy efficient ... but could apply to the food patterns of an older generation accustomed to herring, small amounts of meat and a lot of tubers”*. Coincidentally, the food purchased and consumed at Skálanes was from a range of medium low to very low contextually to the Swedish study in the period covered. The actual reasons are unclear but some of the “food rules” presented later in this study such as the use of buffets and minimal waste were already being carried out during the period in question which might be a part of explaining this. As FAO (2022) estimates, 17% of food purchased goes to waste inside kitchens.

An informal question raised with university staff leading expeditions to Skálanes for these consecutive summers showed that they had not felt a change in the diet between any years, and not a single instance of students' remarks about the diet being inadequate was brought to bear. The difference in MJ content was down to consumer composition and their perceived needs by the supplier (Skálanes) of what was purchased and cooked. As the guesthouse was not in operation in 2017 and thus a different menu and diet was carried out compared to the previous years, this explains the drop in MJ content as those guests which

were provided larger amounts of cod and lamb compared to students and day visitors shrinks proportionally to the food being prepared. Still, it is impossible to claim that the worldwide energy diet was reduced according to these numbers as the consumption was shifted elsewhere. The tourists not staying at Skálanes in 2017 had a meal somewhere else.

An economic perspective supports the informed view to not utilise the site for farming. In 2017, 237 kg of potatoes were consumed at Skálanes. To replace all grain, sugars and other readily available carbohydrates consumed that year roughly 1000 kg of potatoes would be needed. The price of potatoes per kg in 2017 was on average 205 ISK, the retail price of a metric tonne thus around 205,000 ISK. Even when excluding the cost of investment, running of machinery, all transportation, storage, cooking and waste management. Growing our own carbohydrates compared to buying them would never be close to anything acceptable in the economic sense of sustainability. It is therefore not justifiable to consider a heavy-handed transformation of the landscape at Skálanes, as it would need inputs of chemical fertilisers, heavy machinery, habitat loss for wildlife and a visual change - all alongside of being financially unviable. Since farming involves alteration of a site to tailor it for a certain production, geography plays less of a role. As economic and environmental wants and needs dictate the transformation of landscapes to enhance productivity, often with detrimental effects on ecology and soils Poore and Nemecek (2018) and according to Schöner et al. (2012) peak farmland has already been reached worldwide and we humans might never need as much again so why add Skálanes to it. In summary, due to these multiple factors explained above, it is considered better to delegate food production to specialised food producers and suppliers and only use wild sources of food at most an experience-based resource for students and other visitors.

The results on the Skálanes food system presented here provide a baseline of approach and open up the possibility of further research, where results can be applied for improved food efficiency. They are scalable and applicable to Iceland and to a degree the other countries in the North Atlantic (i.e., Iceland, Greenland, and the Faroe Islands), due to their proximal geographic location and shared culinary traditions.

### 2.5.3 Conclusions

The conclusions and findings of this chapter are a mix of technical solutions, quantitative and qualitative results. Food permeates every person's daily life, and it is impossible to separate it from taste, culture, dietary preferences, health regards and economics through solely the application of a parametric LCA. The main hurdle in the process for Skálanes will be to move beyond the data and theories and to implement or follow through with any planned changes to make them tangible. Food LCA and its inherent energy content is just one of the componential subjects in a niche of sustainability studies ranging over multiple fields of science. As Rapley et al. (2014) emphasise, to have effect, the scientific community needs to “delegate” different responsibilities internally to: create knowledge, disseminate, explain, and advocate for improving on current issues. In such a situation, a “pure scientist” is not enough, and experts have an obligation to involve themselves with the public and legislative discourse. Within this study there is an attempt to span these roles. Local studies are important in assessing the environmental fingerprint of the food system but to achieve energy efficient diets, regional calibrations are informative and reinforce the need for case studies. The findings create a quantitative basis for decision making in choosing food items which are less energy intensive, or at least provide information for further studies. In the period studied, the process of purchases at an individual level was entrenched in habit and standardisation. A simple menu at Skálanes meant there was less waste, with no ingredients going out of date. The menu also created rapid turnover of the usual ingredients in a rotation between days, simplifying shopping lists and making it easier to restock. This was, however, unnecessarily energy intensive based on the make-up of the consumers it addressed as is shown in the difference of energy used between 2015/16 and 2017.

In a system entropy is unavoidable without new inputs. The production of food is an example of that as the process from farm to consumer table demands resource inputs. Ensuring sustainability is important due to inherent negative environmental impacts. However, stakeholders across these systems (such as policy makers, producers, and consumers) often have wildly different views on what a solution is. It should be noted though that these differing views can be

regarded as differences in ideological tendencies and not, except in the most extreme ends of the spectrum, as closed belief systems (Garnett 2014).

The general guidelines applicable for food consumption are very simple; less meat and cheese, more in season vegetables and more locally produced and fresh foods (Silvenius and Bar, 2018; de Vries et al. 2015; Poore and Nemecek, 2018; Carlsson-Kanyama and González, 2009; Carlsson-Kanyama et al. 2003)

Based on this chapter's findings, the following list of simple rules applied for the future of the food system at Skálanes acts as a general but particularly useful guideline meant for the purchase of food to keep the MJ GHG and environmental impact down to a reasonable level.

- **Avoid meat:** The general increase of meat consumption worldwide is a matter of consideration since 70% of agricultural output is used to feed animals for slaughter (Silvenius & Bar 2018), but fish, fowl, pork and eggs are the best option in a climate friendly diet if meat is chosen (Carlsson-Kanyama and González, 2009). The massive decrease in average MJ content in consumption at Skálanes between the years of 2015/2016 and 2017 can be attributed to much less meat being purchased and consumed.
- **Increase the relative use of vegetable dishes:** Vegetable diets excluding ingredients transported by plane have the lowest GHG emissions (Carlsson-Kanyama and González, 2009). Changing your diet is more effective than buying local (Weber and Matthews, 2008). The transport footprint of food in GHG was estimated at 4% at the time of their study. Consuming and buying local produce based on an environmentally conscious diet with less red meat and more vegetable base products is better. A 21-24% reduction in red meat consumption achieves the same results as total localisation of food, but the lack of comparable data makes it difficult to declare the “best” diet based on all parameters. Environmental impacts of vegetables and grain are without exception lower than any animal-based products (Poore and Nemecek, 2018). In the same vein as eating less meat in favour of more vegetables applies between 2015/16 and

2017, there is an interesting trend with the data that even with lowest MJ values in 2017, the total weight of the vegetables still decreases from 886 kg in 2015, 1031 kg in 2016 to 692 kg in 2017 even with more PDUs in the last year studied.

- **Avoid air transported fruit and vegetables:** In the case of Iceland, being highly relevant in context with all imported foods and specifically fresh vegetables and fruits if they are flown in with associated carbon output. This reinforces the notion that foods that are viewed as environmentally friendlier on average are not necessarily universally so. Although full data are not available, it has to be taken into consideration for proposing adjusted diets for Skálanes and in the wider context of Iceland. Apples shipped to Sweden in containers require 8.6 MJ per kg, while fresh fruit flown require 115 MJ per kg (Carlsson-Kanyama et al. 2003; de Vries et al. 2015). As a general rule fresh berries and similar food items which were thought or considered to have been flown in are and have not been bought for Skálanes.
- **Buy as little as possible and use all the food up:** About 30% of food produced is wasted (FAO, 2022; Gössling et al. 2011). Toward the end of every student group stay; food purchasing is intentionally limited, and the remaining perishable fresh food ingredients are used up with the intent of having no waste.
- **Buy in bulk packages:** Food packaging was excluded in the study because it is not in the MJ values of food items in Carlsson-Kanyama et al. (2003), but packaging can be a considerable proportion of the total energy needed for food production. The consumer pattern of the food used at Skálanes calls for a concerted effort to buy simple, in bulk and internally, if possible, repackage in reusable containers. This has not been applied to a great degree at Skálanes.
- **Serve buffets for all groups:** Since the food from previous buffets can often be reused for the next meal (Gössling et al. 2011). Student groups at Skálanes have a lot of buffets where food gets moved between days and

mixed in as new recipes with the intent of not wasting. Similarly, the guesthouse kitchen operation had only 2 main dishes, alternating between days, the ingredients in them being used intermittently between courses meant that they almost never went to waste.

- **Use local ingredients with introduced ones:** Local food creates an experience, a sense of place and “authenticity” (Gössling et al. 2011).
- **Disseminate and discuss, educate:** Carlsson-Kanyama and González (2009) advocate for environmental and health education which includes the effects different diets have on the environment. But Collins and Fairchild (2007) mention that several authors and papers have criticised the idea of an ecological footprint and its usefulness in policy making and or management of food systems.

## 2.6 Summary of literature and autoethnographic reflection

The reason I wanted to carry out this study on food was a personal perceived importance of it for conservation and sustainability. At the initial stage of writing this thesis I was not familiar with the literature of food systems of the world, LCA methodologies, inherent MJ use and related GHG emission of food items. My findings turned out different than anticipated due to the exact choice of parameters, personal bias, lack of knowledge about food systems, and my personal dietary preferences. Initially I set out with a viewpoint of optimising the food use at Skálanes for the environment and planning to go beyond the rhetoric of only academic work to commit to the findings and apply impactful changes at Skálanes. I expected the data generated to provide means for real improvement and to engage in public discourse.

But.

During the process of literature review in this chapter, multiple highly contradictory and important contextual findings to my personal bias about food were found. The following paragraphs are based on them, contextualising the other findings of this chapter in relation to food.

To begin, worldwide food scarcity is a social and cultural problem of poverty and inequality, war, ethnocide, and bad political leadership. Holt-Giménez et al. (2012) showed that the world's food production was able to feed up to 10 billion people if no food produced would go to waste. Through her analysis of food systems, Devereux (2000) quoting the Nobel prize laureate in economics (Sen, 1981) showed that famine is due to breakdown of food distribution networks due to factors such as war and political oppression, not lack of food in the world. Even more surprisingly, world food production can be expected to increase with up to 4-5 C increase in temperatures from pre-industrial levels (Van Meijl et al. 2018). The United Nations food and agricultural organisation expects food production to increase by 30% by 2050 and in all their scenarios technological change is expected to outweigh the detrimental effects of climate change (FAO, 2018; Our World in Data, 2023). Thus, there is no need to increase food production but more to distribute it efficiently and focus on decreasing inherent waste in current food systems with it achieving up to 30% reduction in GHG and inherent energy needs for human sustenance irrelevant of anyone's diet.

Worldwide the area of land needed to grow food has shrunk dramatically with the green revolution and other technological advancements, leading to regrowth of forests, especially in developed nations and reverted from farmland into more complex ecological landscapes. This emphasises that food is made more efficiently in intense farming and requires less land for its output (Chazdon et al. 2020) thus, sparing natural areas from ongoing or eventual marginal and wasteful use in food production. Through this reasoning there are merits to the argument that supplying tractors, fertilisers, and industrial means to underdeveloped areas in the world could accelerate conserving for “wilderness” and ecological protection in those countries as it would constrict the need for current agricultural space use in those areas.

Clune et al (2017) in their widely cited study, reviewed via meta-analysis 369 LCA studies on food and different food ingredients and their respective global

warming potential (GWP), proposed a recognition of hotspots of GHG foodstuffs and omitting them from personal and catering services, creating a simple inventory of things to buy and consume with a massive potential to improve on food carbon footprints of individuals and groups. Their best option with a weighted value of GHG and nutrition was found to be a vegetarian diet with a little bit of dairy. In their study, comparatively in their most extreme case of solely carnivorous diet from red meat ruminants being the highest GHG output dietary possibility compared to a difference of a factor of nearly 25-times less in their respective carbon footprints to a fully GHG optimised of a highly selective vegetarian diet. Both omitting nutrition as a concern. But the massive factor change of a 25-times difference in the “extreme” ends in possible personal diet choices begs for a critical comparison. In a scenario from the Intergovernmental Panel for Climate Change (IPCC) depicting a complete or near complete worldwide veganism by 2050. All animal products taken out of the human population of the planet's diet and personal use, and all land used for livestock and animal products reforested. Land based food related emissions could be cut by 70% by 2050 (IPCC, 2019). But reading further into their reports obtaining that it entails that total world emissions would only decrease 10%. This being put relative to other IPCC reports, IPCC (2018) and IPCC (2022) which state that the world needs to curb its carbon emission from its time of release by 45% already by 2030. Contextually vegetarianism being an easy personal dietary choice to make for minimal carbon emission only reduces diet personal energy by 16% and GHG emissions by 20%, which computes to only a total personal energy use decrease of just 2% and total GHG emission reduction of 4%, assuming a rebound of consumption directed somewhere else when consumers feel that they have a license to consume more because of dietary adjustments and often reallocating in other environmental impacts of their lives with less concern for the environment, (IPCC 2019; Grabs 2015).

Thus in “business as usual”, global human GHG emissions will rise to 86 gigatons/year in 2050 with agricultural food related emissions contributing 11.6 gigatons/year while a total worldwide enforced veganism with total reforestation of all non-used agricultural land would reduce that to 78.4 gigatons/year through an 8.6 gigaton/year reduction (IPCC, 2019). As the GHG approach to food LCA’s is currently prevalent worldwide. With energy systems transitions towards non-carbon emitting primary sources continuing, studies on LCA’s on MJ or GHG in

food systems will adjust accordingly, and the previously approximate 14-30% share of world MJ and GHG emission stemming from food production will diminish to levels of relative concern. This all together shows plainly that renewable energy transformations are a key factor in adjusting the food systems GHG output as in all other systems to reach real emission reductions, and thus reinforcing the relevance of the use of MJ/Kg approach in this study.

Dietary choices are important but are low impact with a clear limited effect of improvement compared to focusing on renewable energy, which tackles the root of food GHG impact. Carbon reductions need to come from other sources than diet to make long-term benign changes. Emerging renewable energy systems will make GHG emission drop and using or implementing more efficient renewable energy technologies is in most cases more environmentally sound and a higher impact choice than adjusting people's diets.

Wynes and Nicholas (2017), did a meta-analysis of multiple GHG mitigation scenarios from various sources, their relative impacts of those efforts versus how prominently impactful they really are. Their results show how low and mid-level mitigation was much more prominently advocated for to young people while the high impact was close to not represented. Creating a gap in meaningful action and actual perceived effects. When participating in a survey and asked to list energy efficient ways to lessen their energy needs, most people inaccurately quoted curtailing and showed little sensitivity to the size of actual energy differences (Attari et al. 2010). This is in accordance with the findings from Wynes and Nicholas (2017) who address the public and educational misconceptions on the relative importance of different ways of mitigating our GHG footprint. Both papers suggest that the public in western countries are aware of the importance and relative significance of low to mid-level mitigation efforts but in the high-end spectrum the relative differences from perception to reality can and do vary by factors of x10. Comparatively a single transatlantic flight (1,6t CO<sub>2</sub> output) means a 100% vegetarian diet for 2 years (0,8t CO<sub>2</sub> reduction per year) by the same person to just offset those few hours in the air. Car use per person is 2,4t CO<sub>2</sub> emission annually.

These examples exclude all other compounding consumption choices a western person makes in a year. Showing that the choice of the study of food in this thesis turned out to be an inadvertent study on low impact choice of food and

energy related to GHG emissions. The individual choices of consumption discussed in Rapley et al (2014), Kahan et al. (2012) and Attari et al. (2010) show how important cultural values are as a factor in the public perception of climate change. As the presumption of numerically literate and or people with higher education having a better understanding of or intent to want to mitigate climate change is found to be equally lacking as other demographics. Instead, the cultural context and political philosophy of the individual plays a stronger part than scientific literacy as they will want to preserve the status quo of their income, established industries or economic actions regardless. This means making people change their lifestyles is complicated and often hard. This human expression transcends partisan boundaries of national politics. It emphasizes the necessity of a diverse approach in communicators and information layouts to address different demographics when dealing with scientific literature on climate change, as not all individuals will react uniformly to the same message.

This is a concise description of me regarding food, its relative importance, and how I purchased it for Skálanes. I was biased, entrenched, and jumped to assumptions about food's impact in the operation and this process and study taught me that. After having studied food systems in this chapter, I have within the parameters used created both solid quantitative and qualitative findings and gained extensive background check on literature on the subject. The conclusions did in a roundabout manner emphasise that the type of energy used in food production and related systems matters more than what it is consumed.

Focusing on renewable energy use in food systems is the highest impact choice to decrease its effects on the environment.

# 3. Skálanes, Conservation and Sustainability

## Summer

*The eiders are early layers this year with over 600 nests already found in the colony. The females do the hard work of incubating and risking predation from mink, seagulls, skuas and arctic foxes. Meanwhile, on the water the males congregate, socialise. Being useless for the rest of the year until they need to turn in their annual 5 seconds of contribution for the continuity of their species come next spring. The summer solstice waits curiously around the corner and the busyness of the Arctic summer crescendos towards it with swoops of feathers, cackling, calling and the intimate combination of careful shyness, gentle care, and quiet booming pride of the bird mothers with their clutches of newly hatched chicks.*

*In the last couple of weeks, we have been busy with planting trees provided by the Icelandic forestry commission. This summer we received 16,200 native rowan and birch saplings to plant. Aiming to restore the woods of the land and its capacity to adjust to a changing world. Eventually the growing trees will supplant the lupine fields, provide habitats for more species, and adjust the succession of ecosystems in time towards something resembling the apex forests predating the settlement of humans. Today, while planting there was a brief encounter with a snipe chick whose grandchildren might breed at the eventual forest's edge. It gave me an introspective and intelligent look as the usual fumbling for a phone and a good picture angle did not raise any alarm. The water retention, nutrition load and filtering from the future forest will most definitely improve the wetlands downhill.*

*The arctic tern colony has been having a bumper hatching / fledging summer with abundant supply of food from the sea combined with dry warm weather. Something sent them all up in the air at the same time this evening. Even with memory being a notoriously bad reference I do not think I have seen as many*

*terns ever before in my life. They were everywhere in a 360-degree arc from the house to the borders of the nesting colonies and out to the water's edge. The chicks are well advanced for this time of year, and we look forward to meeting them in coming decades in their colony on the old fields next to the house. These tern chicks from 2020 and 2021 which were successful hatching years will potentially be dying "naturally" of old age around 2040.*

*These wispy ferocious Quixotean heroes. Whose world record migratory flight distance in their lifetime will be in the span of over two flights to the moon and back again. Who fight every predator, at any odds, which disturbs their nesting colony and endangers their precious dappled downy offspring. They beg the question what we humans will be able to achieve compared to them in the same timespan? Through our actions, invention, and benign intentions for the environment. Comparatively it should be something monumentally good.*

## 3.1 Introduction

Conservation at Skálanes is based on a wide approach of subjects, some based in historic legacy of land use and others founded in varied approaches, professions, and spatial contexts. The intent of this chapter is to cover these often-disparate sets of transdisciplinary subjects, which combine to create the foundation of pragmatic philosophy in conservation at Skálanes. This chapter starts with a general introduction to Iceland and its natural history, leading to conservation thought and philosophy with an emphasis on the 21st Century and the concept of eco-modernism. In the following subchapters, topics related to Skálanes are presented in the framework of sustainability where its economic, conservation and societal inputs and outputs are queried. Eco-pragmatism is covered within classical subjects in natural sciences in the context of management in the anthropogenic 21st Century as changing climate and species migration and what they mean for conservation locally and globally, concluding with an analysis of its connection overall to the concept of living labs. The chapter finishes with a manifesto and an assessment of the thesis goals for Skálanes as a conservation site in Iceland in the 21st Century.

## 3.2 Iceland

The following body of text is a comprehensive introduction to Iceland's geographical and climatic features, highlighting its natural history shaped by volcanic activity, glacial erosion, delving into the impact of human settlement on the island's ecosystem. It emphasises the significant ecological changes, extensive soil degradation, and near-total deforestation that occurred after the arrival of Iron Age settlers in the 9<sup>th</sup> Century.

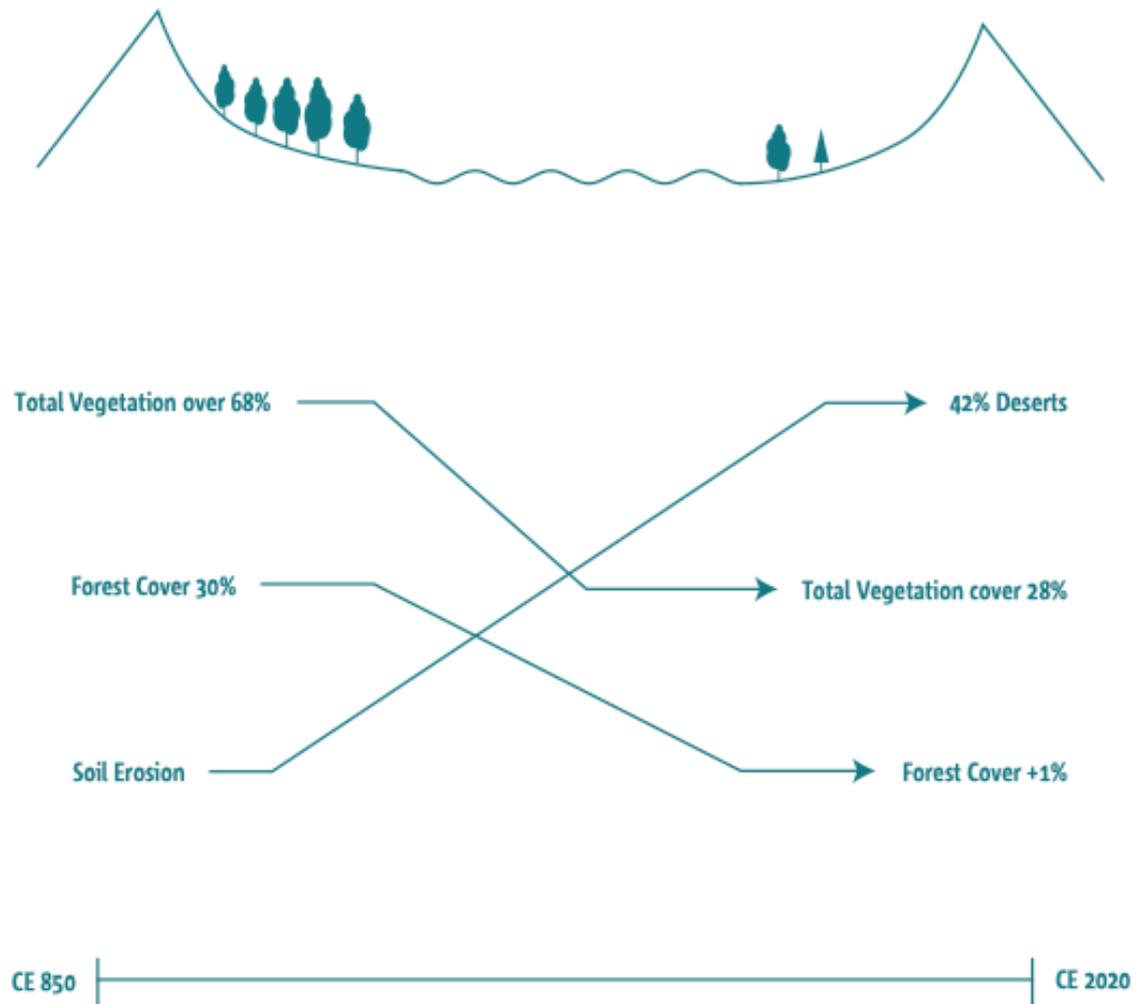
The country is a 103,000-km<sup>2</sup> island in the North Atlantic situated between the Faroe Islands and Greenland. Formed by recent volcanic activity and eroded by glaciers. Due to the gulf-current coupled with oceanic climate, the island's weather is relatively mild given its location between 63 and 66°N. Cool summers and mild winters with ample precipitation during the entire year characterises the weather. Low fronts with storms are frequent, coming in from the sea during the

winter months (Arnalds, 2015). The natural history of the island is established through use of different organic markers found using soil strata chronology dated with hundreds of layers of tephra from Icelandic volcanoes. It makes it possible through various means of analysis to separate natural events and changes such as climate fluctuations and some of the bigger volcanic eruptions from human induced changes. Tephrochronology is a method used to establish precise links between different environmental archives, such as those found in terrestrial, lacustrine, marine, and cryospheric environments (Streeter et al. 2015). By analysing tephra layers (volcanic ash deposits) in conjunction with written records dating back to the 11th Century, it is possible to identify and profile the effects of human activity on the natural history of Iceland. Since humans arrived late in Iceland's history, the effects of their actions can be clearly distinguished from the natural processes that occurred before their arrival, due to the extensive spatial and temporal profiling of the tephra layers preserved in the soil (Streeter et al 2015).

The information embedded in Icelandic soils establishes that the settlement of people from Scandinavia and what is now the UK started around the year 874 CE. Before that no human impacts affected the landscape or ecosystems and prior to settlement, Iceland's environment was relatively stable with much more widespread vegetation cover with up to 30% forest cover, and soils that were more organic, characterised on lowlands by shrubs, forests, and wetlands. After an initial short postglacial colonisation period, varying levels of forest cover reacted to climatic fluctuations are documented in pollen and eDNA (Eddudottir et al. 2020; Arnalds 2015). This suggests that the gradual ecological changes prior to settlement were mostly uniform in the country, the forest's spatial cover reacted to temperature, migrating vertically. For example, in North Iceland at 6000 years BP the forest's upper extent is estimated to have been between 400 and 500 m above sea level (Alsos et al. 2021; Eddudottir et al 2016).

Based on information extracted from soil profiles using tephrochronology, an anthropogenic baseline can be established as an onset of a paleo-Anthropocene in the 9th Century. At this point, Iron Age settlers and their livestock completely changed the country's nature and soils through extensive environmental degradation and through the permanent and massive loss of soil beginning the irreversible modification of the island (Gathorne-Hardy et al 2009;

Arnalds 2005; Ólafsdóttir and Gudmundsson, 2002; Ólafsdóttir et al. 2001; Buckland et al 1991; Júlíusson, 2018; Jónsson, 2009; Sigurmundsson et al. 2021). The synthetic landscape of Iceland tells a story of human survival endured on the margin of environmentally possible conventional agriculture. It has resulted in the country being poorly vegetated as even after substantial reduction in sheep numbers during the later parts of the 20th Century, rangelands remain still in poor condition (Barrio et al. 2018). The marginal agricultural environment coupled with a legacy of human induced impacts has shaped the land, soils, and current ecosystems. The arrival of human settlers and their dependency on winter fodder for their livestock and organic resource extraction entailed an overexploitation of the ecosystem. There is close to an immediate radical change in the organic indicators within the tephra layers of widespread human induced impact, best described as near total ecological collapse and extensive and usually complete and irreversible soil erosion with associated carbon loss. Changes in vegetation were abrupt, and catastrophic, with close to complete deforestation and overgrazing that prevented natural regeneration and resulted in the country being poorly vegetated (Ross et al, 2016), an overall massive ecological degradation and loss of ecological adaptability. This was exacerbated due to the soil properties of the dominant andosols which are highly susceptible to wind and water erosion specifically in the highland interior and higher elevation. Simultaneously there are no discernible climatic nor geological events that can explain these changes (Sigurmundsson et al 2020; Barrio et al. 2018; Arnalds, 2015; Eddudóttir et al 2016; Eddudóttir et al 2020). These human driven changes can be summed in a temporal altitudinal frame as the higher, highland areas deteriorating within the first 100 years after settlement, and fast change in pollen composition from birch to grasses is evident in all sites studied irrelevant of altitude in the period of 950-1100 CE. The vegetation around the lowland farming areas changes from forests to grassland and soil erosion is active at all elevations eventually. Between 900 and 1990 CE total vegetation cover dropped from 68% to 28% and forest cover from 30% to less than 1% (see Fig. 3.1).



*Figure 3.1 A simple visual representation of Iceland's natural history, capturing the interplay of geological processes, climatic influences, human settlement, and ecological shifts that have shaped the island's environment over time, specially reflecting on the immense ecological impact of human activity.*

Currently 42% of the entire country is classified as desert, of which a large portion formed after the settlement, i.e., human induced desertification. The main drivers of this environmental catastrophe are the introduction of grazers such as sheep compounding with woodcutting and burning (Eddudottir et al 2020). Post settlement non-human induced impacts such as the Little Ice Age and several massive volcanic eruptions with associated tephra fall in parts of Iceland augmented these anthropogenic changes and accelerated erosion overall or individually affected regions of the country (Alsos et al. 2021; Eddudottir et al.

2020). The mostly cattle-based agriculture changed to intensive sheep farming as the available workforce diminished drastically, instigated by changing demographic dynamics in agriculture caused by the Black Death starting in 1402 CE, this increased the pressure on the ecosystem and remaining soils during the Little Ice Age, compounding the detrimental environmental effects of humans (Júliusson, 2018; Eddudottir et al. 2020).

Governmental and societal drivers of ecological restoration in Iceland with its almost 120-year history of institutional soil reclamation/restoration and forestry have changed over time. Initially focusing on supporting food production and farming, in the last quarter of the 20th Century more factors came into play such as guilt from human induced environmental degradation and then international concerns to mitigate climate change caused by humans. In the 19th and early 20th Centuries. A national concern for action for the environment in Iceland was driven by immediate and visible issues such as encroaching deserts, desertification, deforestation, and entire areas being buried by aeolian sand deposits from nearby and sometime human created deserts (Aradottir and Halldorsson, 2013). To counter this, the country, which at the time was extremely poor, established both the national Soil Conservation Service and Forest Service in 1907. Initially it was to stem the tide of encroaching sand dunes and save the remaining stunted forests, but after the Second World War, the emphasis moved to a utilitarian approach of reclaiming new areas for grazing and planting new forests for lumber. In the later part of the 20th and early 21st Century it changed towards restoring the productivity of the heavily degraded landscape in national public campaigns to plant trees and sow lupine (*Lupinus nootkatensis*) with the intention of the restoration processes becoming self-regulating. Currently, objectives are aimed towards ecological restoration, carbon sequestration and commitments to international conservation treaties (Arnalds, 2015). Recently declining agricultural activity has had the unintended environmental effect on some of the landscape to start its own processes of succession based on nearby vegetation seed sources. There are signs that the changing species composition, species abundance, trophic networks and even species distribution will be a challenge to come to terms with for conservation, ecology and other associated scientific baselines since they were established during the times of traditional land use of intensive sheep grazing and colder climate of the 19th and 20th Century. These baselines

are created in the environmental conditions prominently expressing the human and natural history since the 9th Century up until the late 20th. Consequently, changes in the 20th and 21st century to and in rural land use are sometimes viewed unfavourably by stakeholders i.e., farmers, environmentalists, and other Icelanders, as they affect the previously mentioned scientific and value-based baselines for Iceland.

Worldwide about 40% of ice-free land has an agricultural or urban use, and 37% more has other uses related to human enterprise and utilisation, restoring and maintaining functioning ecosystems in the remaining areas is the main challenge to prevent species and habitat loss (Ellis et al. 2010, quoting Hobbs 2006). Exceptions to this are the colder and drier biomes including boreal and mixed woodlands, tundra and deserts, which show very little change by human land use. This is not true in Iceland both due to its natural history and as temperature over land in Iceland has increased by 1.53°C from the late 19th Century (compared to the 1.1°C world average). This climate change causes shifts in meteorological zones and transitioning biomes is accentuated in northern latitudes, with altitudinal migration higher into mountain ranges. Modelling and data predict the greening of Arctic areas and that longer periods of photosynthesis will continue along these trends if climate warming is not curbed (IPCC, 2019; Iceland Meteorological office, 2018).

This summary shows that Iceland is far from “pristine”. Its landscape and ecology is changed, the current ecosystems are continuously adapting to changing lands use and climate change. Thus plant, bird, invertebrate and animal species and abundance are a result of the combined factors mentioned so far. This provides a framework for the philosophy, work, and goals of Skálanes covered in the remainder of this thesis.

### **3.3 Conservation and the 21st Century**

Continuing with the chapter this section explores the complex and often contradictory nature of nature conservation, emphasizing the existence of different perspectives among stakeholders. It considers the utilitarian and intrinsic values

attributed to nature and highlighting the ethical duty of conservation despite conflicting views. The discussion extends to the challenges posed by subjective interpretations of ecological terms in science and the evolving paradigms in conservation philosophy, with a focus on the emerging eco-pragmatism that questions traditional preservationist ideals. It advocates for a more adaptive approach based on scientific data and realistic goals. It concludes by raising the question of humanity's role in the Anthropocene and the need for a thoughtful and nuanced approach to conservation that considers both ecological and human dimensions.

What nature conservation entails varies to a large degree between different stakeholders and the focus of the different issues that it encapsulates, as the term can be contradictory or even in conflict with itself, as the goals and aims of conservation are about personal perspectives, social context, and human values. In relation to human needs or perspectives, nature is valued for utilitarian reasons such as productivity, goods, recycling, carbon fixing, food, minerals but also aesthetics, spiritual and intellectual purpose (Castree, 2005). A very strong ethic embedded in conservation is that conserving complex species richness despite these utilitarian views is considered the right thing to do and that we as humans have an ethical duty to conserve (Leopold, 1949). Still there is not a single definitive term that encompasses all ideas and feelings that people have about conservation. In general, though, it includes an attempt at reaching a state where nature has both intrinsic and a utilitarian value and our action or inaction are bent on saving it from losing diversity, species, trophic connectivity, and context (Castree, 2005). While ecological economics along with the concept of nature as the tragedy of the commons argue that its inherent value as a commodity is key for it being conserved (Hardin, 1968; Daly, 1977), despite not all aspects of nature appearing to have inherent useful economic utility (Sæpórsdóttir and Ólafsdóttir, 2022b; Castree, 2005).). Those involved in conservation and protected areas often debate the legitimacy of protecting areas where nature has previously been governed to some extent by human activities (Chapin et al. 2010), but the notion that there is no land anywhere to be found where humans haven't had an impact has grown in literature recently (Kolbert, 2021). That everywhere, except in Antarctica humans have been for some time, at least a few hundred years, altering ecologies and landscapes (Ellis, 2015). As a result, a growing body of

professionals in conservation of nature emphasise that there are no reasons to consider an area corrupt or of little value even though people lived in and used it. Anthropogenically altered landscapes such as most of Iceland therefore also have value, they can be considered visually beautiful and due to human habitation, it is likely that those ecosystems and the areas are well equipped to deal with anthropogenic pressure (Solecki, 1994). Anthropogenic landscapes also have value in the minds of their residents, especially related to their culture, as the history and legends of diverse cultural groups are often very much tied to nature and how land use has been shaped by these same factors (Nelson and Serafin, 1997). Relatively, Cronon (1995) argues that environmentalists need to be more honest about the source of their beliefs, which according to him do not emerge from wilderness or nature as a concept. Instead, they are imposed on parts of the non-human world by certain cultures who have forgotten the particularity and construction of their values. He argues that there is a way for achieving a more environmentally minded human utilitarianism, respectful of human wants or needs. But that usually somewhere in our reasoning it crosses into the sphere of political, pseudo religious or sectarian realms (Nelson and Serafin, 1997). Most environmentalists are also unaware that they are repeating Judaeo-Christian myths of opposing bad and good with heroes and villains locked in struggle over nature. These myths are prevalent in our culture; we know them subconsciously and use them unintentionally through the language of science about nature (Glacken, 1967).

If knowledge and perceptions of nature are constructed or even manufactured by people who study and engage with conservation, terms such as desertification, habitat/species succession, deforestation, soil erosion, reforestation, rewilding, and soil restoration, are certainly subject to such narratives. Conflicts arise when value-driven approaches of knowledge generators conflict on subjects of study and action or inaction. As a result, scientific terms can be used inconsistently, lacking a clear hierarchy (Hacking and Guthrie 2008). This highlights the subjective nature of knowledge due to the influence of individual researchers and their perspectives, which inherently creates challenges for a unified and consistent understanding of ecological terms, and related issues in conservation and how (or if) they are dealt with. This confuses all dialogue about issues related to nature, and science can appear downgraded or made indecisive

and or being manipulated. In addition, some of the approaches in social sciences used to deconstruct language reinforce this confusion as they focus on meaning. They are not adapted to consider the quantitative causalities and outcomes, which in the ecological systems are defining drivers of their states and changes (Mulder and Coppelillo 2005). As wicked environmental problems regarding sustainability concerns and conservation are coupled with quantitative values and subjective terms in science or ideas such as sustainability and conservation, they demand multiple approaches of management and stakeholder engagement to be efficiently addressed. They are ambiguous, lack definition, and are vague as the rule more than exception. The actions taken modify these issues as opposed to “solving” them while their core problems are not unanimously agreed even upon by the stakeholders involved (Etzion et al. 2017).

Since nature is conserved or utilised depending on the needs for resources or reasons to protect landscapes, developed, rich nations such as Iceland are more easily able to conserve areas in many cases forfeiting short-term profits for long-term goals and values and that nature also provides useful services to humans. This reaches beyond the three tiers of sustainability (natural, social, and economies) which are considered as necessary for conservation to be successful (Brundtland, 1987; Daly, 1977). Thus, conservation site managers and policymakers must know not only the side of conservation sites that are directly related to the nature where they work, but also the social pattern and environment in which they are involved. As a result, for a site to enjoy and prosper in coexistence with humans, local people need to have their advocate within its existence as stakeholders so that their views can be expressed in decision-making (Solecki, 1994). By default, conservation thus needs to regard the context of all of its natural and human component as being intertwined, and conservation efforts must acknowledge and address these aspects on a case-by-case basis. The conservation context needs to incorporate the social and economic dimensions that are inherently linked to the natural environment. By doing so, it can be more effective in balancing the interests of both the environment and the local human population.

On a spectrum from anthropocentric to biocentric, most people find themselves placed somewhere between the two, based on individual views regarding the

concepts of humankind and nature. However, as Barrett and Grizzle (1999) point out, for the sake of biodiversity and conservation of an individual's ideas or ethics towards nature: be it utilitarian or intrinsic, one should not narrow down the applicable options or tools to apply. It is important to not approach conservation issues with a closed mind of any theoretical orthodoxy or methodology and that conservation theory and its praxis are not necessarily the same thing. This is partially applied in an emerging conservation philosophy based in the modern environmental movement led by eco-pragmatism. A theoretical and objectively based development in conservation which has created or more likely exposed a schism in the field. The eco-pragmatists include in their argument that; ongoing climate change, urban backyards, anthropogenic landscapes, and all species existing anywhere, irrelevant of their prior habitats or origin, are all realities of contemporary nature conservation (Sandler, 2012). This is an effort to modernise the environmental camp, stating that the preservationist emphasis on evolutionary stasis and its fixation of “wilderness”, represents outdated ecological theory. The eco-pragmatists base their reassessment of the 21st Century, objectively using data about the state of the planet and what is possible to achieve with the limited resources available in conservation (Kolbert, 2021; Hobbs et al. 2011), basing their stance on diverse scientific approaches and findings. They ask if reprioritization of conservation concerns should be considered (Hobbs, 2013), as irrevocable climate driven anthropogenic changes are a fact and there is a need to expand conservation theory to an action-oriented field of science (Murcia et al. 2014). They argue that anthropogenic changes are now too widespread and influential to be ignored, thus that to restore to a previous state of perceived grace is too late, and the efforts available would be better focused on the reality of the actual parameters in place (Kareiva and Marvier, 2021; Chapin and Starfield, 1997). Eco-pragmatists also deny the assumed fragility of nature, instead claiming that novel ecosystems will self-organise anyhow in time without human intervention and proposing that conservation efforts would be better spent on goals set to improving or assisting in that process as opposed to arresting it (Hobbs et al. 2011).

A valid critique of eco-pragmatic modernistic conservation has been its inherent lack of definitions or benchmarks of where the point of no return for a given site lies and that any ecology of site is novel if viewed in an appropriate

temporal scale (Hobbs et al. 2011; Doak et al. 2014). As large areas worldwide are already reverting to a previous ecological state without an apparent ecological pragmatic novelty. A preference as default to cautiousness in management is to be advocated, since a novel approach could degrade a site's status as a self-restoring pre-disturbance condition, and that in some cases, anthropogenic changes such as climate change have had less impact on species distribution than previously modelled (Murcia et al. 2014. Coenen et al. (2011) mention that eco-pragmatists have been criticised as having a somewhat blind trust in modernity, science and that the belief that democratic processes should fix all problems, also that they lack an apparent aim and rate of success to measure against (Murcia et al. 2014). But it is fair to ask in return if classical restoration conservation and critics of technological solutions have themselves fully informed universally applicable, fully defined understanding of pre-disturbance ecology, undisputed aims, and rates of success to measure against and even on a more serious critical note. An inherent problem with democracy?

In summary, the debate between anthropocentrism and biocentrism is rooted in individual perspectives regarding nature and humankind. Eco-pragmatism challenges traditional preservationist views and argues for a reassessment of conservation priorities in the face of irrevocable anthropogenic changes. Proposing an effective and practical strategy with an action-oriented approach to conservation, focused on improving or assisting in the self-organising process of evolving novel ecosystems and that any conservation theory must be pragmatically applied to the realities of contemporary nature and society.

Independent of the use of language so far and in dissecting the eco-modernistic approach critically, it can be described as a mitigation for an anthropogenic approach from current predominance of delegating conservations to the supposedly holistic approaches of normative science and dogmatic theories of restoration in conservation. It is an attempt for divergent processes and philosophies to take to the front stage. The same applies for human development related to issues of conservation - where is human industry and enterprise visible? Should it always be unwelcome? Is there really a clear and simple distinction of nature and unnaturalness in: national parks, salmon farms, hydropower schemes, urban/rural communities, aluminium plants, trawlers, satellites, forestry, agricultural landscapes, modern windmill parks, cruise ships, tree plantations, fish

processing plants, roads, powerlines, parking lots, road signs and sheep grazing? If anything of the above is found, is that landscape thus spoiled and unworthy of protection, aesthetical or conservation value or consideration? If it is “spoiled” from a preservationist viewpoint, can we then do all the above anyway? Since in accordance with the eco-pragmatists there is no nature left which conforms to preservationists’ ideas of nature without human induced changes. Where lies hegemony and precedence? These questions are highly relevant in the context of conservation to benign ideas such as sustainable energy transitions, ecological restoration, biodiversity, carbon sequestration and universal access to nature with associated infrastructure. As they all call for new development and landscape uses in the 21st Century. The classical conservation movement on the other hand struggles to discuss these initiatives since if anything human is there, then nature is lost (Pollan, 1991).

But.

As we are now in the Anthropocene the following question needs to be considered. Have we already made such an impact that there is no way of going back, that actively managing for the future is the only viable option to maintain culture and nature, as the natural now exists firmly inside the sphere and influence of humans? That the way forward now for nature is in the stewardship of human culture and ethics, as it is too late to “start” doing nothing.

“Only now what has got to be managed is not nature that exists - or is imagined to exist – apart from the humans. Instead, the new effort begins with a planet remade and spirals back on itself – not so much the control of nature as the control of the control of nature” (Kolbert, 2021 p 8).

As we possess the presumably unique human trait of ethics, culture and sophistication, an ability for conscience, inherently having a want and care for the well-being of others and the socio-economic option of being able to choose to trade our short-term gain for long-term goals. Cognitively able to process information and look for patterns, theorise and seek out solutions. Thus, applying our benign efforts for the environment.

Is it then not our duty to step up to the tasks to make a difference we believe to be for the better?

My answer is: Yes.

Environmental issues are approachable as projects or problems that can be addressed and worked on, whilst accepting that humanity is part of the problem and sometimes the driver of the solution. As an example, Bastin et al. (2019) investigate the hypothetical planting of approximately 1 billion hectares of canopy forests worldwide in places where, according to their work, forests could and should be growing anyway if human influence was to be removed. These trees would fix 205 gigatonnes of carbon annually after they mature compared to an annual human and natural total emission of over 300 gigatonnes relative to a maximum 8.1 gigatonnes annual carbon reduction if the entire world population would turn vegan in 2050 (IPCC, 2019). Their study offers a pragmatic action-oriented solution with the results of sequestering around 66% of current total annual carbon emissions within decades. This massively ambitious paper, with an attainable if simplistic proposition, shows a way forward with quantifiable predicted results, is also the shortest paper (4 pages) reviewed for this thesis. It spends almost no time on definitions or prose but shows a possibility to meet human GHG emissions with substantial sequestration and useful impact on stopping climate warming from reaching beyond a 1.5 C increase before 2100. A lot of people in science are extremely angry about this paper. Not because it is wrong in its quantitative results but more because it offends their values and domains of knowledge (Science, 2019). To my understanding, humans need not only to scale dramatically down carbon emissions but also proactively reforest massive tracts on the planet, recover wetlands and marine habitats to store and fix back carbon that is already in the atmosphere into soil, plants, the seafloor, and the earth's crust. We do not get there by reflecting solely on the past or dialogue our way out of it but must take collectively concrete and immediate action. On the other hand, environmental modernism like this proposal made by Bastin et al. (2019) on massive worldwide reforestation and other similar ideas on a smaller scale are criticised for a technological fix focus, and for not accounting for rebound effects.

Trueffer and Coenen (2012) argue that a mix of solutions are needed, considered, or applied for issues such as climate change mitigation.

*“The future is already here – it’s just not very evenly distributed”.*

(Gibson, 1992)

Rich (2011) brings forward the term “soul delay”. The idea that the human body travels faster than the spirit: that souls cannot move as quickly as the material world and are left behind the body they belong to and must be awaited upon arrival where the mind connects with its past future. Using this analogy from Gibson for something he terms “nature lag”, a situation of the future already being here with us in the form of climate change, rising sea levels, regular natural disasters, accelerating extinction and coral bleaching. But also: cultured meat, reengineered coastlines, the reanimation of extinct species and evolving scientific knowledge. However, that our souls have not caught up yet and do not acknowledge these facts and other more positive realities, such as the regrowth of forests (in some locations) on a massive scale (Doak et al. 2014; Chew, 2015). That many key animal species are showing very robust population growths in an increased range of habitats (Rewilding Europe, 2022). That human ingenuity is to a larger degree than ever focused on fixing the detrimental effects of our existence and renewable energy grids are being built up faster than anticipated (IPCC, 2021). That species extinction rates are possibly statistically exaggerated and ecological diversity is expanding, not contracting when introduced species are included (He and Hubbell, 2011; Sax et al. 2002).

Addressing this contradicting information and or our internal human condition of apparent soul delay, inability to grasp the present and conflicting states of simultaneous apparent catastrophe and success in conservation it is worthwhile to ask the following.

*“Now that we (humans) are a geophysical force of nature with extraordinary information powers, what does it mean to be human in the Anthropocene? And from this my next question is what ‘passion for change’ best equips us”*

(Swilling 2020 p.19)

Deconstructing these seemingly contradictory conservation theories i.e., eco-pragmatic vs preservationist, I argue instead for a case-by-case approach in conservation being needed - based on the available science and the context of each site in question. That both “old” classical conservation and “new” pragmatic approaches are applicable and valid and one does not necessarily annul the other. That there is no need to try to prove anything as a final always-correct fundamentalist orthodoxy to solve all situations and issues regarding conservation and environmental concerns, that all approaches have their pros and cons. Relatively in the case of Skálanes, which has irreversible apparent ongoing soil erosion, 1100 years of agricultural use, a managed eider colony, complete loss of trees by the 20th century and a reforestation program, a prominent non-native plant (lupine) seeded in 1988 which is very prolific, simultaneously beneficial, and detrimental while also without a known removal or disruption management method. Within these parameters, the modern eco-pragmatic approach to conservation management is the philosophy found most applicable there for the time being. With the intent of assisting the ecology and soils to reach the state of becoming self-adapting and becoming a landscape evolving on its own terms. The conservation process proposed in the case of Skálanes eventually, in time, bending back on itself towards a minimal input, naturally driven classical conservation restoration of sorts.

*“Many of the ecosystems such as heath, moorland, and rough grass... it (conservation movement) tries to preserve areas dominated by low scrubby vegetation (and in the case of Iceland coupled with active soil erosion) ... This landscape is cherished by wildlife groups... It is as if conservationists in the Amazon had decided to protect the ranches more than the rainforest”.*

(Monbiot, 2014, p.8)

This raises a mostly philosophical question of why or how anyone chooses a period or state of nature to restore to? For context, a preservationist attempt to restore the area to pre-1988 (pre-lupine) state would be a mammoth task economically and would need a massive number of person-hours, machinery, effort, and energy (GHG). It would lead to the likely result of less biomass, lower

ecological productivity, fewer eventual niches, less carbon sequestration, and fewer ecotones and habitat diversity. The landscape would need hundreds or thousands of years of soil regeneration to reach a state of reorganisation to a level representing of for example pre-settlement ecology. Keeping in mind that Skálanes is only 12.5 km<sup>2</sup> and the remaining 102,987.5 km<sup>2</sup> of Iceland would not be managed to the same extent in the same timeframe. In Murcia et al. (2014) two examples are taken as of where similar projects have worked well in the conventional restoration conservation approach. They are used as an argument of successful restoration conservation versus the vagueness of eco-pragmatic conservation. The cases quoted are the restoration of a bauxite mine in Australia, annually growing by 6 km<sup>2</sup>, and a 0.11 km<sup>2</sup> coastline in California with invasive introduced species. Both have been restored through decades of research and development, manual piecemeal repeated digging and pulling of non-native plants, over a series of years. With the results of comparative communities which are almost intact with a likely change of total recovery, but non-native species are still in all surrounding habitats with annual spot treatment needed to maintain the restored habitat. These cases and the example of theoretical lupine removal from Skálanes show that classical restoration can work but also when looked at in the context of effort and spatial impact when compared to the rest of the planet is also inconsequential in a larger pragmatic view. The reference ecosystem for large tracts of Iceland are mostly destroyed, successions of ecology and biotic interactions will mirror that fact and the addition of introduced species such as humans, grazers and lupine are most likely irrevocable. Restoration efforts are and should thus be a case-by-case evaluation of feasibility, aims and set against the available resources (Belnap et al. 2014).

### **3.4 Eco-pragmatism and Skálanes**

*“Arguing for wilderness for its own sake, you’re still imposing a human point of view.”*

(Cronon, 1995)

Skálanes' management questions conventional conservation paradigms as it integrates human needs with ecological sustainability, addressing cultural variables, deviating from restorative conservation values. Emphasizing instead a blend of classical ecological restoration and eco-pragmatism, the site's contemporary practices focus on increasing adaptability and preparing for climate-induced species migrations. This highlights the need for a paradigm shift in conservation strategies from analogue approaches based on historical norms to adaptive and pragmatic approaches focused on contemporary conditions and future resilience. This challenges some conservation norms, and questions values applied to preserving degraded ecosystems. It underscores the necessity for innovative and transdisciplinary conservation approaches in the face of climate change, discussing the debates around intentional species reintroduction and translocation, emphasising pragmatic, action-oriented strategies and considers unconventional actions as it reflects on a forward-thinking approach.

As an independent conservation site in Iceland, it differs from governmental approaches of managing protected areas. It allows an exploration of the site's pragmatic approach to managing its environment in the classical scope of sustainability, while also considering cultural variables that intersect with environmentalism and natural sciences and presenting new findings and or considering contradictions in science and environmental dialogue. Lastly the chapter ends with a philosophical manifesto based on the above. The management of Skálanes is aimed at a site where people actively interact with nature, live, work, and visit. Without a way to enjoy, understand and study this location it is impossible to understand where an appreciation of its diverse values would come from. This is a divergent model from the values of restorative conservation in an attempt to find an alternative way of living with benign intentions for the area through an input driven conceptual narrative from multiple participants/stakeholders.

That we, the stakeholders work there together, agree on the operation and site is important. Its value for conservation should be higher than if we did not agree, because of our interactions in and with it (Berriet-Sollicec et al. 2022). As it is a space dedicated to science, teaching, and conservation, the collaborators seek solutions by actions and trial, adjusting throughout this learning process. Our work questions the point of where to draw the lines of moderation in our intentional

actions, and the inputs needed for the management of its environment, society, and economy. The assumption for Skálanes is that the impact of actively managing it is a “better than” attempt due to inherent benign and ethical human intentions. That said, we currently do and will make mistakes. The belief is that through these interactions the “wilderness” that exists on site can potentially have an earlier chance than not of their “second nature”. It is an example of a possibility in management and simultaneously a reaction to the conservation philosophy in Icelandic government, questioning if just the epic or distinct visual parts of the country, such as: glaciers, lava fields, volcanos, interior deserts, and the biggest river gorges are only relevant to conservation and therefore society, economy, and all of its natures? Contextually Iceland is defined as having 43% of the top 1% of wilderness in Europe in (Wildlands report, 2022). The report defines the existing ice sheets as wilderness and ignores the human induced deserts and degraded ecosystems as being anthropogenic so long as they do not have a contemporary infrastructure such as roads or power lines. These landscapes are continuously and widely described in public and academic dialogue in Iceland as “true” and “untouched” nature. It is important to keep in mind that in Iceland as in other countries, land use in both protected landscapes and utilitarian sites is debated within circles in the public and professional spheres of divergent stakeholders. The vagueness of environmental terms such as “independent conservation site” and or landscape uses results in differential understanding to different people as per Wyckoff-Baird et al. (2000)

Skálanes as an entity and the work there aims at expanding the spectrum of conservation into areas relating to the Anthropocene as it considers the ever-evolving coastal post agricultural ecologically novel cultural landscapes and parallel sites as being valuable in national conservation thought and praxis. At the same time trying to manage not for the nature that was there, but for what it will be or might need to become, while allowing the ecological processes in place to run their course, with managed assistance. It intentionally does not have the planning definition of being officially protected, its impact is small, resembling a hybrid between an organisation and a movement or a state of protection based on conceptual expression of values and not legal definition. It shows by doing both in theory and praxis, and its philosophy and claim of being an independent conservation site might resonate with some. To others it can be considered

nonsense given the abundance of introduced species on site, its visitor impact or the way it is funded. Trueffer and Coenen (2012) point out that niches such as Skálanes would be acting as either an immature variant of a potential future, or a regime of state while suffering from incompatibility issues between the society, governance, and practices. Due to this, such entities in conservation depend on a nurturing environment to allow restructuring and configuration processes to act and adjust. When coupled with transitions of sustainability or environmental modernism, Skálanes finds itself out of sync with both historic and conventional methods. Therefore, there is a need to acknowledge that the necessary long-term interaction which has taken place with experimentation, exploration and learning is important for the specifics of our “program”. It is also uncertain if it will achieve validation as a hegemonic reality as an alternative “norm”, due to societal changes and rearrangement of values. But being validated is far from being an objective for Skálanes, on the contrary, once it stops being divergent in its evolutionary process in time and capacity it loses a big part of its founding principle of asking questions as an entity of sustainability action.

With the above in mind, there is an important distinction to make for the following text in this chapter related to conservation thought and the study in general. Which is that ecology, biology, geology etc are scientific fields, whereas environmentalism might have elements of science, but it also includes cultural variables such as ethics, religion, politics, and cultural context of everyone, a personal interpretation of nature. Such a claim is counterintuitive to many environmentalists as their belief in the existence of the wild or pristine nature is the foundation for their activism - naturalists can be environmentalists, but the reverse is not necessarily true (Chew, 2015; Castree, 2005).

### **3.4.1 Ecology and Biodiversity**

Management success in conservation, often gauged by biodiversity metrics such as species richness, encounters challenges as ecological paradigms shift. Moving beyond traditional species counting, contemporary conservation acknowledges the interconnectedness of ecological, societal, legal, and economic factors. There needs to be critical analysis of the dynamic landscape of conservation, questioning of historical equilibrium theories, advocating for a focus on habitat ecosystem function, and challenging normative approaches that prioritize undisturbed

ecosystems. As conservation grapples with human-dominated landscapes and the complexities of predicting ecosystem behaviour, there is a need for nuanced, context-dependent conservation strategies. The conclusion, advocating for an adaptable and pragmatic approach to conservation that aligns with emerging scientific insights.

Management success is often measured by its ability to retain or increase biodiversity, usually done by counting the number of species in an area, their variety and variability within political units such as countries. The more found, the greater the species richness is (McDonald, 2003). It is worth noting that this approach alone says nothing about the number of individuals in each species, their rarity, and the state of the ecosystem. Ecology is one of the cornerstones of conservation, and developments and findings in conservation have in turn changed the disciplines of ecology and conservation. It now involves a wider approach, where decisions include societal, legal, and economic concerns (Mulder and Coppolillo 2005). It is a step away from the important process of identifying, cataloguing, counting, and monitoring species. It asks the questions of how species interact in networks and identifies patterns, as opposed to earlier ecological theories which aimed to find the state of nature where all species coexisted in stable predictable hierarchies, equilibrium and interconnectivity with each other and their environment i.e., “the balance of nature”. A state where humans would always negatively tip the scales with their actions tearing down the integrity of the stability (Zimmerer and Bassett, 2003). But early on, multiple scientific findings challenged this theory of proposed equilibrium. Instead, they accentuated the “noisy” variables of instability, and chaotic environmental variables, an example in Iceland being birch and its unpredictable seeding patterns and growth (Óskarsdóttir et al. 2022). This unpredictability was especially noted on large spatial scales in which equilibrium theories were ignored. Instead, these studies show that the disturbance in systems is the key element in the structure of their ecology (Botkin and Sobel, 1975). One of the theories put forward supporting these observations is the “intermediate disturbance hypothesis” proposed by Connell (1978), in which intermediate disturbance of habitats favour niche species which do not thrive in established habitats and disturbance (e.g., fires, droughts, geological events), and help maintain a mosaic of useful habitats with higher species richness. The nature and frequency of the disturbances affects

different species and species composition. This paved a way to reconsider humans and a default viewing of their actions and associated ecological disturbance as a negative. Thus, by this ecological reasoning humans should be included in conservation considerations and these theories contest that all ecosystems are constantly in recovery from their last event of disturbance to the next one. Thus, it is not equilibrium that creates biodiversity but complexity, variation, and disturbance (Castree, 2005; Reice, 1994).

That said, this is not an excuse in conservation or landscape management that anything goes, and nothing needs to be minded since it is all just chaos anyway. There are patterns to be found, key species and habitats to protect and conserve with care. As human dominated ecosystems are now widespread in and outside of conservation areas, declining wildlife and plant populations are a real concern. Studying the interaction of species and systems is a key activity in conservation (Rangarajan, 1993). But the scales of the concerns we are addressing in the issues we face are often unclear. The following is of interest in that context.

*“Species extinction is already at least tens to hundred times greater than it averaged over the past 10 million years.”*

(IPBES, 2019, p. 11)

The quote is from a 1500-page UN report on decline of and threat to biodiversity, prepared by 145 main authors and 310 contributing authors. This assessment is based on the species area model by Wilson (1961). A statistical approach used to model habitat fragmentation, predicting linearly extinction rates. Looking at the quote it is relevant to consider the variables there in: “tens to a hundred times” coupled with “in the last 10 million years”, compared to for example of all Northern Europe being ice bound only 20,000 years ago. He and Hubbell (2011) challenge the general assumptions of the species-area-model. The conclusions of their study were that extinction loss requires greater loss of habitat than previously thought and it also refuted the homogeneity of all species in relation to habitat fragmentation or loss. Their findings are supported by Murcia et al. (2014) and Brook et al. (2003), who argue that the model should be improved to account for greater complexity and unaccounted variables. Such as for example, the

relationship of species richness, spatial mobility of different organisms and the environmental complexity in areas i.e., soil and climate, all of which adjust the outcomes of the linear modelling used hegemonically (He and Hubbell, 2011; Rosenzweig, 1995; Lomolino et al. 2010; Kreft and Jetz, 2007). Thus, one needs to take into consideration that the extinction numbers presented in the quote are just numbers based purely on a statistical approach and not lists with actual species names which have gone extinct. There are uncertainties and limitations in estimations of biodiversity patterns and processes of species extinction.

The assumption that old and less disturbed ecosystems are always of the highest value in all conservation parameters is the normative approach, which creates the notion that anything less than old and undisturbed has a lower value. Still the parameters and how science “counts” dictates the outcomes, as shown by Malhi et al. (2022) who studied energy flows in tropical forest habitats. They found that moderately logged forests, which were also used by humans for hunting, demonstrated a x2.5 increase in energy flow across all species ecologies as compared to an undisturbed one, while still retaining resilience on par with old forest. They demonstrated that disturbance and the greater accessibility in the logged forests created a higher value based on their parameters in aspects of ecosystem services, than the pristine old undisturbed jungle.

The primary focus of conservation management should be on preserving habitat ecosystem function, considering the significance of species and landscapes on a broader scale, regardless of their status as endangered, historic, invasive, or otherwise. Additionally, it is important to acknowledge that the migration of new species into non-historic ranges is a natural process (McDonald, 2003) and although species succession in ecosystems is influenced by chance and past natural history, it should not be perceived as a predictable extension into the future. This is particularly pertinent since the concepts of ecology and biodiversity are human constructs meant to describe and sometimes impose cultural values on nature. Ellis et al. (2010) thus propose that it might be possible to protect and enhance biodiversity even in human-dominated landscapes (anthromes). However, achieving this goal necessitates further research to comprehend the unique features of novel ecosystems, such as landscape and community structure, habitat connectivity, and ecological processes. They also caution that relying solely on past trends and historical environmental conditions

may not yield reliable predictions for the behaviour of these ecosystems in the future.

As a lot of studies in ecology were (and still are) being established through study of degraded or collapsed systems which lack key species, the baselines generated are skewed or even unaware of important variables such as anthropogenic disturbances, or even miss entire species which have contributed to the development of the ecosystems being studied (Paine et al. 1998). Thus, temporal and spatial context is a genuine factor for consideration in management and attempts to recreate historical ecology that is often based on baselines which inaccurately reflect the ecosystems managed in restoration conservation. An effort considered by some to be better spent being focused on contemporary ecological processes and functions instead (Bullock et al. 2011). Contextually what effect might the extinct Icelandic walrus have had on shoreline bird and invertebrate populations at Skálanes (Keighley et al. 2019; Traustadóttir, 2022)? Or agricultural land uses in regard to the natural history of Iceland and its degraded landscapes in relation to impacts on current bird, plant and invertebrate communities? There is ample archaeological evidence around Seyðisfjörður of sheep and possibly some walrus utilisation combined with significant archaeological remains of a 10<sup>th</sup> Century settlement in Seyðisfjörður (Þórhallsdóttir et al. 2019; Traustadóttir, 2022). Since trophic diversity works both vertically and horizontally, we simply do not know and our understanding of the ecology in Iceland is based on studies and population counts with or without those species and associated ecologies.

Terms such as biodiversity and sustainability are both hegemonic terms and ideas which currently do not in themselves solve any issues in nature even if extensively used by conservation professionals in dialogue and print. The inherent agency and human effect of the deconstruction of the language is obvious in the following expressions made by different academics in the same year related to food systems and nature.

Deforested lands and cultivated organic soils cause 42% of emissions, which is not computed in food studies at present. Thus, conserving forests and peatlands from agriculture is important, as is recovering drained sites and revegetating previous forested areas (Poore and Nemecek, 2018).

## Versus

*“There is great potential for using more of Norway's less favourable land areas as grazing pastures for animals. Which will contribute positively to biodiversity by maintaining traditional landscapes and preventing overgrowth” (Silvenius and Bar, 2018, p. 216)*

The latter claim is not inherently wrong if it is based on narrow parameters for anthropogenic landscapes used for grazing in a human value-based context of a ‘correct’ version of Norway. But, as a rule, ecological food webs and ecosystems have more stability when there is greater connectivity and more channels from which energy flows and in general more biomass and bigger plants equate to that.

For example, for management of biodiversity at 65.3°N while including ecology and ecoservices, worldwide latitudinal species diversity reduces as the patterns of diversity are studied further north and elevationally higher in landscape. Areas with low precipitation also follow this pattern, which is evident in mammals, plants, birds, and most marine organisms (McDonald, 2003). Increased biodiversity is thus not necessarily a benchmark for management success in Iceland unless it is supported by relevant ecological or climate induced changes.

It is important here to emphasise that the intent is not to confuse the science behind estimated extinction rates, or how biodiversity is measured, because in reality many species and wild animal habitats have declined by half from 1970-2010 (Living Planet, 2022). In addition, the intellectual debate regarding constructivism and non-constructive, and who has hegemony over subjects of science and truth is not useful for the sake of environmental issues (Proctor, 1998).

It is clear from this chapter that natural science and its connection to conservation is complex and constantly evolving as new findings challenge traditional assumptions. A more pragmatic and nuanced approach to conservation on a case-by-case basis is necessary. It is one that considers complexity, variation, and disturbance and is adaptable to changing scientific findings and data.

### 3.4.2 Native and Non-Native Species

In the dynamic context of Iceland's evolving ecosystems, it is worth considering if a more diverse approach to management and theoretical discourse in Iceland should be considered regarding restorative and modernist conservation. If one examines the current conservation paradigms, this chapter urges for a nuanced and inclusive approach that considers both native and introduced species. It emphasises the need for management strategies based on contemporary knowledge, challenging traditional assumptions, and aiming for functional ecosystems with increased ecological function in conservation sites.

At present, Skálanes is a sub-Arctic ecosystem made up of composite native and non-native species ecology, on a site disturbed by human activity which cannot nor should be considered pristine. In Iceland as in other places in the world as opposed to a binary approach of bad and good, the introduced species should be classified on a spectrum of different impact categories. Their effects range from being beneficial, neutral, to detrimental, varying between categories depending on ecological context (Kourantidou et al. 2022). When utilising available information and experience Sax et al. (2022) argue that the objective of management should be considered to focus on which species are detrimental to management goals on a case-by-case basis. They use of the concept of “native” in the context that nature has embedded: biology, politics, ideas, implications, and false extensions. The Darwinian assumption of adaptation as causal principle transformed into the idea that anything native is in a perfect state is a fallacy, since evolution is only a principle of “better than”, not optimisation (Gould, 2002). Introduced species sometimes perform better than native species since their evolution performed better so far due to the chaos and randomness in nature, ecosystem evolution, transportation, climate change, disturbance and pure contingency. Native species are therefore simply just the species which found their way first, found their footing in given geography and are not necessarily the “best” forever (Gould, 2002; Dial et al. 2022).

Non-native species are often cited as one of primary drivers of extinction worldwide (MacArthur and Wilson, 1967; Wilcove, 1999). Chew (2015) highlights that the data in MacArthur and Wilson (1967) and the follow up studies which support the claim that invasive, introduced species are the second most active

driver of species extinction on the planet, is limited in spatial and temporal scale. As a result, the statement has become canon in invasive biology and conservation papers, cited repeatedly, seeming to have a life of its own, circulating in politics, within conservation and in general environmental public dialogue. Instead, the statement that invasive, alien, or introduced species cause extinction as a general primary rule is yet unproven by data, unspecific, and not useful (Chew, 2015)

A case of soul delay?

Furthermore, the impact of non-native species on native biodiversity can be positive or neutral in certain cases. Non-native species can provide new food sources for native species, promoting pollination, or restoring degraded ecosystems (Kueffer et al. 2013; Vitousek et al. 1996). Complexity, disturbance, native species interaction, and natural disasters are found to be more significant causes of extinction than introduced species (Kueffer et al. 2013; Vitousek et al. 1996). Unaccounted irregularities, chaotic events and disparities found in the physical world need to be kept in mind and accounted for in management. Through these factors species diversity is also positively correlated with the diversity of habitats as ecotones, or the fringes of two or more different habitat types where they meet or merge. They support divergent behaviour and speciation due to the complexity of the habitat edge effect (Murcia, 1995).

Dialogue about conservation and introduced species between professionals and members of the public has to do with an individual's environmental background and cultural ideas, combined with knowledge and understanding of ecology, personal ethics and perceived baselines. This boils down to what entails the right version of landscapes and nature. Wotton and McAlpine (2012) produced a contextually interesting study on invasive plant management. They investigated if alien weed control via glyphosates and herbicide application achieves necessary conservation goals, such as maintaining biodiversity and restoring native ecosystems. They questioned the fact that many conservation site managers applied weed control without measuring the management outcomes. They found some success stories and others with less or no measured results. Their study shows that management of weeds is highly variable in success between sites, application, and species in question. Interestingly, the extensive use of herbicides

for ecological management in conservation sites was not questioned once in their paper.

Sax et al. (2022), quoting Fischer et al. (2012), state that Europeans have little understanding to whether organisms are native, but more to their aesthetics. On social media there are plenty of pictures of Icelandic ponies standing in purple lupine fields posted by tourists. There are already a considerable number of introduced species in the country due to historical, utilitarian, or accidental reasons and animals missing either completely or in parts of Iceland where they used to exist. Some have gone extinct while others have been hunted out of their habitats. To name some; white tailed eagles (*Haliaeetus albicilla*) which are only endemic now in the west and due to isolation are genetically threatened by inbreeding (Riis Hansen et al. 2023), the now extinct species of the Icelandic walrus (*Odobenus rosmarus*) (Keighley et al. 2019), and the great auk (*Pinguinus impennis*) hunted to extinction all over the North Atlantic (Bengtson, 1984).

The emphasis on native species and how they are counted and monitored while excluding introduced species from ecosystem ideas and all their effects as only being detrimental is not useful. The words *weeds* and *vermin* are human terms, where the same organisms are found in less disturbed settings they are usually not as dominant as when closer to human settlements and land uses. The same applies for example to lupine on a landscape scale in Iceland. It does exceptionally well for itself wherever humans have already overexploited and degraded the ecosystems.

*“Man is by definition the first and primary weed under whose influence all other weeds have evolved weeds are not the others. Weeds are us.”*

(Pollan, 1991, p.112)

Lupine is already in Skálanes and Iceland, its application as a conservation tool is just a large-scale ecological method of “composting” the landscape. Known management removal methods do not apply to it as it has proven to be indestructible in Iceland. Therefore, management at Skálanes must plan for the succession stages post lupine, expecting that the ecology of those sites will gradually evolve towards increased habitat fragmentation and taller plants such as

angelica or a more forested ecology. As productivity increases, so does biomass, carbon, and nutrition content in soil (Lehnhart-Barnett and Waldron, 2020; Aradottir, 2002), and with that the opportunities for increased trophic connectivity and trophic webs change in time and space. A U.N. report on land degradation and restoration efforts such as the lupine states that actions can and should be taken in an integrated approach. The report emphasises that every step and every contribution in restoration matters, and that the effects of worldwide large-scale land and soil restoration could have wide scale positive influencing on wild areas, biodiversity, food security and carbon offsetting (UN, 2022).

A related topic of consideration is carbon sequestration which is a modern environmental issue, not accounted for historically in the writing of the classical conservation camp. Modifying environmental factors to accelerate natural succession for ecosystem services is important when facing habitat loss with ongoing soil erosion and associated carbon loss which could take up to centuries to stabilise without assistance. Degraded overgrazed ecosystems are often the most difficult to recover, but usually have the highest capacity to store the most carbon (Wuerthner, 2015). Lupine is not just preventing soil erosion and improving its fertility with nitrogen, it is also storing carbon efficiently compared to the native habitats and it grows most prominently in areas in Iceland where there is increased potential to store carbon.

The following values show the respective measured ranges of carbon sequestration found in Iceland by different ecological setups of plant systems; they are still being calibrated in quantity and time by ongoing studies but there is a clear picture of relative differences and values (Snorrason and Brynleifsdóttir, 2017; Teitson, 2022).

- Grasslands 1.3 – 1.88 tons carbon per km<sup>2</sup> per year.
- Birch 2.7 – 3.4 tons carbon per km<sup>2</sup> per year.
- Lupine 3.2 - 5 tons carbon per km<sup>2</sup> per year.
- Introduced black cottonwood 23 tons carbon per km<sup>2</sup> per year.

These values have implications for management policies and need to be taken into consideration for expected shift of biomes poleward and both short- and long-term considerations for expected ecological succession when compared against

curbing and fixing carbon which is the main driver behind anthropogenic climate change. Icelandic soils can contribute to fixing carbon if set under a restoration plan (Arnalds, 2012), and this should be considered in context of restarting lupine seeding (Teitson, 2022). As desertification and soil erosion in Iceland is a human induced atmospheric carbon source, then for conservation reasons restoration of such areas should be of the first priority (Eddudottir et al 2020).

Due to the ecosystem of Iceland having evolved in isolation, they are sensitive to introduced plants and animals (Arnalds, 2015; Schmalensee, 2010a). Since the settlement of Iceland several thousand plant and animal species have been imported. Of these, seven have been identified as invasive: the American mink (*Neovison vison*), nootka lupine (*Lupinus nootkatensis*), cow parsley (*Anthriscus sylvestris*), Spanish slug (*Arion lusitanicus*), heath star-moss (*Campylopus introflexus*), white tailed bumblebee (*Bombus lucorum*) and European physa (*Physella acuta*). Paradoxically Arnalds (2015) adds that reindeer (*Rangifer tarandus*) introduced in East Iceland are not considered an invasive species, as they are an important part of the rural economy (Arnalds, 2015). The main drivers of ecological degradation in Iceland, sheep (*Ovis aries*), are omitted by a value driven choice based on economic rural importance, or not considered at all out of a possible fixation on baselines, or due to cognitive dissonance (Kourantidou et al. 2022). This suggests a preference or bias towards a classical preservation conservation or ecology, using the 20<sup>th</sup> Century as a baseline in the consideration of what is welcome and what is not. Iceland has a high rate of desertification with associated habitat loss (Arnalds et al. 2001), and restoring soils and revegetation is a valuable tool for protecting species and amending ecosystem services. The combination of soil erosion and degraded ecology instigated the introduction of lupine, after a trial period by the soil conservation agency of Iceland. It is a self-propagating nitrogen fixing pioneer plant, which has been used extensively in Iceland to revegetate human-made deserts and degraded sites. Case studies and anecdotal evidence show that as it replenishes the soils it grows and eventually alters its own preferred habitat and is usually eventually replaced by high growth plants such as willows, trees, and angelica (Aradottir, 2002).

At Skálanes, lupine was introduced in 1988 as part of a national campaign aimed at citizen to stop desertification, establish vegetation and fix nitrogen in

depleted soils. In Iceland it has turned out to be disputed for assorted reasons as it transforms landscapes visually and ecologically. It is emphasised that it is prominent at parts of Skálanes in the context of this thesis. It is highly economical for conservation in its service as a self-propagating erosion stabiliser, creating more productive soils and needs minimum input apart from simply manually throwing out seeds once in a location. It is also invasive and successful, altering the succession of plant and animal ecological systems where active. Its use is cautioned due to its success or invasive traits and in some places unsuccessful efforts are in place to eliminate it in protected areas (Arnalds, 2015). Davíðsóttir et al. (2016) show that previously eroded but later re-vegetated areas (such as by grass seeding, fertilised, or seeded with lupine) have a much higher number of birds and invertebrates than untreated degraded areas. Iceland has a high number of breeding waders, and Arctic species which are dependent on low or sparse vegetation, whilst areas with more robust vegetation favour species which are less threatened worldwide and are considered generalists species. Higher plant mass in Iceland can mean there are pressures in some cases on bird species such as whimbrels and golden plovers which are rare worldwide or threatened.

Davíðsóttir et al. (2016) showed that different methods of revegetation produce alternating communities of birds, plants and invertebrates and correlations of invertebrate numbers and stages of succession of ecosystems as revegetated sites developed with time and that the managing for more vegetation showed positive effects on species diversity.

Interestingly sheep, reindeer and lupine were all initially introduced for utilitarian and economic reasons and in the case of lupine for conservation. All have inherent economical values, but the sheep and reindeer are omitted from lists of causing possible detrimental biological effects. This said, deer culling involves a substantial amount of work, thousands of kilometres of travel with associated carbon and material input directed by the Icelandic government, with the intent of preventing overgrazing. This ties again to the idea of shifting baselines where the pre-regenerated and degraded areas in Iceland represent populations of animal and plant species that have calibrated to a landscape affected by induced degradation and soil loss. Aradóttir and Halldorsson (2013) exclude all non-native species from their study, many introduced for reasons of food production, commercial silviculture, and erosion control. By default, studies

then neglect to consider any potential beneficial impacts introduced species might have and assume there are only costs or negative effects of all non-native species (Aradottir and Halldorsson, 2013; Kourantidou et al. 2022).

Despite this, Sax et al. (2022) advocate for a more open-minded approach of simultaneously assessing the multiple negative and positive impacts of non-native species. They emphasise that a binary view of introduced species as either simply good or bad is inherently limiting. When considering native and non-native species, their assumed detrimental and positive impacts should be considered simultaneously as they can have negative, neutral, and positive impacts within one species across biodiversity, pollination, as a food source, or restoration (Sax et al. 2022; Kueffer et al. 2013). Non-native species worldwide have had in cases a large positive impact on regional biodiversity as there are many more species found everywhere than where previously, environmental policies and their practical application need to consider this carefully as erroneous management in the context of introduced species being by default detrimental can be completely misguided (D'Antonio and Meyerson, 2002; Sax et al. 2022).

### **3.4.3 Changing Climate**

*“We have become the major drivers of extinction and also probably speciation. So pervasive is man's impact that we live in a new geological epoch - the Anthropocene... Atmospheric warming, ocean warming, ocean acidification, sea level rise, deglaciation, desertification, eutrophication... ... Humans are producing no analogue climates and ecosystems, a whole no analogue future.”*

(Kolbert, 2021, p.7-8)

This section serves as an introduction to the realities of the 21st Century regarding the relevance of climate change about conservation, and what it entails for consideration in management.

Currently the planet is expected to warm up to +1.5°C from pre-industrial levels by 2050. The effects of this warming are amongst others, latitudinal poleward shifts of increased average temperatures, changes in precipitation patterns, and biome and ecoregion shifts (IPCC, 2021). It is, however, becoming more likely that the warming will exceed +1.5°C by the end of the 21<sup>st</sup> Century (IPCC, 2023), whilst the IPCC does acknowledge that truly apocalyptic

anthropogenic climate warming, drawn from the earliest predictions, now looks less likely due to ongoing mitigation factors (IPCC, 2021). Still, any reduction in carbon emissions and or sequestration that is achieved has a lag of 20 years until registered in curbing climate change. Meaning that in a best-case scenario for the future the warming will temporarily overshoot before the climate stabilises. If the planet reaches 2°C of warming it will plot a course to completely non analogue climate and environmental disruptions not seen for the last hundreds of thousands of years. But if all the mitigation efforts to cut GHG emissions are carried out to their fullest possible extent, reversing these trends will be possible, stabilising the warming at well below the +2°C benchmark (IPCC, 2021).

A consideration for Iceland is that the Arctic is warming up to about two times faster than the rest of the planet, a phenomenon known as Arctic amplification (IPCC, 2021). An even more serious observation is found by Rantanen et al. (2022) where they state that Arctic warming is up to four times faster since 1979, based on their climate modelling. In decades, parts of Iceland will be subject to conditions more suited to harbouring a deciduous Caledonian forest rather than the current tundra habitat. By around 2050 the temperature in Iceland is expected to rise to between 1.3 and 2.3°C (Iceland Meteorological Office, 2018). This dramatic warming will exacerbate soil erosion, increase precipitation, shift ecoregions, increase photosynthesis with longer growth time of plants and increased rates of carbon and nitrogen fixing.

Warming climates will influence species composition, instigate regime changes in ecology, food webs and shifts in biomes and thermal distribution ranges of species. This can happen non-linearly and quickly in regime shifts when a tipping point occurs. These changes are irreversible due to the new environmental parameters which instigate them in the first place (Heide-Jørgensen et al. 2022). Conservation must therefore face the question of what state in the past to restore to and resist the urge to manage for a historical natural ecosystem, which is going to be irrelevant due to climate changes. Instead, it is pertinent to focus on function and resilience based on contemporary and future conditions. Novel species composition and abundance driven by climate change will create and force choices that conservation must make decisions on that have no analogy to the past (Kolbert, 2021), entailing a future which needs tough decisions made with associated resulting changes in conservation sites. Where entrenched ideas

and values in those regards will be forced to look beyond regional and national levels of concern as they will need to consider organisms displaced by the climate to be able to continue to exist in new geographic ranges. This natural and assisted migration of species will cause unintended and unforeseen ecological disturbance (Dalrymple, 2022). While some scientists focus on areas where species may be able to survive, others are looking for places where species can move from one habitat to another. However, even species capable of adapting to the current rate of climate change may face challenges due to human alterations to the landscape and additionally and there is a risk of misinterpreting where species should relocate (Hoffmann and Sgrò, 2011). The fossil record also demonstrates that past periods of climate change resulted in significant changes in species ranges and abundance, often forming ecosystems that no longer exist. It is challenging to predict how species, ecosystems, and entire ecoregions will respond to current climate change, especially when considering the impact of human interference (Yale, 2021).

The following examples of ecological adjustment to climate warming are a case of concern for classical restoration conservation but similarly a conundrum where they are also cases of population growth and or range adjustments of animal and plant populations. These changes are causing a cascade of unforeseen new environmental problems if an emphasis on perceived stability and a historical baseline population are the basis of studies or conservation philosophy.

- In the seas off south-eastern Greenland a drastic ecological regime shift and associated trophic cascade has been observed. Increased sea temperatures have caused a reconfiguration of fish, krill, plankton species composition and abundance, and High-Arctic species such as narwhal, walrus and arctic cod have been supplanted by much more numerous “southern” whale- and boreal fish species. This is a mass multispecies migration into a new range where those species have never been historically observed and are now there in considerable biomass and species numbers. A poleward shift of an entire saltwater ecoregion. The influx is from neighbouring areas further south which in some cases now

show a considerable reduction in the species now found off south-eastern Greenland (Heide-Jørgensen et al. 2022).

- In Svalbard, the native reindeer population has grown as their diet has adjusted due to the warming climate. Less snow cover in winters and more grass dominated habitats due to higher summer temperatures has benefitted the reindeer with a longer and more nutritious grazing season causing the population to double from 1995 to 2012. The reindeer have thus shown an ability to adjust to changing local climates, by adjusting their diet to include 30% increase in grassy plant species during the study period of 1995 to 2012 (Hiltunen et al. 2022).
- Dial et al's. (2022) paper on the long-distance northward migration of white spruce in Alaska is of note. The species' historic habitat range has been established and stabilized since the Younger Dryas, but now previously unknown evolutionary traits have been observed where the range is shifting northbound extremely fast. The individuals in the new northerly ranges are growing differently, taller and become sexually reproductive earlier than the Krumholtz parent population further south, indicating some hope for plant species to overcome the changing climate, even surpassing physical barriers such as mountain ranges. As they genetically possess the ability to adjust their ranges to fast changing climate as they did last time 12,000 years ago at the end of the Younger Dryas.
- In the Antarctic, recent and substantial growth in fur seal populations and increase in habitat ranges due to climate change and a recovery from historic hunting has been observed, causing unprecedented vegetation damage with trampling and over-fertilisation by faeces in their recently expanded ice and snow free terrestrial colonies (Convey and Hughes, 2023).

These changes are but an expression of ongoing widespread readjustment in Arctic biology which is undergoing transformative processes leading to non-reversible alternative states of ecosystems. Since these changes may not be

apparent until a tipping point is reached, there is a pressing need for adaptability in local and international conservation management. Transitioning biomes demand diverse approaches, extending beyond the scope of existing protected areas, as some of these sites may no longer be suitable for safeguarding the intended ecosystems. This could undermine the original reason for conservation designation sites if they are meant to agnostically preserve a system that will migrate outside its boundaries (Yale, 2021). This is supported by Dobrowski et al. (2021) who show when coupled with anticipated climate change of up to +2°C and using current analogies of biomes and ecoregions, 54% of terrestrial land on the planet is expected to have a different ecoregion classification. Iceland is currently classified as a northern latitude tundra which in their study is found to be overrepresented worldwide comparatively in protected areas to other biomes. Tundra ecoregions are also expected to have some of the highest likelihood of changing from their current ecoregion classification and be replaced partially with a more temperate set of environmental parameters. These predicted changes mean that conservation values, methods and parameters for success might not be able to draw upon previous normative approaches. Not only is the planet going through a cathartic transformation but so is also the conservation movement as it is in some way unable psychologically to deal with the realities presented in these contemporary issues and the predicted challenges of the future (Hobbs, 2013).

Analog approaches to conservation will be unable to adjust as they are based on the past and current climate. The current changes are towards nature with no analogue, and are happening already worldwide, necessitating a pragmatic and realistic approach focused on contemporary conditions and future resilience. These changes, driven by climate warming, are causing widespread readjustments in marine and terrestrial environments, with species composition and abundance undergoing rapid shifts. As these processes may not be discernible until reaching a tipping point, conservation strategies must extend beyond traditional protected areas and prioritize maintaining region-wide adaptability and providing migration corridors for species.

### 3.4.4 Assisted Migration and Translocation of Species

The previous passages on natural history, sustainability, natural science, changing climate and management have built up a foundation to approach the topics of intentional reintroduction or translocation of species. This is a pragmatic transdisciplinary action-oriented approach in conservation which is useful since it allows for a wider approach of considerations as opposed to a single discipline of science. Dalrymple (2022) states that restoring or maintaining current systems will not be enough in the face of climate change and anthropogenic pressure on nature, and that reintroduction, ecological replacement and assisted colonisation of organisms will be needed to be considered to avoid permanent species loss and to support functional ecosystems. A controversial proposition to some but since the historic origin of the species in question will be outside the current or historical ranges, unintended consequences are to be expected when translocated (Dobrowski et al. 2021). Hobbs et al. (2009) acknowledge that such ideas are countered by people who claim or believe that they are a deviation from established ideas in the field which aim towards restoring or maintaining original systems. Dalrymple (2023) objects to classification of conservation methods or ecosystems being unnatural if in any way altered by humans. The lupine, tree planting and sheep grazing being obvious examples to consider in such a manner in Iceland. All have uses to humans while also having multiple different effects on the landscapes they thrive in. While classical restoration approaches do reach well beyond conservation in current and even proposed protected areas, they in themselves do not represent the complexity nor abundance of species or habitats that need to be maintained for the anticipated climate warming. Just as changes in temperature and precipitation associated with anthropogenic climate warming will push species out of their ranges or contract them (IPPC 2023; IPCC, 2021). Climate change will transform ecology, species abundance, and distribution ranges, and is already creating novel ecosystems and regional climate conditions. Conservationists need to invent and implement tools quickly and efficiently to assess, plan and carry out the needed actions to prevent species extinction. For protection of biodiversity, protected areas are and will be vitally important and their role in nurturing ecosystems has been shown to be critical, enforced and influenced even further by human actions (Dobrowski et al. 2021). Dalrymple

(2022) and Bullock et al. (2021) emphasise that prioritising for the rarity of species should not necessarily be the deciding factor in choosing which to translocate but their ecological functions in their new range as ecosystem successions are often based on previous species and their interaction and internal and external inputs outputs- and natural history.

Hobbs et al. (2009) acknowledge that data and findings from all over the globe show how deeply changed nature is by human actions. This situation requires a consideration of deviation such as translocating species, from the normative and entrenched values which predominate in conservation. They wonder whether some of the lack of will by these entrenched groups is due to mental denial associated with their perceived loss of species, nature and ecosystems which in some cases are due to ongoing changes in nature, are irreversible and or caused by external factors out of their reach (Hobbs et al. 2009). This brings forward the notion of emotional stages of grief as being a contribution to some conservation professionals' inability to reconsider their values based on the eco-climatic reality facing them (Hobbs et al. 2009).

In face of the irreversible changes in our biomes, climate, and species distribution the inability to acknowledge this can be classified as a human denial of reality comparable to climate change denial. Objective reality exists, it is just questionable how well humans can cognitively distance it from their subjective based values. The fact is that conservation needs to incorporate the realities of anthropogenic climate warming, and deal with it as a discipline in a pragmatic vein. Different demographics need tailored messages about food and sustainability to create the necessary impact (Kahan et al. 2012; Rapley et al. 2014; Attari et al. 2010). The same applies for academics and professionals in conservation who are in a state of selective climate change denial.

The last white-tailed eagle seen in Seyðisfjörður was shot from the front door of my current home in 1904. It was considered a heroic act at the time and made it to the local newspapers applauding the shooter. White-tailed eagles were systematically hunted to regional extinction in Iceland in the 19<sup>th</sup> and early 20<sup>th</sup> Century. Regional assisted reintroduction of them to the east coast might have interesting and varied trophic cascades in nature, society, and economy. If nothing else, the application of the knowledge generated in this thesis and the existence of Skálanes to campaign for a reintroduction of them as an exercise in wrestling with

the government and various stakeholders might be just enough for conservation dialogue to progress and discuss new realities. Considering in the vein of assisted migration, Skálanes could apply to the government of Iceland to import white tailed eagles from Norway and release into the wild, with the intent of increasing their native range to a previous historic state. This could be reinforced by the reasoning that it would add genes to the genetically challenged domestic white-tailed eagles as per Riis Hansen et al. (2023). The fact that Skálanes has a sizable eider colony would help confuse the dialogue through deconstruction of perceived financial gains as eagles prey on eiders, negatively affecting the income from the eider down collected on site. Comparatively, on the island of Mull re-colonisation of white-tailed eagles has brought an annual £5 million to the local economy (BBC, 2011). Something similar could be used as an incentive for tourism in East Iceland and would still be worth considering compared to the currently traditional subsidised rural activities of sheep and dairy. The trophic cascades of ecology on economy and society are unpredictable but can be positive. This could create a framework by legal precedence of subsequent applications for other species, through the action of querying the eagle's translocation with the government, conservation professionals, the environmentalist camp and the public about processes and application of reintroduction. Skálanes could raise awareness, create dialogue, and bother a lot of people with "applied" legally supported bureaucracy to pave a way onward with the purpose to ask the follow up questions of more exotic species which might need to be addressed subsequently for assisted migration, seeking refuge from climate change.

Considering a rapidly changing environment, it is essential for conservation and restoration efforts to embrace new and innovative strategies. However, these strategies must also be mindful of potential impacts and ethical implications (Hobbs, 2013). Hobbs (2013) points out that conservation and restoration conservation are young disciplines and that the dialogue about means, methods and policies should be open and not limited in a conversation by professionals involved as latest information and data is presented. Specifically, they emphasise and quote multiple studies in topics such as novel ecosystems, reintroduction, and translocation of species and or ecosystems reacting to altered conditions. Translocation of species is the intentional re- or introduction of an organism aimed at preserving it in a new, re-establishing or a completely new location to save it

from extinction. It is undertaken on a case-by-case basis and with a combination of urgency in decision making and needed assessment of its viability, a cautionary approach cannot be used to stymie decisions that need to be taken. The urgency for unnaturally fast human assisted migration of species due to climate change might increase the use of this method in conservation worldwide with the anticipated mix of mistakes and success stories. The translocation of species with conservation intent is an important topic but also contested, with an argument that the focus should shift from what historical species are in a location to what ecosystem services are needed and how to work in the reality we now face in conservation.

Continuing along the vein of assisted migration, the warming climate until at least 2100 will transform the landscape into suitable habitats for animals and plants which are common elsewhere, including animal species such as: moose, otters, snow hares, beavers. All of them are charismatic, relatable, and not really that exotic for the geography of Iceland. By applying for their assisted migration, one could continue to expand the realm of possibilities, ask questions, and generate needed dialogue for the future. Finally, when viewing eco-modernistic environmental landscape management, the utilisation of high-tech applications such as selective breeding, gene splicing, nano robots, and weather control seem farfetched from the traditional environmentalist's idea of conservation. But these are already being utilised or considered in projects to maintain ecologically important sites in face of external human induced pressure (Rich, 2011). For management of species in Iceland, a possibility exists with applied genetics. An assisted migration from the past, to try to reanimate extinct species such as the Icelandic walrus (*Odobenus rosmarus*) and great auk (*Pinguinus impennis*). An idea and a hypothetical plan of action where conservation modernists and preservationists could meet in a strange union of technology and the past in restorative ecology.

In the context of conservation management, we do not know exactly which species can continue to exist in their current habitats with the predicted climate change. If they need to migrate, they might need decades of habitat evolution to be in place to be prepared for them. Biological systems might take decades to develop for a

migration that takes only a few hours if needed to be translocated intentionally by humans. The same applies to human systems such as government and conservation entities in dealing with these concerns. They might need some gardening of sorts to assist in their evolution in face of these challenges presented and Skálanes can experiment in action and philosophy due to its independence to facilitate and help create a framework and precedence by official enquiry.

### **3.5 Conservation at Skálanes**

Succeeding is a discussion on the ecological and cultural characteristics of Skálanes, an isolated independent conservation site on the east coast of Iceland, emphasizing the interconnectedness of nature and human activities. The justification for conserving Skálanes is explored, highlighting the diverse values, including landscape beauty, ecological potential, cultural history, and social and economic impact. The narrative delves into the contrast between the traditional national park model in Iceland, influenced by English-speaking conservation founders, and the alternative independent eco-pragmatic approach adopted at Skálanes. The author advocates for a more contemporary and comprehensive conservation strategy, considering local conditions and the symbiotic relationship between nature and culture. Finally, it addresses broader philosophical questions surrounding human intervention in nature conservation and the need for interdisciplinary collaboration and adaptability in conservation practices.

Located on the east coast of Iceland, Skálanes is relatively isolated, situated on a peninsula that juts out into the Atlantic Ocean. It has rugged landscapes, diverse wildlife, and a rich archaeological and cultural history. The peninsula and mountain range above it is home to a variety of habitats, including, shoreline, wetlands, grasslands, heathlands, and cliffs, which support a range of plant and animal species. Some of the wildlife that can be found there includes arctic foxes (*Vulpes lagopus*), reindeer (*Rangifer tarandus*), seals (*Phoca vitulina*), and numerous bird species, such as puffins (*Fratercula arctica*), kittiwakes (*Rissa laridae*) and arctic terns (*Sterna paradisae*). The site is also an important cultural site, with evidence of human habitation dating back to the settlement of Iceland in 870 CE. The area has been used for fishing, farming, and other human activities for centuries, and there are over one hundred historical archaeological sites and

visible remains of structures there. Currently Skálanes is a popular destination for students, scientists, nature lovers and outdoor enthusiasts.

The justification for conserving Skálanes rests on a combination of the perceived beauty of landscape, species composition, potential to ecologically evolve, its social and economic impact on the nearby community, the big bird colonies, public and scientific outreach and lastly the various potential study subjects for resident scientists and students. Basing all conservation on either economic/social values or a “true” nature to preserve is too narrow a focus and can endanger sites and places where those values and parameters cannot be “found”, making sites seem unfit or undeserving for any reason for conservation consideration for example being too modified by human actions, as Skálanes is justifiably based on certain values and views. Considering that the writings of some of those involved in conservation address the spectrum of stakeholder’s agency in nature conservation and the inhabitants of nature conservation areas being intertwined and compatible under the guise of nature utilisation by ecodevelopment (West and Brechin, 1991; Daly, 1977). Nature protection and conservation are human endeavours, and they need an agent or multiple ones depending on context for them to happen and maintain on a site where they have not previously been considered. All these factors mentioned, and the agency of the agents present influence the choices made about its management and evolution.

As might be evident by now, my stance on conservation in Iceland is that of a moderate eco-pragmatic, an environmentalist intent on mitigation and to be a positive conservationist. An engaged constructive realist as is shown with my action and agency of being the founding director of a “NGO”-company, set up to support a vision for conservation, teaching and science, managing a 1250 ha independent nature reserve and field centre for 18 years. A community-based entity with multiple local and international partners, input/output networks of academics, businesses, local community, and regional politics. Roughly compared in management to categories IV and V on the IUCN list for protected areas i.e., conservation through management and intervention of land and seascape with recreation, tourism, field centre and some utilitarian land uses. The operation supporting a curation and preservation the local history and cultural landscape using natural history, oral and written sources, with a significant emphasis on

archaeological research. Through the work at Skálanes, it encourages community development, education, research, and wildlife and landscape conservation to the best of its ability. Our outreach efforts, involving students, faculty, and other visitors, aim to instil pride in the work conducted at the site and offer them personal inspiration. An example of bottom-up conservation, growing from activist roots. An alternative management to the domestic national park system's perceived lack of recognition of the 21st Century anthropological landscapes existing all over Iceland. By assisting the multiple natures of Skálanes and their adaptability and output with direct management, believing that it will in the long-term sort itself out on its own terms, but it can do with some help in the meantime.

Founding it as an independent conservation site was in some ways a response or a question set towards the Icelandic governmental national parks which draw on the influential U.S. Park systems of natural and pristine areas (Sæþórsdóttir and Ólafsdóttir, 2022). Up until 1947 when the Everglades National Park became the first U.S. national park established solely to protect ecosystems as previously parks in the U.S. had been founded around spectacular sites. The Everglades was the first which did not have the largest trees, deepest gorges or highest peaks or any similar landmarks. Smith (2000) cites Runte (1987), who stated that national parks based around natural wonders were "postcard national parks", created mostly for economic and social reasons. That historically the boundaries of parks almost never considered the ecosystem and landscape units that exist within them. Instead, they were left behind by administrative boundaries, based on land ownership, sizes of nearby urban areas and so on. Thus, large groups of organisms within the ecosystems that were really needed by them ended up outside the protected sites, highlighting the need for a comprehensive and ecosystem-focused approach to establishing protected sites, ensuring the relevant organisms and ecological processes within the larger landscape are considered. The current and historical emphasis on conservation in Iceland is influenced by rhetoric from the canon of English-speaking founders of the park conservation movement in North America such as Aldo Leopold, Henry Thoreau, and John Muir (Sæþórsdóttir and Ólafsdóttir, 2022). For Iceland it begs the question of its relevance to site specific national and contemporary conditions and issues. The philosophies put forward by these men were formulated on a different continent at a time in human history with completely different parameters of

knowledge and context of ecology, energy systems, climate change and a much smaller human world population. Like the ones in the U.S., the Icelandic governmental parks have spectacular scenery and embody “wilderness” devoid of perceived human impact but can also be summed up as: deserts, mountains, lava fields, glaciers, volcanoes, canyons, and landscapes often representing ecologically degraded and eroded overgrazed highlands. Sites where there was also often little relative economic use found in the 20th and 21st Century when they were founded, i.e., classical North American postcard parks plastered onto Icelandic reality. Their current management largely ignores the extremely degraded human-induced ecology present in large tracts of their areas, and it can be questioned if within them there is even any classical ecological restoration work carried out at all. Outwards, visitor management seems almost the sum of their policies and work. Sæþórsdóttir and Ólafsdóttir (2022b) point out that in the case of nature and protected areas in Iceland as a resource, the use of it for tourism creates a paradox where the attraction can deride the sites of their original attraction. In a survey, tour operators were asked about their perceived anticipation for a possible national park created in central Iceland. Of those asked 49% were negative toward the proposal and only 5% of all survey participants anticipated improved natural protection of the sites (Sæþórsdóttir and Ólafsdóttir, 2022b). The same percentage of 5% expected better infrastructure and less than 4% that control of tourist traffic in the park would improve or be controlled in a positive manner. This shows a gap in difference of perception of parks and different stakeholders. As a veritable case of a search for the Garden of Eden in the traditional North American and by default Icelandic model of parks is that they supposedly preserve unspoilt nature, maintain the heritage for the future and the preservation of historical sites. While simultaneously in Iceland a vast majority of influential stakeholders are not sold on them being actually successful in conservation, infrastructure development nor controls of visitor impact.

### **3.5.1 Beyond Binary Thinking in Conservation**

The following chapter addresses the dead-ends of binary thinking in conservation literature and encourages instead for interdisciplinary collaboration, participatory

engagement, and pragmatic decision-making. The emphasis is on the importance of action over adherence to a particular theory.

Parks are not isolated from the realities of humans, they are dependent on their environment in a broad context and have a role in the country, interconnected with the existence of people and their economic needs and actions (Machlis and Field, 2000). Nature and beautiful “picture” frames of remarkable or beautiful human artefacts, can synergise with each other and improve their perspective value. Would Machu Picchu in Peru be such a remarkable place if the city ruins were less than 5 metres above sea level next to a rusting industrial zone in a city? Would the mountain Huayna Picchu which is behind the postcard photos of the city ruins be as interesting to visitors without the human impact? History and its interplay with culture and nature often creates places of attraction. In many parts of the world, where "wilderness" or uninhabited “wild” areas cannot be found and whole continents are anthropogenic in composition (Pétursson, 2003). National parks in such areas are where the owners of the land have agreed on a greater level of protection and emphasis on environmental issues (Van de Steeg, 2002). Still each country must have a clear goal of its conservation reasoning. Borrowed models can be and are helpful but they need to fit in with local conditions and the opportunities that each country has for protection need to be evaluated. Contextually to Iceland, I wrote in my bachelor's thesis 2 years prior to co-founding Skálanes:

*“It is also not necessarily the case that the state must always be involved in the operation of conservation sites and or parks. Landowners or private parties should just as well be able to initiate the establishment and oversee their operation on their own”.*

(Pétursson, 2003, pp. 9, translation)

This alternative model could be a basis for discussion of such ideas if people consider themselves to benefit or be hindered by a national park over other land use options (Mulder and Coppolillo 2005). Compared to the U.S.A., in Africa and, to some extent, in South Asia, the role of parks established during the colonial period was usually to protect large mammals such as elephants and rhinos, which had hitherto been hunted by colonial masters. It was also the case that in Europe,

where long-term residence and land use was intense, the main emphasis was often on protecting human settlements within nature. Internationally the dialogue drifted away from solely national parks and began to revolve more around the general and specific reasons for protection of respective areas (Van de Steeg, 2002). For an example as in the case of the Cevennes National Park in France which is entirely in IUCN category V (*“protected landscapes or seascapes with a natural conservation plan, allowing for for-profit activities while safeguarding unique ecological, biological, cultural, or scenic character while striking a balance between people and nature through engagement with surrounding communities and traditional systems”*). To emphasise contextually that in addition to nature conservation, Cevennes National Park is about protecting the human landscape and unique culture that can be found there (Cevennes, 2022).

*“With such a policy in conservation as an example (Cevennes National Park), it can be justified that a park or a conservation site in East Iceland could encompass areas that would not be considered pristine or impressive enough at first glance to be a national park. On the other hand, it could be said that residential remains in the whole area and e.g. The turn-of-the-Century settlement in Seyðisfjörður is remarkable enough for human habitation that it, together with surrounding nature and its human history could justify an IUCN category V national park “*  
(Pétursson, 2003, pp. 24, translation)

At Skálanes, which is 14 km east of the town of Seyðisfjörður, the nature conservation plan is in hand with the culture embedded in the landscape. It is impossible to distinguish anymore where the human effect ends, and “nature” as understood being in a pre-disturbance state begins. As a conservation site it is close to European philosophies and approaches where anthropogenic landscapes are integrated in sites (Van de Steeg, 2002). Thus, some of the traditional foraging, hunting and land use related activities have been continued, such as eider farming, fishing, and berry picking, being part of the cultural heritage and because they are part of current Icelandic historical land use and therefore ecology. If one tries to separate nature and culture and look at the landscape as completely non-human and “pure” that segregation gets complicated as soon as you need to visit a restroom, eat, dispose of litter, or seek shelter in those

locations one would otherwise deem natural and apart from humans. Thus, my reasoning is that humans need to work on finding their place in nature as opposed to resisting a union.

Relevant to this is the field of political ecology championed by several geographers questioning the “naturalness” of environmental degradation (Blaikie and Brookfield 1987; Bryant and Bailey, 1997). Their studies have defined their approach as historically wide or global, focusing on agents and stakeholders from locals to governments in sites affected by environmental issues. This is directly applicable to Iceland with its deforestation and subsequent large-scale soil erosion following the settlement of the island. This has had a massive environmental impact, involving a wealth of both historical narrative and scientific data which represent an undisputed pattern and the reason for the contemporary state of Iceland's nature. It is important to consider here since the operation at Skálanes goes beyond simply documenting and quantifying the current ecology irrelevant of the past or its future. Welcoming instead the consideration of the effect of the future, communities and humans, their role in resource use and conservation upon the ecology of sites and the possibility of being benign creative benefactors rather than problematic destructors (Nelson and Serafin 1992).

The site is not managed like the government of Iceland would. But its policy is just another method and means to an end, allowing a different spectrum of trials, errors, successes. It is not in contradiction nor opposition to national parks or other official sites, more like an option to experiment where without the initiative taken there would have possibly not been anything anyway. In that context one can ask what is your favourite or most appropriate ecosystem or management method? The answer will depend on who is asked, what they know, what they like, how they vote and what their concerns are. The general public's concerns about wilderness are based on a simplistic view of the world. A naive realism which assumes that people can easily identify what is natural and what is not, a belief that natural things are inherently good, while unnatural things are bad, resulting in an oversimplified view of complex issues related to nature and the environment (Cronon, 1995).

Stewarding a drastically modified anthropogenic landscape we need to deal with the consequences of historic and future irreversible anthropogenic changes, through eco-pragmatism to become the cultivators of the current state of its

nature. taking a stance with the environment where humans are a part of the solutions needed. Uniting the classical rights of nature and utilitarian approaches of humans, adjusting to changes, and modifying natural processes and our resource use via diverse management solutions. With the current and future state of some landscapes in Iceland being degraded beyond their ability to recover in a timely manner for many important contemporary environmental reasons. In some cases, we are even unable to prevent continued deterioration of soil with associated ecological loss as the processes of active soil erosion are often irreversible if left untreated. Unorthodox choices of action are justified to be considered and that intervention requires a proactive approach based on optimism since the end goal is something perceived as better than the current and future of the unattended conditions, possibly involving taking risks and trading short-term losses for long-term gains.

So, is there a win-win for nature conservation that exists within these described conditions, or is any human input and or action to be viewed as zero - sum? Are compromises where human enterprise makes a mark in landscape always a loss to the environment and a betrayal of altruistic ethics on its behalf? The management philosophy of Skálanes prior to action should consider and study the issues of concern to take into view spectrums of ideas and knowledge attached to them. Agents and stakeholders should be involved and settle on action or inaction based on attainable and plausible results. As many of the more convincing arguments in conservation literature unfortunately often contribute to accentuate differences and polarise realms of knowledge and their agents into opposing camps of binary thinking and subsequent negative feedback which defies using creativity. Thus, applying interdisciplinary collaboration, integrating participatory engagement in dialogue and work with the aim of adaptability and reflexively using pragmatism in consideration of multiple knowledge domains and philosophies. This should though not be confused with the possible results of indecisive neutrality or lack of ethics. What gets done successfully matters more than if it fits a certain theory.

### **3.5.2 Management, Ethics and Philosophy of Skálanes**

The management of the site at Skálanes is influenced to a degree by classical ecological restoration philosophy (Leopold, 1949) with the added elements of eco-

pragmatism in the context of contemporary and site-specific issues. Its aim is towards increasing ecological adaptability and preparing for adaptation to migration of new climate refugee species, be it natural, random, or pre-meditated human assisted. It is done by planting native trees for accelerated reforestation, stabilising soil degradation and erosion, damming drained areas to restore wetlands for plant, insect, and bird habitats, keeping visitors contained to certain paths and legal culling of predators and grazers such as the non-native American mink and reindeer. These management actions aim to gradually create higher density of species interactions, increase the flow of energy as it supports interactions between species and through it increase adaptability, function, and ecological re-configurations in face of changing taxonomy (Hines, 2015; Oliver, 2015; Schleuning et al. 2015). The temporal scale of measuring the effects of this management as the ecology reaches tipping points is not necessarily expected to be expressed in a gradual linear fashion and without applied management will not be enough to enhance the ecological complexity (Woodcock et al. 2012; Martin et al. 2013). The expected transitions in ecology at the site are expected to conflux at tipping points as a shift from one state to another happens. Sustainability jargon such as the word resilience is often used to support a decision to arrest an ecosystem from migrating from one state to another (Loorbach et al. 2017). But to act is always a reduction of thought and reality into a tangible and simplistic decision while studying the effects of these actions taken, as opposed to indecisiveness or at worst paralysis through inaction possibly causing more harm. The current state of Iceland's nature begs the question of how different approaches to conservation emphasis can positively contribute to its current state, while asking which values and ethics apply for perceivably preserving eroded or heavily degraded ecosystems?

*“Thoreau and Muir and their descendants went to the wilderness and returned with the making of (America's) first environmental ethic. Today it still stands, though somewhat strained and tattered. What if now instead of the wilderness we were to look at the garden for the makings of a new ethic? One that would not necessarily supplant the earlier one but give us something useful to say in those cases when it is silent or unhelpful”* (Pollan, 1991, p. 190)

What would conservation be concerned with if invented in 2023 without historical baggage?

The question leaves us with our individual relativist ideas and background to interpret what nature there is and how we would like it to become. As the mountain does not care for us, neither do the birds, plants, or reindeer. They do not have a long-term plan for their future nor a common goal of anything apart from survival and procreation. None of them have heard about the scientific terms presented and used to define their state by and for humans. If we let nature to its own devices as “she/it/he knows best” we cannot automatically assume a state of increased diversity or adaptability, better carbon capture and so on.

Worldwide, in most cases, habitat-based conservation is the only way to ensure the maintenance of important endangered species and related biodiversity. Due to the historical context of the landscape at Skálanes, its state and ongoing climate change, the active practical management applied there is to work towards reclaiming the ecological processes of the site in the long term. This will increase its capacity, adaptability to chance, reinforcing its trophic systems and short-term stopping active soil erosion. Gradually and asymmetrically setting the ecology loose to progress on its own terms as soil deterioration stabilises in different locations in time, and biomass increases. There is no way after the impact of the introduced non-native species such as humans and their sheep to restore the ecosystem to any previous state of conceived pristine nature. After these species arrived in the 9th Century a substantial amount of landscape was eroded clean of its soils - there is no replacing that in a conventional manner. The compromise is thus a baseline of any data, every new day from now and into the future as species move in and out while the climate and land use adjust to human enterprise and changes in nature.

With ongoing global biological decline, doing nothing at all is not an option as Tittensor et al. (2014) and Trisos et al. (2020) emphasise. This is, however, contradicted to a degree by some literature which suggests that extinction and biological diversity loss rates might be exaggerated (Chew, 2015). Still, it is important to keep the main trends in mind and maintain the following as being extremely important.

*“Large bodied, economically significant and habitat sensitive species are being extirpated and replaced with smaller, generalist species that thrive in human dominated places”.*

(Mulder and Coppolillo 2005, p.2).

And

*“Globally human activities have facilitated species extinction, invasion, introduction and domestications, increased soil erosion, altered fire frequency and hydrology and incited profound changes in primary productivity and other key biochemical and ecosystem processes”.*

(Ellis et al. 2010, p.590)

As Chase (1986) implies, wilderness is crucial for organic evolution from a biological standpoint and is fundamental to the essence of creation from a philosophical perspective, possessing its own inherent rights. The words “essence of creation” exhibits a value driven approach bent towards human ideology of theological matters. The management of Skálanes is based on established natural history and ecological theory, coupled with a philosophical value laden approach. It does not hide from the latter. Pragmatists avoid intellectual froth and approach their projects without some of the negative excesses of post modernism in deconstructing empirical approaches in science i.e., excessive theoretical debates, convoluted abstractions, or speculative ideas that lack practical relevance or real-world applicability. Pragmatists acknowledge the role of personal values and interpretation in scientific research, still they do not undermine the essentiality of empirical evidence and objective analysis. But by stating that the focus on pristine wilderness and nature has no inherent solution to address many and serious contemporary environmental issues, I am unwilling to entertain that all science is just based on interpretation and personal values nor that either camp presents nothing. Theoretical debates can and do detract from addressing real life tangible problems (Proctor, 1998). Pragmatism is a problem-solving paradigm applying itself as an action-oriented discipline using science with learning by doing without the constraints of any fixed theory. If an action for improvement is useful then it should be applied, and creatively if needed, and its scientific findings only based

on their usefulness while acknowledging that there is nothing wrong with applying oneself with a personal commitment in the search for solutions to simple problems as they can usually be addressed compared to excessively big, complicated issues (Proctor, 1998).

Coming back from this chapter in a contextual summing up of the terms of ecology, biodiversity, language, and management on the hegemony in conservation and our human values while looking at the following quote from one of the founders of modern western conservation ideals.

*“The intrinsic value of nature is of course subjective and is based on nature having its own right without any sociocultural approach and it should have rights legal and ethical as to include the soils, waters, plants and animals”* (Leopold, 1949, p.239).

Here I strongly disagree on the word “without”. Because without human values which are obviously present in the previous passages about ecology, species, biodiversity, management, food, and language there would be no notion of nature as a subject. Consequently the “*without*” in Leopold's statement has embedded a deeply rooted fallacy in the classical conservation camp. That true nature exists somehow irrelevant of human influence. Management in conservation reflects directly on how individuals involved know or think they know the local ecology and nature. It is also based on local characteristics and judgement calls based on human values. Interpreting this and constantly questioning the output and learning from new findings is important in adaptive management. To idealise the values and knowledge of the locals (e.g., Mr. Aldo Leopold or me) should be avoided since our values can be and are often fragile, less dynamic, and less open ended than some claims suggest (Ross and Pickering, 2002). Locals might overemphasise species and systems with traditional value or usefulness. Thus, my informed view in regard to Iceland is that the current ecologies being conserved through multiple governmental agencies is arresting ecosystems from evolving into something which would be more diverse, robust and adaptable to disturbance if more diverse conservation policies would be considered. All this questioning where local and or any human decision for a true nature starts or ends.

The management of the 21st Century is about species adapting to changing biomes with associated species range shifts in face of predicted global climate change. Thus, Skálanes serves as an experimental, ecologically active, and productive site with a primary focus on the future's overall biotic system, general processes, and indicators, rather than solely concentrating on individual species that primarily reflect the past and provide limited insight into the future. This applies evenly to intensively managed sites such as: reforested hills or reclaimed wetlands over to eroded sites left to their "own" devices. The historic extensive loss of habitats and soils in Iceland with lowered functionality and capacity to grow back due to loss of soil and nutrients arrests their evolution and capacity to adapt. What will have to migrate due to temperature rise in the next 70 years, and what habitats will need to emerge for those species? Classical conservation restoration management, which aims to prevent the occurrence of unexpected trophic cascades while referring to it as resilience or stability, is no longer applicable. Collapsing all management choices and their effects into a narrow spectrum of the three tiers of sustainability of: social, economic and conservation also limits the options of good intentional practice and activity. The problems are complex, and the choices made are always open for interpretation. Multiple perspectives apply and not everything is constructed in the realm of an individual thought as the systems and patterns found in nature, and of which are subject to the goals and management in conservation are a physical reality and ontological realism (Swilling 2020). The philosophy of approach for the site is an anthropogenic temporal wider scale recognition of general diversity, greater biomass, higher energy levels, carbon storage, and soil retention. The outcome is uncertain. One should expect changes, remain mindful of any homogeneous system, and consider where are important niches, possible new emerging habitats, or species? We are manipulating, observing, and studying the landscape with the perceived end goal of protecting and enhancing wildlife and plants in the long term. That means we do need to trade for lesser gains in the short term.

Official protection status is not a clear path to conservation success. Effective strategies and actions are. The general emphasis worldwide on more and bigger areas under the status of conservation protection need to be asked of how successful they are already on a case by case and how they affect other elements such as societal and political repercussions. This notion is supported by

a meta-study of hundreds of conservation wetlands sites and their bird species, which showed that in conservation management the steps taken, and actions are more important and effective than the scale or size of protected areas (Wauchope et al. 2022). In the case of Skálanes our large and diverse populations of ground nesting birds and their healthy colonies are an indicator of our ability since 2005 to at least manage that part of our nature.

Hopefully, we will have the grace of success for the concerns we have been entrusted with.

As we try to engage actively with contemporary environmental and conservation issues and have a belief that the sites strive for its “second nature” entails human intervention as it integrates and complements the natural environment in context of conservation.

For that a bit of gardening is needed.

For a comparison in the period of 1982-2016 close to half of the planet has seen greening or regrowth of forests with associated increase in biomass. This is due to widespread abandonment of rural agricultural land, CO<sub>2</sub> fertilisation and tree planting (Zhu et al. 2016). As in multiple other international trends Skálanes is a microscopic manifestation of this, being abandoned as a farm, fertilised by lupine and having been partially replanted by native birches and rowans. Birch is an early successor species, growing easily in poor soils and able to do long distance migrations in the right conditions successfully. It has a wide range of habitats it can colonise. In the Arctic it is sometimes the dominant tree species because of limiting factors for other tree species to thrive there. Where it is a successful coloniser, birch changes the soil chemistry, microclimatic factors, microbial compositions and the flora and fauna as the forests gradually matures in space, size and temporal context and environmental factors such as grazing pressure, wind and precipitation govern their growth (Óskarsdóttir et al. 2022). In their case study, from south Iceland, birch pollen production increased 150-fold in the first 15 years of the colonising period and by a factor of 700 in around 30 years. If that is true for Skálanes it means the first self-propagated birch plants seeded by the first

manually planted ones in 2007, should make their appearance around 2030 and then the evolution of the landscape continues on its own terms based on our managing intervention of planting them along other inputs and external factors. The primary productivity of biomes shows in general a correlation to increased biodiversity as more vegetation growth transforms into more species in the upper echelons of the trophic levels (Lemoine and Svenning 2022). For a temporal and spatial comparison, the national forest of Hallormsstaðir near Skálanes was protected in 1907 (Guttormsson and Blöndal. 2005). In its initial state best described as a bushy hill which grew into a medium sized mature forest by 2023.

The consensus amongst Icelandic foresters in the 20th Century was that the species of native birch and rowan would have a population distribution of one hundred birches to every single rowan. But as the forest crested its 100 years anniversary of protection from mostly just grazing, the foresters noted that the rowans were coming in higher numbers in the oldest established plots. The intraspecies abundance changed as the forest moved from a first generational regrowth (Eysteinnsson, 2019). According to a pollen analysis study by (Jónsson 2009) in lake sediment in Fljótsdalshérað in the east, birch was abundant prior to the settlement in the 9th Century, it went into massive decline immediately after and it did not start to recover until the black death associated with human and livestock decline in the early 15th Century. The forests grew back until around 1750 when sheep numbers increased again because of international demand and selling them abroad became an economic possibility (Júliusson, 2018). This coincided with the cooling of the little ice age. Thus, the forests retreated again under the joint pressure of cooling climate and unsustainable grazing pressure. The Icelandic birch has weathered dramatic climate fluctuations and volcanic events and it's gene-based resilience shows that. If grazing stops for any reason, the birch, which has a great intraspecies diversity, often sprouts from roots lying dormant in soils. The trees growing from this source usually are gnarled and spread out low in a bush like manner. Whereas the trees sprouting from seed germination or planted in newly colonised areas have more of a trunk like growth, can reach heights of up to 14 m and have a circumference of up to 35 cm (Guttormsson and Blöndal. 2005; Óskarsdóttir et al. 2022).

Contextually, ongoing climate change in Iceland with regards to birch and any introduced tree species used in silviculture Dial et al's. (2022) paper on the

long-distance northward migration of white spruce in Alaska is of note. Where the species habitat range has been established and stable since the last glaciation. Now with climate change unknown evolutionary traits have been observed where the range is shifting northbound extremely fast, adapting at speed to changing climate as they did last 12,000 years ago at the end of the younger dryas. This might possibly be happening already in a similar manner in Iceland with birch spreading in massive seeding events (Óskarsdóttir et al. 2022). But also happening in pre vegetated landscapes and so far, being mostly unnoticed still as the trees are still too small to be observed as a habitat type by remote sensing similarly to what Dial et al. (2022) observe with the white spruce in their study. Suggesting that existing ranges for birch and other plants in Iceland are not useful anymore as a baseline for future patterns since they are based on the general climate prevalent since the end of the last ice age/younger Dryas.

Continuing along this vein, conservation orthodoxies currently predominant in Iceland regarding lupine should be reconsidered with this in mind as currently they focus mostly or just at all on the perceived negative impacts in ecology. Its economic value as a self-replicating soil fixer, fertiliser and vector for carbon sequestration should be considered too. A case study by Lehnhart-Barnett and Waldron (2020) of freshwater carbon export at Skálanes showed that lupine has a retention effect on carbon washing out of areas where it grows. Both fixing and retaining carbon more successfully than the native habitat of grass-, wetlands and eroded areas. Lupine is effective in this manner but with predicted climate change including higher precipitation and runoff (i.e., soil erosion) expected in Iceland the effects of it on current carbon storage in soils are unknown (Lehnhart-Barnett and Waldron, 2020). A consideration for the management is how fast the lupine spreads while soils are still continuously lost via erosion if that if we can decide to lose more soil and associated ecology eventually until the lupine seeds into and stabilises areas? Should we as caretakers of the landscape assist in the migration of lupine to prevent that? A pragmatic question on assisted vertical migration on site at the lowest scale imaginable with diverse results for varied factors in ecology.

Since 2006 there have been over 100,000 saplings of native birch, willow and rowan trees planted on the hills above Skálanes. I've personally put many of them into the ground. The full effects will not be seen in my lifetime. It is a task

with aims and goals about trading short-term gains for long-term goals. Reforestation is also a national cultural activity, and it makes me feel relevant somehow. How do I feel when I observe the trees growing and changing? Content. Why did I plant? For carbon sequestration, resilience, nature's lungs, biomass, ecology, trophic cascades, aesthetics, there used to be a forest here, indoctrination? It was growing here in the 9th Century before carbon and carbon sequestration became a topic which trees in some cases have been delegated beneath. The planting we did was intentionally carried out on the most denuded and eroded patches of land. Hard places for the young trees to thrive. But the plan was to establish young "forest" patches ahead of the non-native lupine which was seeded in around 1988/9 as a part of a national campaign to stop soil erosion. The lupine grows best in soils with low nutrition and thus "seeks" out the current and previously eroded areas, acting like a natural fertiliser fixing nitrogen out of thin air into the soil next to the birch roots. Thus, allowing the establishing trees in a counterintuitive symbiosis to grow faster, outcompeting the colonising lupine and accelerate the succession of ecosystems by decades. But as the years passed without a sign of the trees growing the plan seemed to be a failure. Fortunately, it turned out to be at least partially successful as in the last few years we are seeing thousands of trees shooting for the sky just in time before the lupine would shade them out. The lupine mats strongly inhibit seeding birch from establishing inside the primary areas where it grows but in the fringes of lupine patches the establishment of birch is more successful. Winter frost heave is less in the lupine patches thus helping the birch that does colonise them (Aradottir, 2002).

As now we have successfully reintroduced the native trees in sufficient numbers for them to seed into the landscape on their own terms from now on, it looks like exciting times are ahead as the ecology will continue its rotation of transformation into a more dynamic, productive, and vibrant system of higher plants and the welcome arrival of new plant, invertebrate and avian species. Waiting the lupine out while it stops the erosion and revitalises the soil with humus and nitrogen and then let the whole thing run on its own terms somehow backtracking into classical restoration conservation as the landscape becomes more robust. The anticipated post lupine ecological dominant plant system in mid to low altitude around Skálanes is expected to be a mixed birch and rowan forest as it has been manually planted extensively, the low plants in non-forested areas

expected to develop from mosses and ferns to grassy and then flower meadows and willows as the forests grows and matures (Guttormsson and Blöndal. 2005). With such claims it is reasonable to ask where is the methodological standard case by case for conservation success and failure and the time element of ecosystem development exposed to new species? How long do dominant or emergent systems take to mature on site on a case-by-case basis and give way to enhanced habitat diversity?

In a perceived sense of a positive approach, which management applications are justified and for exactly what?

### **3.5.3 Evaluation of Impacts of Intervention and Legacy**

Skálanes serves as an example of an organisation working on a mission of conservation. Its historical establishment embodies a narrative of dynamic adaptation, as the management approach has broader views than conventional conservation paradigms of only “nature”. This works within the site’s biodiversity and ecology, encompassing avian, botanical, invertebrate, and mammalian components. All of these are also considered in context of anthropogenic, scientific, and pragmatic management for its mission with the eco modernistic view of the co-inhabitation of nature and humans. The work carried out thus far includes systematic surveys, empirical data accumulation, transdisciplinary studies, and species registries. This is mirrored in a commitment to integrate science to create a paradigm of holistic site management, incorporating infrastructural development, ecological stewardship, and scholarly inquiry which transcends compartmentalised categories of management models. The structure presented in the following pages is loosely based on the IUCN green list for sites which demonstrate equitable and effective governance. It covers the work done at Skálanes for its management, encompassing almost two decades of work, and some sentences reflecting hundreds or thousands of hours of work, considerable focus, effort and or expenses. Contributing to the management subjects covered are staff, students, volunteers, contractors, faculty, volunteers and even guests.

#### **Facilities:**

In 2005 there was immediate need to upgrade the main house at Skálanes for the needs of the planned operation. It entailed a rebuild of the old farm building, adding extensions, outdoor decks, replacing plumbing and electricity, installing septic systems, and connecting it to the national electric grid. This build up has been ongoing since 2006 to current date and now the site has sleeping facilities for 24 people in the main building, 2 separate cabins each sleeping 2 people, 2 decks for pitching tents which can each accommodate around 10 people, 9 toilets, 3 showers, a laundry, kitchen and seating area for around 20 people to eat at a time. A mud lab, wet lab and dry lab and separate hut for refuse storage. In Seyðisfjörður, there is a garage space of 360 square meters with an office and a general open workshop space for study projects, infrastructure needs and general maintenance.

### **Accessibility Improvements:**

From 2005 to 2023 there have been multiple approaches to improve accessibility to and on the site. Firstly, the road to the site was for the last 4 km of the stretch a dirt path which diverged around mud pits and its state with the anticipated visitor increase and work activity meant that it needed to be built up to gravel road consistency. Also, there are 3 river fords on the road which can be dangerous when the water rises due to rain. Heavy machinery, diggers, tractors and such was used to lay out a better gravel road over the old track, also the fords were cleared of the biggest stones and in cases they were carefully placed downriver as obstacles to catch drifting cars to prevent them tipping over in heavy current. Most recently one of the rivers has been “tiled” with pavement slabs to improve the conditions in that ford. Secondly one of the earliest projects was to rebuild all the footbridges on the way out to Skálanes, adding handrails and make them theoretically wide enough for a quad bike to be able to pass in case of emergency in case of heavy rain obstructing the fording of the rivers.

Thirdly footpath work has also been addressed on and off, building of steps, drainage, pathways over wetlands, signs, markers and lastly building a platform by the cliffs, with improved accessibility and sturdy handrails to accommodate hikers, students and any other guests frequenting the site.

### **Surveys, Data Collection, and Studies:**

The following list is not comprehensive nor chronological and omits some of the ongoing projects being carried out at Skálanes or in the fjord of Seyðisfjörður by students, faculty and staff in the period from 2005-2023. Behind every project is a dedicated reviewed study ranging from field reports to peer reviewed papers and a couple of PhD dissertations. The findings and information generated in this body of work is used for management of the site.

### **Species List:**

Staff, rangers, and students have compiled species lists of plants, mammals, invertebrates, and birds found on site.

#### **- Birds**

- Long term population monitoring (Tern, Fulmar & Kittiwake).
- A ornithology survey of the reserve.
- The maternal effect on postnatal growth in the common eider *Somateria mollissima*.
- Accumulation of plastic microfibres in nesting eider duck female's faeces and their fresh water sources.
- The effect of weather conditions on the behaviours of Atlantic puffins.
- Effect of environmental conditions on breeding performance and foraging behaviour in a colony of Arctic terns.
- An investigation into factors affecting parasite abundance in common eider nests.
- A study of nest site selection of ground nesting birds being influenced by the presence of Alaskan Lupine.
- Nest defensive behaviour of the golden plover.
- Identifying intraspecific brood parasitism in the common eider by using egg morphology.

#### **- Invertebrates**

- Preliminary studies on marine, freshwater, and terrestrial invertebrate diversity in the area.

- The distribution and frequency of rocky shore periwinkles in association with shell colour.
- A terrestrial invertebrate study across the reserve for many possible habitats as possible; heath, marsh, grassland, lupine beds, reforested ground, established forest, and bare eroded ground.
- Public participation study of the spiders of Seyðisfjörður
- A study on the foraging dynamics of bee species against wildflower distribution and to gain insight into the pollination ecology of Skálanes.
- An investigation into the impacts of the invasive Alaskan lupine (*Lupinus nootkatensis*) on invertebrate assemblages

### **- Geography**

- Proximal sensing Drone Aerial Mapping of vulnerable coastal bluffs in Seyðisfjörður
- Skálanes hydropower investigation
- Geological mapping of Skálanes
- Spatial and temporal variations in organic carbon budgets in two stream catchments.
- Drones for science, first response, and storytelling
- Food and energy potential of Skálanes.
- Hydrographic profiling and eDNA characterization in Seyðisfjörður

### **- Mammals**

- Study of arctic fox population distribution with a focus on dens, parasites, diet and non-invasive genetic sampling methods.
- An analysis of the endoparasites present in an isolated population of the arctic fox.

### **- Plants**

- An investigation into the ecology of the introduced species of lupine within the site and its impact on the native flora and fauna
- A study of invertebrates to see if the diversity is higher within or outside the patches of lupine

- Investigating the spread of the lupine and at how rapidly it encroaches upon the various other habitats on the reserve and examine the existing seed bank in the soil.
- An investigation into the relationship between invasive Alaskan lupine and native habitat types and the impacts of this on the distribution of ground-nesting birds

### **Pollution**

- Distribution, size, and abundance of microplastics.
- Environmental DNA and Seawater Quality in Seyðisfjörður
- Plastic pollution and plastic ingestion in a colony of Arctic Terns

### **Social studies**

- Topographical Survey and Analysis of the Landscape of Skálanes Nature Reserve in Order to Locate and Identify Sites of Archaeological Interest,
- Study Abroad at Skálanes to a Transdisciplinary Research Framework in Seyðisfjörður.
- Assessing Community Acceptance of Salmon Farming in Seyðisfjörður.
- Millennium by the Atlantic Ocean, PhD research in Archaeology
- Geography, Happiness, and Place: A Case Study in Rural Seyðisfjörður,
- Translation of ATLAS Seyðisfjörður and the importance of place name origins.

### **Habitat management and interventions - Wetlands, Lupine and**

#### **Reforestation:**

The interventions at Skálanes, encompassing efforts to increase wetlands areas, control the invasive lupine species and promote reforestation with native rowan and birches, illustrate the challenges of trying to modulate and or change nature with an improvement in mind.

- **Lupine:** The plants were seeded around 1988/89 at Skálanes, and by 2005 were found in all main areas they still grow in. From 2007-2012 considerable effort was exerted by staff and students at Skálanes to stop and or limits it spread by cutting, manual removal, trashing and other similar

methods. Trial plots were established where these different methods of manual removal were assessed for three consecutive years. Gradually it became apparent from studies and anecdotal experience from around the country that currently there are no plausible long-term methods which are justified in output to contain or remove it. A few years later we experimented with keeping semi free-range pigs in enclosures inside lupinated fields to assess if their rooting and cratering behaviour would affect the lupine. Their effects were negligible. All test sites, previous pig enclosures and sites where lupine was removed manually are now completely covered in lupine and impossible to discern as being in anyway different from the rest of the sites covered with the plants which were undisturbed by any of management methods mentioned.

- **Reforestation:** From 2007 to 2021 around 100,000 native rowan and birches were planted in the hills above Skálanes, in patches of ground and areas deemed likely to be colonised by lupine, to try to establish the trees so they could benefit from the nitrogen and soil fixing properties of lupine. Accelerating the diversification of the habitats created by the co-existence of trees and lupine growing in mostly poor soils. Considerable physical effort was put into carrying the trees uphill and plant, the effects of this endeavour are still to be seen but, in some areas, there are already thousands of 15 – 40 cm high plants growing.
- **Wetland restoration:** Ponds had already been made by the previous owners of Skálanes but in 2006 and 2008 more were added both close to the house and at the eroded edge of a distinct wetland which was partially drained by soil erosion. The effects of these habitats were almost immediate increase in wader and eider nests, bathing and socialising by multiple species and higher ground water which encourages diversification of plant system near to the ponds. Considerable work is needed regularly to maintain dams to retain desirable water levels.

### **Legacy and Recognition of (In)dependence:**

The long-term impact and legacy of Skálanes' interventions by the management of the site is not solely about physical developments or scientific investigations; it is a interplay of concern for nature and ecology, sustainable practices, and the synergy created with science and pragmatic conservation. Accessibility improvements, infrastructure, pragmatic habitat management, surveys, data collection, and transdisciplinary studies undertaken at Skálanes have generated a wealth of knowledge essential for effective management. From birds and invertebrates to plants and pollution, there has been a considerable investment in understanding the present ecosystems. Initiatives to address invasive species like the Alaskan lupine and to promote reforestation with native trees have taken a pragmatic proactive stance in mitigating ecological imbalances and fostering habitat diversity, while the experimental approach taken with pigs exhibits an innovative solution approach. With the sites continued evolution it creates a clear foundation for future conservation efforts, emphasizing the importance of transcending conventional boundaries and embracing a wider approach of subjects to include in management that encompasses the interplay between nature, humans, and science.

### **Conclusion and Counterfactual Analysis**

As a alternative site of conservation, Skálanes is a model that weaves together anthropogenic needs with a steadfast commitment to biodiversity preservation and sustainability. The continuous upgrades and expansions in Skálanes' facilities are indicative of an effort to align infrastructure with the evolving mission of the site, showcasing adaptability and a pragmatic approach. Further, the focus on infrastructure upgrades and accessibility improvements aligns with the broader narrative of sustainable tourism. However, potential areas for improvement exist for refining strategies and a deeper exploration into the actual impact of these initiatives on minimizing ecological footprints and visitor impact is warranted. More consideration should have been given to alternative, eco-friendly construction materials and methods, which, if adopted, could potentially have reduced the site's environmental footprint.

A counterfactual scenario of the practical implementations of conservation management provides a valuable perspective for long-term monitoring with adaptive management. With the legacy of Skálanes' interventions is

acknowledged, while prompting a consideration of the site's adaptability to future changes. A counterfactual approach could involve a more robust system of long-term monitoring as opposed to the mostly ad-hoc style studies being done, coupled with adaptive management strategies that swiftly respond to emerging ecological challenges. The management of invasive lupine has proven challenging, leading to a landscape still dominated by these plants to some degree. Not enough has been questioned in regards the examination of alternative methods and cutting edge technologies that might have been overlooked to control it. While the reforestation efforts at Skálanes are noteworthy, there is room for critical evaluation regarding the selection of tree species and their compatibility with the local ecosystem or the future ecosystems which are anticipated with changing climate. There has been little consideration regarding the integration of more diverse and future habitat-specific tree species, with the intent of enhancing the overall adaptability of the ecosystem.

In conclusion, Skálanes serves as a model of eco-modernistic conservation, fostering coexistence of nature and human endeavours. The site's multifaceted efforts underscore the interconnectedness of ecological health, sustainable practices, while acknowledging the need to continuously analyse and question our work. The proactive conservation efforts at Skálanes have likely prevented or mitigated potential ecological degradation, loss of biodiversity, and negative impacts on the site's overall health. The various interventions and studies have played a crucial role in shaping a more sustainable and ecologically resilient environment at Skálanes in the future.

### **3.6 Exploring the Three Tiers of Sustainability**

The impact of national parks and protected areas, exemplified by the case of Skálanes, extends beyond environmental conservation as it also encompasses economic growth, community engagement, and adaptive strategies that intertwine economic prosperity with sustainable practices. This section aims to present a nuanced perspective on the interplay between nature, society, and economy in relation to Skálanes.

The impacts of national parks and protected areas is often overlooked, but their existence creates economic and social benefits, especially in rural areas. Around them, development takes place, jobs are created, and they maintain the social health of communities as well as protecting areas from unrestricted development due to tourists. For many, the establishment and operation of a national park has been a prerequisite for people to be able to seek work at home instead of relocating in search of work (Machlis and Field 2000). Achana and Leary (2000) argue that research into the economic impact of national parks suggests that they themselves, and related activities generate income, have a multiplier effect, and create new jobs in local communities. Their existence and proximity promote the economic benefit of the inhabitants living close to or within the parks for various operations from restaurant sales, diverse employment, accommodation, and tours. Tourism, which is largely dependent on parks, has a more diverse positive effect on the population than just economic. Conservation is a vital component of global efforts to promote sustainable development through diverse protected areas which have been established around the world to protect species ecosystems, and cultural heritage.

### **3.6.1 Sustainable Economic Development Through Conservation**

Conservation sites provide benefits to both the environment and nearby human communities as they contribute to promoting sustainable economic development and social well-being. In the case of, for example, ecotourism at Skálanes which has emerged as a source of income and employment for the nearby community of Seyðisfjörður and providing opportunities for scientific research and education. Instigated by these inputs from its existence and operation it has encouraged community growth and resilience. The effective management and conservation of natural resources and biodiversity are also vital for achieving a needed interaction with growth of the three classical pillars of sustainability: nature, economy and society which are addressed in the following subchapter through the lens of ecological modernism, the optimistic pragmatic view that societal, technological and economic solutions can provide answers to environmental issues and problems and that they can be explored within different or alternative development options of parks or in nature protection, as is the case of Skálanes.

The founding of conservation sites is the result of value-driven actions in specific settings, created when there is a strong economic, social, and natural foundation. Moreover, the global increase in protected areas, coupled with improved economic efficiency and dematerialization, signifies an inflection point in societies where humans can de-utilize entire landscapes for the sake of conservation (Wauchope et al. 2022). In affluent western nations, these processes are evident as their economies have decoupled from the classical model of consumption, leading to a decline in the use of natural resources and emissions (Gibbs, 2006). This phenomenon can be understood through the concept of the environmental Kuznets curve, where economic growth and advances in cultural and spiritual values shape the hierarchy of needs over time. As societies progress, environmental concerns move beyond mere nutrition and basic living standards, causing a bending of the Kuznets curve towards a more sustainable path (Pinker, 2018). This trend does not only apply to national economies but also companies and Skálanes being one by adhering to these changes in society gains advantages amongst others by avoiding possible financial costs later due to clean up of pollution, improved recruitment and staff retention and by the sales of ecotourism products (Dryzek, 1997). This approach has been criticised as being a repetitive dominant theory that absolves the current market economics and its agencies from dealing with their environmental policies. That by the proposed effects of ecological modernism, somehow good things will happen automatically, and that the environment still has a value as a natural resource beyond its classical utilitarian extraction values for example: intrinsic, ecological services, spiritual, intellectual and education (Hanink, 1995; Brandon et al. 2001; Colding, 2000). These authors also criticise ecological modernism because it creates a lose/lose scenario as less market friendly aspects of nature needing protection would be ignored. The role of technology coupled with western economic models in the 20th and 21st Century should still not be dismissed as they have contributed to augment the notion of conserving the environment as being a resource to be managed and conserved for exactly the non extractational economic purposes stated as being neglected. Worldwide, conservation was traditionally the domain of governmental institutions up until the 1990's. But due to a change in thinking associated with the Brundtland report in 1987 private conservation investments have filled in the use of no-value land (Hanink, 1995b). In 2020, 16% of the earth's

land and 7% of sea had an official protection status and the number of designated areas being protected has risen from 9,214 in 1962 to 244,869 in 2020 (Protected planet, 2020). Ecological modernism has adapted capitalist market economics for a constructive approach to environmentalism utilising tech, economy, science, and democratic processes. The impact of the conservation work carried out by these means is an understanding of a conservation based economic ecosystem which is created where conservation would possibly not have happened, such as at Skálanes.

### **3.6.2 Community Engagement and Local Identity**

Conservation-based enterprises like Skálanes not only contribute to economic growth but also support cultural preservation and community pride. Rural areas, such as Seyðisfjörður, can capitalize on their landscapes and cultures to attract visitors seeking out for positive experiences. These initiatives foster local engagement, enhance the quality of life, and align with the broader concept of ecological modernism. Other benefits of these trends include support for the protection of culture and natural monuments, increased pride of local people and their identification with living in a place that is considered desirable by outside visitors. One of the potential opportunities for the countryside is to be a playground for people from urban areas. The nature and culture of the countryside is highly valued by millions of people who are willing to spend money to enjoy it for a brief time. In this regard Iceland has relatively large recreation and tourism services, which are its "heavy industry" of sorts (Andrason, 2007) and substantial national income generators. It is only recently that people have realised the common interface between regional policy in rural areas and its effects on the area's economics. For some isolated communities, it is quite possible that recreation and tourism are one of the few economic options in their future not needing massive outside investment as it accommodates guests getting to experience what makes a region unique, its authenticity of nature and the people living beside and within it. The economic health of communities is based on the cooperation of citizens in identifying their needs, resources, and market areas. This participation can also play a part in training people to take initiative and action while ensuring their loyalty to their community (Summers and Field, 2000). However, it should be noted that over-emphasis on tourism can lead to difficulties if it fails temporarily

such as during the COVID-19 pandemic. National parks are potential tools that can kick-start the tourism industry, but then sustainable development must be the guiding principle (Machlis and Field, 2000). Investigating these trends presented in conservation and sustainability reflect a shift towards more holistic and economically beneficial approaches and a greater understanding of the environment's value beyond mere utilitarian extraction, opening new opportunities for local communities and entities like Skálanes to thrive sustainably.

### **3.6.3 Environmental Challenges and Societal Responsibility**

While national parks and conservation efforts offer economic benefits, they must confront environmental challenges, including carbon emissions and resource utilization. As entities like Skálanes grapple with their environmental impact there's a growing need to balance the economic needs with responsible environmental practices. Advocacy and local engagement can contribute to sustainable solutions.

*“Private property is only partially successful in... affecting sound management, for several reasons. First, private property ensures economic but not necessarily ecological sustainability. The costs are transferred... substituting a tragedy of the commons with a tragedy of the sole proprietor... State ownership regimes may be unavoidable in situations where other property rights cannot be relied on, but often they also do a poor job... Administrative law is rightly feared for ancient reasons, “quis custodiet ipsos custodes” or who shall watch the watchers? It is well known that state owners easily succumb to political pressure exerted by interest groups and thus are prone to sanction destructive short-term use”.*

(Mulder and Coppolillo, 2005, p.149-150)

The last sentence quoted was prominently evident in East Iceland just prior to Skálanes being founded. As a governmentally protected area called Kringilsárrani in the central East Iceland highlands was resized and partially unprotected by law by an initiative of the Ministry of Environment to accommodate the highly controversial Kárahnjúkar dam megaproject. The Ministry of Environment did this with spatially targeted and highly specific legislation without any scientific work being carried out which supported the decisions of why the site had lost its

relevance as important to conserve. It was just a political necessity in a coalition government to destroy its own red tape and get all the needed planning permits for the biggest dam in Iceland's history to power an aluminium smelter. This was a formative experience to witness as a local person and as a citizen. Thus, one of the main tenets of Skálanes was to avoid ties and funding from governmental sources so as not to be subject to its electoral whims. This political reality described was fundamental to Skálanes being formed in 2005 as a company which has since then functioned as a shell for its legal structure and organisational reality, compartmentalising its socio/economic, conservation, and science mission.

Now, in 2023 an application for a permit to operate a 10,000-ton salmon fish farm in the bay next to the site has all the hallmarks of regulatory capture of the Icelandic parliament and the relevant governmental agencies. All of whom are supposed to regulate the fish farm industry have become heavily influenced or even controlled by the very industries they are meant to oversee. This takeover of the government has happened through lobbying or other forms of influence by corporate interests through the creation of policies and or regulations that are more favourable to the fish farm industries rather than prioritising the interests of the public. This has been realised with the creation of loopholes, legal exemptions, or other optimal conditions (National Audit of Iceland, 2023). Whether the decision made in 2005 to avoid official governmental recognition of the site of Skálanes being officially protected would have mattered in the case of this proposed fish farm is impossible to assess. But there is little reason to believe it would have, since the same process as at Kárahnjúkar dam is evident now in a blatant display of crony-corporatocracy in full progress of crushing down all red tape and obstacles for the interests of the fish farming industry (National Audit of Iceland, 2023), all under the guise of a manufactured fake democratic participatory stakeholder involvement.

The nearby community of Seyðisfjörður as my hometown and the logistical, economic, and social support to Skálanes, has historically, since 1850 to the when it started to grow into an urban community, gone through repeated resource-based boom and busts associated with fisheries and the rise or dwindling of fishing stocks. Higher automated productivity in the primary industries has diminished the need for manual labour and as in other western countries these trends along with

other cultural, demographic, and economic shifts associated with urbanisation has contributed to depopulating rural areas. Many farms in Seyðisfjörður, as in Iceland have been completely abandoned during this period, but novel approaches to landscape use in socio, technical and economic configurations have appeared since the later part of the 20th Century and are evolving contextually and often irrelevant of each other (e.g., fish farming, salmon fly fishing, wind farms, forestry, tourism, conservation, and carbon sequestration). All have appeared as land and space use possibilities in the rural areas of the countryside. As a part of this evolution of landscape use is the emerging utilisation of a new resource value/extraction form such as conservation/visitor destinations such as Skálanes. These are places where the environment is preserved and taken care of, with an effort to manage it in a way that benefits the local community. This recent land use, along with advancements in technology, has allowed the employment of residents and the development of services. This mirrors a smaller-scale version of an economic and environmental Kuznets curve where countries or economies transition away from industries that extract resources from nature and shift towards providing more services. The same applies to Skálanes, which was abandoned as a sheep farm in the mid-20<sup>th</sup> Century to now, in 2023 being a highly organised tourist destination with over 10,000 annual guests visiting on scheduled day tours, employing 9-10 people. Treading the waters of international academic partnerships and science collaboration, a conservation site and field centre hosting around 100 students and faculty every year for that purpose.

The fiscal and legal policy framework set up by the actions of the government in Iceland during the period of 2000-2008 aimed to build up an economy based on international banking services failed with the spectacular result of 3 of the 10 biggest bankruptcies in world history being Icelandic. This economic meltdown led to the devaluation of the national currency the Icelandic krona in late 2008, by around 50%. Coincidentally combining with the volcanic eruption of Eyjafjallajökull which captured the attention of the world media shortly afterwards all together lead to a surge in tourism. The massive increase in associated service demand this generated was quickly explored by individual business owners and entrepreneurs all over Iceland, stabilising the national economy by 2013 and pushing it even further with an extensive governmental fiscal surplus by 2020 when COVID had its widespread impact on travels. How tourism became the

biggest national economy income generator, and a big employer is mostly due to the government failing in implementing its plan of reconfiguring the national economy in an attempt of creating a deregulated North Atlantic financial hub. Skálanes, founded in 2005, experienced all these economic changes. Setting out initially with a degree of optimistic naivety or confidence that to create its income from tourism would be the easiest and logical way for funding itself. It needed to be an income generating enterprise which was fluid and often forced to be able to adjust fast when needed, unencumbered by governmental bureaucracy, paperwork, and analysis paralysis. The trade-off being a needed focus on making money. The economic paradigm shift which occurred in and after 2008 in Iceland made the operation gradually more viable as an economic and social entity. For context in 2018, the small town of Seyðisfjörður (pop. 680) had around 400,000 visitors including a growing number of cruise ships which host about 20% of those guests while the remaining majority drive in on rental cars over a nearby mountain pass. This massively disproportionate number of tourists to locals has been used efficiently for the financial operation of Skálanes.

Since 2005 multiple approaches have been taken to try to strengthen the economic foundation of Skálanes and or find any income where it could be found at each time within associated, fluid and the sometimes-extreme national economic parameters described. Trying to get something going off the ground like a self-funded independent conservation focused field station is optimistic at best. It has needed an enormous amount of unfair, unintended, and unpaid contribution from staff and the families associated with it. They are owed. An instrumental part has also been the understanding of local business service providers, when considerable debts have been negotiated for extended delayed payment dates which in instances kept it from bankruptcy. The financial history is not an exemplary case study of outstanding work related to social justice or economic stewardship. As most of the income generated was opportunistic due to lack of the financial ability to plan and invest for the future and it has only thrice in 18 years of operation been run with a budgetary annual surplus / audited profit, reinforcing that I as a conservation entrepreneur am driven by motivation to create (Skálanes) and not necessarily initially by knowledge or the ability to make money or optimise economically (Coghlan, 2019; Barba-Sánchez & Atienza-Sahuquillo, 2017).

Currently, day trips and other organised tourism operated by Skálanes is integral to its operation, since the income from that allows the organisation to grow and pay decent competitive salaries, fixed and variable costs, invest, subsidise science and carry out active conservation through that. There is a danger of depleting the value of conservation or nature as a resource through for example tourism by losing sight of its goals, overcrowding, loss of habitats and an inadvertent deconstruction of its original mission and its use of the site for conservation. A creep towards increasing tourist numbers for an associated beneficial income increase is a valid concern, but equally valid are other mission creeps of different nature if one is e.g., dependent on the government for policies and funding. But either way Skálanes is currently an active entity which economically participates proudly in mitigating locally the boom and busts of other economic sectors in the local community, contributing to diversifying and providing a sustainable base of employment and income for locals. Providing economic alternatives, diversification, enhancement, and environmental sustainability by reducing the exploitation pressure of local resource dependency (Hanink, 1995; Weaver, 1999). Hosting day tours also has a genuine educational mission of which our guests can better appreciate the site, its mission and learn about the work being carried out from our guides.

Visitor impact on site has been limited to a footpath and a viewing platform so guests almost without exception only walk and stay in an area which they have discreetly been designated to use without need for excessive signs use or restrictive physical boundaries, zoning is thus successful and has minimal visual impact. If the area was to be degraded by visitor use, then its attraction lessens and its value as a destination deteriorates, thus there is a need to constantly think about if our actions are affecting the site and how any such issues of negative nature should be ameliorated. The need to keep a stable income base drives the operation towards mitigating negative impacts which could hurt the finances, reinforcing that in our case the ability to successfully manage a site of outstanding beauty and big bird colonies. If we degrade our “product”, I and all the people employed see that immediately on the finances which pay the salary. The operating costs and cash flow are the fundamental issues in being independent, but it has allowed Skálanes to stay dynamic in its income base and funding while the lack of monitoring and reflective evaluation on the work it is taken on for

income has in cases diverted it from its main mission. In instances such as when focus has been on maintaining essential staff employed annually with community and personal minded altruistic intentions. Through a genuine attempt towards a social/community responsibility we have highly likely arrested its development for science and conservation to some degree by those choices. But people living in the area were and are employed year-round as the “bad” trade off.

For context, the impact Skálanes has had on the socio-economic in the local area, it has in the period 2005-2022 through its revenue and work turned over around 600 million Icelandic kronur (3.5 million GBP) of which about 300 million Icelandic kronur (1.75 m GBP) have been salaries and local purchases created from the operations combination of land use and knowledge, through an enterprise where there was no demand for or supply of before. In our “off season” income generation we have found ourselves participating constructively in rebuilding several historic houses in the local community, restored valuable practical workshop spaces, and worked in an unprecedented post-natural disaster emergency and clean-up project. Resulting in annual employment, salaries paid and flow of money/energy that has at least not impoverished the local town, contributed to disaster relief, and added to its visual, practical, and cultural appeal. Thus, according to liberal economics, wealth was created in a new manner in a rural community and its internal economic and social ties strengthened and diversified. Economic and social development and viability are both a key component for conservation to be successful.

#### **3.6.4 Adaptive Strategies for Economic and Conservation Success**

The future of national parks and conservation enterprises hinges on dynamic strategies that navigate economic and environmental uncertainties. Achieving long-term success requires a delicate interplay of community involvement, sound financial management, and innovative approaches that uphold both economic prosperity and environmental conservation. A valid question regarding how Skálanes funds itself is what would it be doing and achieving if it did not need to raise money commercially for its yearly operation? Is the collaboration at a local community level in the economic and social context a result of our need for conservation? Would the science have been carried out been better? How many

people would draw a salary? Would its social and economic contribution in its community context be broader or more reclusive? Would fewer or more people learn about the nature of east Iceland? It can be argued that there might have not been any of the science nor conservation happening in the area without the approach taken. Lots of people have ideas but not everyone goes through with carrying them out.

By hosting students/scientists and conservation professionals both international and local as part of the operation, to be an educational outreach outlet, utilising ideas about conservation and lastly disseminating the findings of the work carried out on site. Skálanes has been a successful vessel and arena of change, created a unique configuration for local and regional development and has so far managed to use to its advantage the proximity to environmental economic and cultural synergies as per Sutherland (2000). There is also economic value in the preservation of species richness or biodiversity, organisms and landscapes and conservation efforts have value for humans for intrinsic, spiritual, and economic reasons. Without conservation, tourism in many places would falter and thus the basis for the protection of species or landscapes there as in some cases the income supports or pays for protected areas and their management (McDonald, 2003; Garnett 2014). In the case of Iceland, the soil erosion being an obvious symptom of unsustainable resource use and an historically underdeveloped economy where more is being extracted than replenished. But economies can outgrow environmental exploitation, environmentalists emphasise that without society's dependence on nature there are no jobs. The opposite can also be claimed that without acceptable standards of living and meaningful values in society there is no incentive to protect nature (Hayter, 2008).

When used for recreation, landscape has a travel-cost association where successful or sites with greater attraction have a longer range of where visitors are drawn from. In this sense Iceland is highly successful and Skálanes gets to pick and choose its guests based on mission (scientist, students) and their economic value (day tours) as its current preferable composition for the socio/economic value of the site. Currently the key issues with the current income generation is due to inherent pollution from standard and scientific tourism carbon emissions. This impact which is not currently offsetable is created by the environmental distancing of the operation of Skálanes by planes, cars, and cruise ship GHG

emissions which are delegated to the “commons” of the atmosphere as our guests, students, and faculty fly, drive and cruise in. For all issues in conservation there needs to be prioritising which is addressed within practical achievable means. Unsustainable consumer patterns with associated environmental problems such as carbon-based fuel energy systems coupled with long international travel to Iceland/Skálanes require the application of an overdue global solution, possibly entailing a wait for a cleaner and more renewable energy transportation technology with regime transitions spanning decades. By expecting and betting on renewable energy systems transitions instead of seeking other cleaner income generators shows in this case for Skálanes how privately run enterprises are reluctant to consider possible other angles that are not in line with their interests as per Hacking and Guthrie (2008) or that we are being simply pragmatic about our options and impact on the rest of the planet in the rural east of Iceland.

To curb GHG emissions as an end destination at the edge of the world is not a simple thing while being dependent on entrenched technologies and locked in worldwide states of regimes of economy and politics. Coming from this it raises the question if a relevant activism and focus on environmental campaigning might be called for in the local and real setting of the study, as the literature reviewed often had a high emphasis on developing nations and or underdeveloped communities which have a lower resource impact than similarly sized western populations (Hanink, 1995b). Iceland falls on the side of high resource utilization within the spectrum of nations. Therefore, it is suggested that a study like this, which explores the ways to assess and talk about environmental inputs and outputs in different sustainability situations, is particularly relevant due to its significant impact on the environment. Environmental dialogue needs to be tailored for different demographics and realities, representing outcomes related to people’s lives to try to reach optimal impacts amongst the population segments which are being informed. This is supported by studies which suggest that when people make decisions even when presented with clear scientific findings contrary to their values most people still stay value driven in their choices and ignore the information given (Hornsey and Fielding, 2016; Kahan et al. 2012; Attari et al. 2010). There are lessons in improving the systems based on the lifestyle most people aspire to achieve i.e., high consumption. Instead of guilt-tripping and denying others those aspirations we should also consider if it is a higher impact

choice as environmentalists to focus on remedying the effects of this consumer pattern.

For an entity like Skálanes or any company/initiative to make environmental amends to its operation there is need for a surplus/profit so there is capital to invest in future enterprises of conservation, improved equipment, and science. If there is no capital for that, it is forced to cannibalise its resources and its ability to react is thus proportionally diminished. If losses continue for an extended period, it ceases to exist due to bankruptcy. The gradual economic transformation or success of Skálanes might be considered a regime change from a niche activity towards a regime of state happening due to its mission and partial success in dealing with external economic forces dictating it's toolset for creating income (Jorgensen, 2012). However, the dividends of the population could be higher from this money as the spending of visitors is seasonal. It leads to seasonal income and work associated with the site. But we also do not have sunlight for 4 months every year and the place gets completely snowed in and that is an environmental factor which dictates the seasonal work just as much.

Trueffer and Coenen (2012) point out that there is little insight or studies on eco parks and their impact of spill over to the local economy. However, there is no reason to downplay the economic side of sustainability as unwelcome since without success or at least adequate comfort of operation there are no jobs nor continuity of work for the other two three tiers of sustainability that is society and environment. Economic development is a key component for conservation to be successful be it in the public or private sector. By starting a novel land use through conservation and education and by it creating economic value at Skálanes, whilst approaching the mission of operation with the aim of through that use, to not degrade its ecology and visual values. It can be argued that it is a diversification of economic activities in a similar vein as when looking at trophic networks and their increased robustness with more species and interconnectivity. Contrary to most natural resources, the conserved environment's extraction value is used on site where other uses such as minerals, wood, and food would be transported to a location of utilisation. Through a combination of landscape and species abundance and reclusiveness, in the 21<sup>st</sup> Century using a relative economic advantage or land use niche for conservation and visitor hosting. Coupled with societal, technological and economic changes and knowledge Skálanes has been developed into a new

resource or landscape use. Conservation can make more economic sense than the former way of utilising the landscape while being compatible with development. It depends on the economic aspect for its success (Getz et al. 1999). For further entrenchment of the socio/economic dialogue so far, I emphasise that I find every single of the following quoted underlined parameters about conservation being true to the success of Skálanes and its relation to the neighbouring community of Seyðisfjörður. “

*“It works best at sites where the threat is local and not too extreme and that are blessed with at least some of the following features: high tourist revenues, strong national political support, high potential for sustainable extraction, low natural growth in population... strong intact communities, stable consumption norms and fundamental compatibility between project goals and local culture and economic traditions”.*

(Mulder and Coppolillo 2005, p.259)

### **3.7 A Living lab, a Sustainability Transition**

Skálanes, a pioneering living lab, defies conventional conservation models, embodying adaptability, and innovation in its journey, providing insights into sustainability endeavours beyond traditional tiers. It is specifically and retroactively viewed as a pioneering living lab with a comparatively long operation. The approach is supported by the fact that living labs did not really exist as a discipline when Skálanes was founded in 2005 and has in 2023 accrued a continuous 18 years of operation. Initially a niche enterprise and organization functioning as a small-scale, innovative, and often experimental operation at the margins of mainstream economic and social systems. Focusing on sustainability and contributing to the exploration and development of novel approaches or practices that have the potential to foster more sustainable and environmentally friendly systems. During this period, it has experienced a gradual transformation from a state of a local niche initiative into an established yet still growing organisation in every aspect of; collaboration, theory and output without any substantial local governmental funding usually applied in the context of living labs. The fact that it is

still ongoing, coupled with its comparatively very long operation makes its economical set up and temporal scale an interesting novel and unique study subject.

The Brundtland Report (1987), with its widely recommended sustainability policies, catalysed a chance for something like Skálanes to happen since its publication opened the spectrum worldwide of possibilities for more agents than governmental conservation (Brandon et al. 2001). The report pushed further the science of sustainability in conservation and notably the second wave of it focusing on environmental issues and conservation into a series of action research initiatives, contextually of living labs and mitigation in sustainability transitions, diverse factors combine for management decisions requiring input from multiple collaborators and as Berriet-Sollicet et al. (2022) emphasise that the production of academic knowledge per se is not enough and that multiple partners of collaboration grouped together around a common goal are needed to create and implement concrete practical alternative development scenarios. But these multiple outputs of academic, experience based, action and solutions in the context of Skálanes are and should be diverse and the findings of work difficult to generalise, while promoting agency of participation with the intent of a common good by assessment of the ways to merge these inputs and outputs coming from stakeholders, guests, government, and academic partners (Heidkamp et al. 2021). Geels and Raven (2006) suggest that local niche experiments in action aggregate on a global scale and adjust to become global outcomes i.e., regimes. Skálanes is, according to that, simply a symptom of its time of the trend of the rise of independent private conservation efforts happening worldwide starting in the 1990's (Brundtland, 1987; Brandon et al. 2001). Its operation is based on the need to address perceived problems derived from past and current social and technological patterns and their retroactive interactions with economic and institutional systems. All being carried out at Skálanes on different levels of scale and with varying degrees of coherency between actors, stakeholders, and policy makers.

During this transformative process, Skálanes transitioned from its initial state as an abandoned agricultural site, which was locked into a hegemonic condition, to states of disruptive change as it approached tipping points in its

development, ultimately becoming a conservation field centre. With stages of take-off, acceleration, and stabilisation through a path of incremental innovation and changes with impulses which are often quite spontaneous, chaotic and in reaction to external changes (Loorbach et al. 2017). Its growth has not always been parallel in every aspect of capacity, mission nor facilities and it is not a case of a schematic idealised academic diagram found in sustainability action research papers. But instead, a complex, pragmatic real world, personal, value driven project for conservation through an application of sustainability in a three-tier approach where needs of nature, society and economy are considered but not always met evenly due to diverse limiting factors. Showing how complicated and complex its process of evolution in reality has been, it has sought to diverge from the traditional norms and setups found in the location of its operation in multiple manners. The *de facto* conclusion for the conservation mission, meant that for it to be successful in this case in underdeveloped areas such as an abandoned rural landscape in east Iceland is that it would need to entail not only deep personal stakeholder commitments. But also include local development and economic gain/interest beyond nature conservation to be successful (Abbot et al. 2001). Potentially, the slow accruing changes made in a small, isolated site might seem like lack of conviction or commitment to address the bigger environmental problems humanity faces. But this approach might be well suited as it addresses through its operation local multifaceted projects in fluid networks of change as opposed to challenging issues inside locked-in monolithic hierarchies. Starting as a local bottom-up approach in conservation it had to juggle varying factors during its evolution. As such it has worked like an adaptable multicellular organisation or organism which has evolved, growing and trying out specialised cells to meet its purpose for either immediate or long-term goals. Shedding some constituents of its composition later in its evolutionary process of finances, tasks, knowledge capacity and mission. Seeking or being forced at every time to adapt for a contemporary internal configuration of not perfect but a “better than”. A protected space where the utilisation of ecology and new socio-technological configurations are coupled with experimental disorder (Coenen et al. 2011).

This story of incremental steps of growth reflects on the small local population, distance from governing institutions and limiting internal capacities for science and funding. But without a vision for improvement based on relevant

knowledge, planning and action, the classical approach to sustainability and sustainability transitions will be disjointed unsymmetrical steps of vague improvements, in a similar vein to Heidkamp et al. (2021), of thinking holistically in the classic tiers of sustainability where each supports the other. Transitions towards sustainability have been worked on and studied, spanning technology, market, ecology, social systems, innovation, institutions, and space but they have been somewhat compartmentalised to date (Jorgensen, 2012). Where the systems and structures created are expected to provide ecologically sound and socio-technically viable solutions through these multi-tiered approaches to sustainability transition in a spatial sense. When the focus is on a more complex approach to conceptualisation of transitions as opposed to being nonrelated components acting independently of each other (Coenen et al. 2011). An argument is made for this study being exactly a solid case of non-compartmentalised transdisciplinary agency in conservation via nature conservation, economical and a lesser degree on the social spectrum. Skálanes existing and operating in 2023 proves the point and as it encompasses the components of a living lab as it evolves through feedback effects in accordance with its mission with inputs from a diverse group of contributing agents. A reality where actual experiments or pilot projects for new socio spatial technical configurations are developed and where scalability can be assessed (Geels and Schot, 2007 from Trueffer and Coenen, 2012). As emerging transitions have unforeseen end results that are dependent on experimentation and learning by doing. They can only be analysed in hindsight and those results can only be assumed to be useful for any future transition patterns or dynamics of change. Shellenberger (2020) and Loorbach et al. (2017), synthesise that transitions on sustainability are publicly and academically debated with a bias on Western European, developed, and modern societies and that its proponents argue for widespread and fundamental changes for it to be successful. But at the same time, it is understood that these changes are not necessarily always desirable or good for society in general as they can be disruptive. It is important to keep in mind that for Skálanes there are, due to feedback and the realities of networks, no best solutions for sustainability, conservation, and the environment. More like decisions that need to be taken with the best intent, waiting for feedback to generate reconsideration of action or intent. The question is how will it make an impact

beyond its self-contained bubbles of communication while preaching to the converted? Whilst Trueffer and Coenen (2012) argue that innovation networks transcend national boundaries. Where is the evolution as a niche and transcendental overlap of Skálanes? In its collaboration and education outreach via academia and dissemination of information to international travellers or the discussed and claimed practical approaches where the gradual steps to improvement being used as examples in the study are just a case of retroactively finding correlation for the philosophy of pragmatism and sustainability employed (Etzion et al. 2017).

Mario and McAdam (2003) state that organisations and social movements each serve contrasting functions in society. Organisations provide structure and stability, serve as a repository for established ideas and values. Social movements, on the other hand, are characterised by change and transformation, as they seek to challenge established norms and bring about social change. Social movements often operate outside of the traditional organisational framework in order to gain momentum and effect change. Once they have amassed enough power, they can then work to alter the status quo and bring about new laws and social norms. Skálanes is akin to a transitional organised movement in a conservation of otherwise public services such as found in a national park or an academic institution as Holman (2009) quotes (Keirstead and Leach 2007). It exists and works in a spatial setting of diverse social and technical actors, institutions, and personal/public impressions which interact/conflict and combine to initiate change, while being careful to not assume social nor institutional hierarchy or being overly ambitious (Trueffer and Coenen. 2012; Holman 2009). It has little or any emphasis on rules, formalities, regimes and the actors involved at Skálanes in context to its challenges, processes, and optimal outcomes. The complexity of the real world with its inconsistencies allows for a focus on the actors and their decision making and problem solving in a multi-layered/tiered/interconnected network (Trueffer and Coenen 2012). Thus, its interdependencies and causal networks can be difficult to describe in scope and based on the approach taken by individual actors and the interest of the analyst. This reality supports the need for diverse transdisciplinary topics addressed in this thesis as it is about a complex and real-life application of action for transition (Nijemeier and De Groot 2008; Trueffer and Coenen 2012)

As the site is in a constant state of ongoing development, action and information gathering as demonstrated in this chapter, an entity with a mission of conservation and to strengthen the community I live in, diversifying, creating jobs and strengthening our base to express ourselves. It is therefore of interest to consider the following. If niches or living labs such as Skálanes possibly or eventually fail or transform out of being living labs, they are still germinators of ideas which disseminate in the wider context of society through diverse media, staff or contributors which eventually pursue different careers. There is a level of actors involved, people with skills needed, vision, contacts, a critical mass. An actor constellation of people involved with the site and their experience there might have a positive impact in their future endeavours and career paths.

### **3.8 A Manifesto**

Following is a manifesto that defines the approach of Skálanes and the author to conservation in a changing world, its intent is to address the complexities of conservation and the enduring impact of human activity and climate change on the environment. Emphasizing a pragmatic, contextually-driven approach, which encompasses the following key principles:

1. **Acknowledging irreversible change:** Recognizing the irrevocable changes introduced to ecosystems by human activities and climate change. Conservation efforts must focus on enhancing contemporary ecological processes, energy flow, and biomass within the existing landscape.
2. **Adaptive management:** Applying an approach based on adaptive management, which involves ongoing problem-solving and learning by doing. Prioritizing practical and applied solutions over theoretical debates based on the belief that the value of empirical evidence and objective analysis should not be overshadowed by each other.
3. **Rejecting the concept of a pristine nature:** Challenge the notion of nature as separate from human influence. Human values are inherently intertwined with conservation management, and these

values should be openly acknowledged and considered in decision-making processes.

**4. Interdisciplinary perspective:** Advocate for a holistic view of conservation that recognizes the interplay between ecological, philosophical, economical, and societal elements. This perspective is crucial for addressing the complexities of the contemporary conservation landscape.

**5. Continuous commitment to effective practices:** Emphasize the importance of effective conservation strategies and actions over the mere designation of protected areas. Our manifesto reflects a commitment to ongoing experimental efforts to manage and enhance our natural environments.

This manifesto aims to guide our approach to conservation in the 21st century, focusing on adaptability and problem-solving while addressing the intricacies of ecological, social, and economic conservation with the inseparable influence of human values on conservation practices. This manifesto calls for a shift from theoretical debates to practical solutions and challenges long-held assumptions about what constitutes nature and a dedication to effective conservation practices and the recognition that the success of these efforts is contingent on adaptability and continuous commitment.

### **3.9 Concluding Assessments**

The outcomes of this thesis emphasise it as a success in achieving its objectives as it addresses the need to establish a comprehensive understanding and informed critical dialogue about conservation and sustainable land use. It investigates the sometimes polarizing and conflicting approaches to sustainability and conservation prevalent in academia and society, which is achieved by embedding the subject within the local case study of Skálanes. This aligns within a review of the natural history of Iceland and contemporary challenges created by ongoing climate change and anthropogenic land use changes, adding depth and

site-specific context to its relevance and by providing an understanding of these issues. The thesis employs a multidisciplinary approach to investigate the complex problems associated with modern conservation and sustainability issues, which are characterized by both quantitative and subjective elements. These issues demand diverse management strategies, multiple domains of knowledge in consideration and stakeholder engagement for effective improvements. It navigates the complex interplay between ecology, biodiversity, language, and management as it critically examines conservation paradigms, challenges assumptions, and highlights the intrinsic role of human values in shaping both theoretical and practical conservation and sustainability efforts. Acknowledging the need for empirical evidence while embracing a value driven approach. The study strikes a balance that allows for adaptive management without succumbing to theoretical excesses, incorporating a range of perspectives, from the founders of modern conservation ideals to contemporary scholars and personal experience, drawing attention to the dynamic nature of conservation as it emphasises the importance of changes and the need of flexibility in management in the face of global biological decline, as it exhibits a commitment to fostering positive change.

The thesis achieves several significant goals and outputs, including:

- A comprehensive exploration of dietary trends and their implications within the context of Skálanes. The relevant chapter examines the evolution of the food system and its effects on energy consumption, waste reduction, cost efficiency, and environmental impact. These outcomes highlight the potential for enhanced food consumption efficiency, the analysis indicates that over the studied period (2015-2017), energy use for food at Skálanes showed a marked decrease. This unintentional change led to a significant reduction in energy consumption per person, per kilogram of food, and per food unit (PDU). The examination of food categories reveals a shift towards a more flexitarian diet, marked by decreased consumption of energy-intensive items like dairy and meat. This shift aligns with the project's sustainability goals, demonstrating a concrete shift in dietary choices that resonate with broader environmental concerns. The findings underscore a positive trend towards improved food consumption efficiency,

encompassing several aspects including waste reduction, minimized packaging, and more controlled costs. The calibrated values for energy consumption in 2017 are particularly noteworthy, indicating remarkable efficiency when compared to previous data and external studies. The conclusions indicate that energy sources used in food production and related systems have a more substantial influence on environmental outcomes than consumption patterns. The study highlights the importance of renewable energy in food systems as a high-impact approach to reduce environmental harm.

- The utilization of Skálanes as a framework for successful modern eco-pragmatic transitioning sustainability project presents a multifaceted evolution which by merits of transdisciplinarity connects conservation, ecology, and human values. Founding the project based on the pillars of sustainability of environment, economy, and society with the intention to foster moderation and cooperative dialogue within conservation discourse. This initiative further contributes by shaping modern anthropogenic-based conservation policy and a philosophical manifesto, rooted in ethical considerations and conservation reasoning, which finds practical applicability both at Skálanes and within the broader Icelandic context.
- The inclusion of an autoethnographic account from the founding director offers a distinctive perspective on the evolution of a small-scale rural independent conservation enterprise. This blend of personal experience and scholarly analysis offers a holistic view, contributing to the academic landscape while enhancing the practical insights gained from the project's development.
- The study's exploration of applied action research within a pragmatic transdisciplinary setting, presented through the retrospective framing of Skálanes as a Living Lab, provides valuable insights into the effectiveness and challenges of this approach in rural conservation initiatives. But also enriches the broader understanding of transdisciplinary action research in real-world contexts.

- Lastly but most importantly this written monograph extends its impact beyond the PhD thesis itself, with Skálanes being active and operational. Playing a pivotal role in the outcomes and providing a platform for the practical application of the study's findings. These findings inform a case of real-world conservation effort with the adoption of sustainable land-use practices, and their dissemination. Consequently, the thesis serves as a foundational resource for Skálanes in implementation and management, its contribution to academia is possibly more significant by its application than the possible eventual peer reviewed papers which it might contribute to.

In conclusion, the use of Skálanes as a model for modern eco-pragmatic transitioning sustainability initiative represents a successful endeavour that challenges existing conservation paradigms while providing insights for both academic and practical conservation. It reinforces the notion of the value of interdisciplinary approaches, personal narratives, and pragmatic methodologies in addressing complex environmental challenges and contributes to dialogue and action for a more sustainable future. The thesis successfully achieves its goals by fostering critical approaches, addressing conflicting sustainability approaches, and providing practical insights for conservation efforts, thereby extending its impact beyond academia into the realm of real-world conservation practice.

## 4. Autoethnography

### Autumn

*Soon we will slow our pace after a frantic summer, but today we went with the students on a boat into the bay and along the cliffs, sailing amongst a massive megapod of white sided dolphins. They shared the waters off Skálanes with gannets, puffins, seagulls, guillemots, razorbills, fulmars, kittiwakes, a basking harbour seal and a curious humpback whale breaching repeatedly next to us in fog laced with sunshine. The place is still in a frenzied race to feed and hunt by all those animals to get their young strong enough for the coming migration. Fortunately, this summer has been a success as the sea has been a generous provider.*

*With the first fresh snow of winter in the mountain peaks the seasons are flowing indiscernible around us as the midnight dusk hints at the passing of summer, autumn harvests of berries, mushrooms, and geese. A time of the year when the green moss on the mountains is blackened with crowberries and sanguine arterial spray patterns. The reindeer who came on sail ships in the 18th Century were introduced to a country without any natural predation. Their population is now culled to control grazing pressure as a conservation gesture by the descendants of Neolithic hunter gatherers who in millennia past chased the deer ancestors across Eurasia. And like them, arrived on ships but just a bit earlier.*

*Last week the pigs were let free to roam beyond their lupine enclosure to forage, graze and investigate the landscape with no chance of raiding bird chicks or eggs. They came close to the house for the first time in their lives as they sauntered and sniffed down the gravel path leading to it. They had an obviously intense moment while processing the experience. These four pigs are delightful troublemakers and seeing/doing a first of some kind every day. But as quantum physics suggests, creativity and evolution of any kind might lie where order and chaos meet. So too do the pigs with their wanton destructive tendencies. We drive our operation close to the edge of a new vortex every year to see what happens.*

## **4.1 Autoethnographic Framework**

The unorthodox autoethnographic output dispersed throughout the study is a solution driven approach, based on my experience and knowledge while attempting to be respectful of and valuing different people's beliefs and knowledge. It also is especially important to acknowledge that this study is a methodological attempt of only "better than". A study on transdisciplinary action research of an evolving site/organisation with pragmatism being a vital ingredient in explaining its evolution and choices made. The method used demands the author's approach being of a personal narrative and a subsequent auto critical review of it and associated output thereof. In this work I demonstrate and narrate the evolution and current successful operation of Skálanes, in it describing a vague complicated process that was and is based on learning by doing, while adjusting and dealing with multiple setbacks and successes. It involves multiple domains of knowledge and experience such as conservation, economy, ecology, society, research, entrepreneurship, landscape, visitor and species management, staffing, finances, construction work, pedagogy, and geology to name just some.

Through the period of 2005-2023, I have had the privilege to be a host and friend to an enormous pool of talented professionals in the sciences, arts, and public sphere all of which have contributed to this process. I was exposed to their research and work while living the practicality and responsibility of managing and running Skálanes as an evolving site and an organisation, being simultaneously an insider and outsider. The methodologies chosen in this study reflect theoretically on the realities I faced and dealt with, and the use of autoethnography in context to provide a critical evaluation of my own stance and experience. An attempt of mitigation of objectives, realities and opposing values is made in this work, and understanding where one's writing is coming from is important to explore in that context.

## **4.2 A Narrative**

Culturally, I am a product of a time and place. Challenging work ethics and physical prowess was merited beyond educational gains in my youth, at least until my teenage years. Long working hours in harsh conditions in the fishing and

construction sectors along with a societal emphasis on competitive sports. Enduring, considered the epitome of an admirable worker/individual. Mostly masculine role models; tough men with a few notable exceptions, getting drunk in the local pub and heroic accounts of memorable violent foul play in football matches. Still, I was raised in a relatively open-minded household during transformative times of social change overall in Iceland. In my childhood my parents, among other things, ran the hotel in town, campaigned for restoring historic buildings and advocated feminism. They are both critically minded activists of sorts, in action and theory. Thus, when I was a kid, I was exposed to more than the fishing industry and physical sports but also to foreigners living in the hotel, different languages, contemporary dialogue and action about equality and feminism, and the importance of the preservation of architectural heritage. Even just a different cultural/culinary experience made an impression by eating lunch at the hotel with a rotation of diverse guests and staff.

When one looks at historic photographs from the town of Seyðisfjörður taken around 1900 and up to the 1980's. In these pictures, when one shifts the focus over the shoulders of people and to the landscape in the background, compared to 2023 there is an incredible change of scenery as the number of plants and their size both within the community and also in the mountains around has increased enormously. This is my childhood baseline, a somewhat desolate industrial fishing town in economic and social decline, surrounded by steep mountains, the vegetation growing or clinging onto partially exposed glacial soil deposits. Currently, not only are the trees planted by the local forestry club and intentionally introduced Alaska lupin prominent, but also a greener landscape of native grasses, flowers, willows, and birch. The number of sheep decreased, people planted, the climate warmed and the local economy adjusted to new realities. As a child I would ski in the town using a small lift behind a house named Skafffell, from just a few metres above sea level. Now, in 2023, the ski area has been relocated closer to the top of the mountain plateau at around 450 m above sea level to allow a steadier supply of snow. Skafffell, which was a carpentry workshop I worked in as teenager, has changed into the visual arts centre of East Iceland. Expressions of socio-economic and natural Kuznets curves in a warming climate? Things change.

In 2005 I founded Skálanes with my family, based on an idea that sprang out of my education, experience, and cultural background. This thesis so far has been a part of my narrative about it, of a project inscribed in landscape, geography manifested. Its founding is based on diverse influences such as wanting to improve the amount of primary research done in East Iceland. During my time in Reykjavik when studying for my BSc. it was apparent there was a lack of data in large parts of Iceland as basic things such as species counts and ecological baselines, general mapping of vegetation, and geology pointed towards an undemocratic regional discrepancy favouring the southwest of the country. At the same time as I was discovering this general trend, the extremely controversial Kárahnjúkar dam project in East Iceland was being worked on within the government. It became a point of observation from that process that the environmental impact assessment for this megaproject seemed mostly like a predesigned cataloguing of the part of the area which would then be altered or destroyed by the proposed project, reinforcing the idea that Skálanes could be a site generating knowledge and science pro-actively in the east and through its work eventually being able to contribute to dialogue on conservation and or land use in general. My family and parents also played a role due to exposure to their interest in nature during formative parts of my youth. This added with personal experience such as living, working, and travelling inside and next to national parks and protected areas in Brazil and Portugal. All combined with encouragement and guidance from my supervisor for my BSc. thesis in Geography at the University of Iceland, Professor Karl Benediktsson to write about an alternative national park proposal in Iceland, using the area, I still live in as a case study of a different model than the prevalent one at the time in Iceland.

From my BSc. thesis 2003:

*“There are probably many things that people will enjoy in the future, but closeness to nature is probably something that never goes out of fashion. Deserted fjords and valleys in Iceland will become much more valuable. The number of affluent people is constantly increasing and when a certain wealth is reached, they will start looking for a real quality of life (not the newest cars or the biggest houses). Iceland being one of the few countries in the world where it is still possible to buy*

*natural wonders at an acceptable price. There are countless examples, but in the east you can for example buy farms such as...Skálanes (emphasised). In this context, I have wondered that all national parks in Iceland except one being mostly desolate landscapes such as: glaciers and volcanoes.... It is therefore worth considering that the form that has been used for Icelandic national parks so far can be adapted to a different landscape use...for example an independent park... There are compelling arguments that a well-prepared national park / protected area establishment and operation could bring spiritual and worldly benefits to the local inhabitants. Locals can simply by getting people in their area to join as a group or by taking their own initiative, create a national park.”*

(Pétursson, 2003, pp. 43, translation)

By a series of coincidences, we literally did in 2005-2023 with Skálanes what I wrote and proposed about in my BSc. in 2003. As we suddenly and unexpectedly had this farm at our disposal 2 years after my graduation, we went about establishing an independent reserve. A field centre, funded through tourism and active conservation bent on restoration, aesthetics, acknowledging the realities of natural systems in place, planning for adaptability to wider change and lastly with a personal belief that this was worthwhile. Going along with what we believed in our capacity in regard to the realities we faced would and could be resolved in time.

*“Management as enacted by managers is in reality, more likely to be emergent, as opposed to deliberate, occurring alongside or even subsequent to action, as opposed to preceding it”. Etzion et al. 2017, p.168*

I am this person described in the quote, a creative communicative entrepreneur. Sometimes unfocused, bent on non-economic activities of conservation and science. A bricoleur as cited from Engstrom (2012), a person who uses various skill sets and knowledge to build up componential structures. Someone who, without formal qualifications, set out with an idea and plan where the financial set up was created *ad hoc* to support the mission of Skálanes and not vice versa. A reference to this in regard to the thesis is in David et al. (1991) where they state that action research is a good vessel to make academic research relevant, that researchers should try out their theories with practitioners in real situations and

real organisations. This work is about a combination of places, processes, and people where an idea, a belief in a plan and carrying it out in action fits that observation.

As a founder of Skálanes I have never ever been alone or without help of others in the work and the responsibility inherent in creating and leading its evolution. There are so many people who have had a hand in making it what it is today. All have shared the evolving missions and visions of a place of learning and conservation. A community of family, friends, students, faculty, guests, and co-workers who have leveraged it to this point, so far, together. If an enterprise such as Skálanes is a classical musical composition, then the students and summer birds are the high notes. The violins and clarinets flourishing and elevating the piece. Whilst the mid notes of the seasons and the yearly routine of our work and experienced visiting faculty, temperate and accentuate the high notes acting as the horns and the bigger bodied stringed instruments. Adding their voices to the song. Sometimes both weave together to make the sum more synergetic and bigger than their individual components. My personal contribution the whole time has been mostly the low notes. The baseline of the cello, tuba, and bassoon. The simple repetitive percussion of maintaining the tune for all the others so their output has a deeper body of sound supporting their expression. Some of the keys I play unheard, imperceptible to discern and often utterly invisible at the very back of the stage.

Counting the bars.

In the first years, alone for extended periods.

Carried the tune on, over time.

A continuum.

Catching the smaller instruments as they falter in their solos, adjusting the tempo to allow them to catch up or slow down. All together creating a three-dimensional harmony of work and a place which on its best days is a wonderful melody of humans and nature.

The constant factor every year.

*“What can we say about a collective action problem that so disrupts humanity’s most basic experiences of living and acting together? How should policymakers deal with all the layers of uncertainty and ignorance? The short answer is with humility: about the reach of science and about when to stop relying on science or technology because the problems we face are as much ethical and political. Science fixes our attention on the knowable, leading at times to an over-dependence on fact-finding. Even when scientists recognize the limits of their own inquiries, as they routinely do, the policy world, often encouraged by scientists, asks for more research. Policymakers need to understand, as Pope Francis suggested in his climate encyclical of 2015, that looking to science is not equivalent to finding ethical solutions. Science and technology advisers, too, should welcome the diverse forms of knowledge that should ideally inform political decisions.”* (Jasanoff, 2018, p. 13)

I am, hopefully, humble. My values and beliefs are moderate in the sense of how much one can realistically affect society and nature at a larger scale. I am not a convert of the neo-Malthusian environmental camps approach of constant imminent doom, an Adventist of retarded collapse, nor a climate change denier (Swilling 2020). Rather I want to apply myself to repairing and preparing the landscape through actively working on sustainability utilising an approach for a better future and new ecologies of all sorts. Therefore, the pragmatic principle utilised at Skálanes of prioritising resource application, moving forward incrementally, developing, and working in partnerships, collaborating and delegating “ownership” of its componential work. In building relationships and networks, be it: businesses, council, community, academics, students, and guests. This has created an opportunity to work with individuals from diverse backgrounds in life, profession, and science which has been a true privilege of being educated constantly. In this process I became the advocate and ambassador of Skálanes, interacting with this diverse range of people which have over the years critically contributed by very gently and politely suggesting needed changes or improvements. The development of the site and our mission based on their knowledge and experience was instrumental for its current state. Without these suggestions the work carried out would have been narrower, lacking in democratic

contribution, professionalism, transdisciplinarity and international context. This collaboration has been of the utmost importance.

In the early years of operation there was often little capacity to carry out the improvements politely mentioned, but the ones heard, deemed practical and realistic were considered and kept quietly around until ready for implementation when the organisation, financial or personal capacity reached the stage of needed maturity to implement changes in infrastructure, research, or policy. From this entire process of doing while learning, it was apparent how far Skálanes had to go in its initial stage to become what it aspired or claimed to be. As plans progressed from conceptualization to execution, the comprehensive structure of the systems being developed became more prominent as I gathered information through a random, piece-by-piece approach that lacked a systematic framework as per Fear et al. (2006). Through this, Skálanes evolved towards its mission to become an established organisation/entity bent on the tenets of modern conservation, field science, and later, activism. At times there was a struggle to meet any standards of professionalism, but gradually it reached a state of being able to provide a comfortable, engaging learning environment on an actively managed conservation site, partially open to guests via covertly controlled access. Catering to a wide range of subjects of study and also to individual ethical and spiritual growth. Slowly it was able to evolve into something more confident and knowledgeable, with a 21st Century global perspective, actively engaging the wider world. Through this process at a certain point a decision for change towards more professionalism was made, with a decision to write this thesis, which is also a manifesto of the place and its mission. This was to a degree spurred by the want and encouragement of the visiting faculty who are my friends. But also, internally a personal readiness to continue to evolve in capacity. Through the patient long-term commitment of hammering the low notes and grinding on we gradually reached the current stage of relative stability for Skálanes. In ways, its future options now surpass the scope of possibilities initially considered by us and our collaborators.

As is clear now, my role and capacity has changed since 2005 from being something of a glorified janitor in an empty derelict house in the rural east. A passionate young person burning for the ideas and plans I have described. When

we bought the site, it was a crofter's farm, the fields littered with rusting equipment, car wrecks, heaps of old nets, plastic debris collected from the beach. All things that might be useful "later". The old farmhouse in shambles, uninsulated, no heating, generator electricity, rudimentary. There was also a "supply" of hundreds of ruined car tyres spread around the meadows as bird nests/shelters and hundreds of metres of non-utilitarian fences of different makes. A massive amount of work went into collecting all of it together and cleaning the site from that version of human nature. The "weeds" of human industry that grow so easily wherever we use and stay in the landscape. But for the operation to function according to the plan set out, the facilities also needed to be adequate. Thus, we continued the work by renovating the old house and adding an extension. A massive job in the middle of the winter, involving tens of people and considerable costs. Eighteen years later: so many tourists, cooking, logistics, planting trees, damming wetlands, minding the eider colony, financing, lobbying, maintenance, liaising with student groups and faculty, residential huts, path building. The list goes on and on year after year. Now in 2023 almost two decades later I have promoted myself to the role of a director. Someone who by now has the experience, knowledge, confidence, and credentials needed for this functioning site. In hindsight, I was maybe unconsciously forced to adapt to the operations growth and internal changes. Focusing on creating partnerships, writing this thesis, which will be a tool for improvements, minding the finances and assisting "better than" in such a role than being distracted by the immediate manual needs of the site. Carrying out the work and roles described and more for 18 years now. Without drawing a normal salary for extended periods. Some years well below the minimum national standard defined as poverty.

Through lack of personal income for years on end and a fanatical personal workload...

I hurt my family.

So, it seems...I made a selfish choice.

Where did my sense of responsibility lie?

The community I am a member of has historically faced challenges of its economy being dependent on varying fish catchments, the whims and fortunes of tourism

and changing demographic composition in age cohorts. Similarly, there were times when I was confronted by issues and challenges at Skálanes or in my personal life that changed the course, dictating our progress or slowing it down. These challenges have names: banking crisis, volcanic eruptions, personal injury, national micro currency with fluctuating exchange rates, covid, worldwide inflation, a landslide.

Loss of motivation.

I have repeatedly fought tooth and nail at my own personal and my family's expense to keep Skálanes going. My finances and personal/social context has been negatively affected. Neglecting friends and family due to unhealthy workload/ethics has had a cost and hurt. This has repeatedly contributed to loss of enthusiasm and drive for the entire project. But that lived experience eventually helped me realise that realistic financial stability and genuine care for all staff and participants including myself is a key factor of allowing the better, more interesting aspects of our work to be successful and improve. That anything else is abusive.

Is what I have written so far, a laudable commitment to one's vision and integrity or of a state of unhealthy relation to it?

### **4.3 Analysis of Narrative and Reflections**

This thesis I have been working on part time for the last 7 years involves the work at Skálanes so far, data from it and a review of a wide range of subjects. New knowledge was created in it, it is academic, personal, and practical within a solid, if unorthodox theoretical framework. Utilising an analysis and auto-criticism of the narrative created from a mixture of positivist science and constructivism, theoretically and methodologically, turned out to be a useful approach to cover Skálanes and its ideas. The combination of subjects, methodologies, theories, and the long timespan of a personal nature in relation to my work at Skálanes makes this thesis singular in scope and narrative. Having the position of being present since the start of the project and having gone through a personal modulation of knowledge and narrative in the process. The agent of action, producing a mix of

applicable objective and subjective, discrete or complicated findings which have the researchers' values bound into them. Among them a manifesto for a site with an exceptionally long operational scope for becoming a living lab, including in it is my narrated experience as a conservationist, entrepreneur and academic. All these make me an insider of those subjects which relate to the thesis, an autoethnographer by default (Maydell, 2010). Translating that to my work at Skálanes was a challenge, as I accrued the necessary language to describe it, while managing the process of evolution of the site, the vessel of a long-term vision and engagement. Proving that local private or independent initiatives in conservation can grow and be useful. The steps taken towards its current state in both formal and informal intellectual capacity have been small, with long-term goals kept in mind. The process was a chaotic feedback loop of financing, projects, capacity, ideas, infrastructure and even a couple of natural disasters. There have been setbacks and mistakes, happy days, successes, burnouts, dark moments, and achievements.

A lived living lab.

The version of the story of Skálanes narrated in this study has strengthened my belief that we have had the capacity to generate outcomes, assist people, carry out science and continue to be a local positive social and economic influence for an unforeseen future. The methodology and values presented generate a message of pragmatic optimism, of mitigation and the chance to be proactive and useful on an individual level for the environment. A story of a place that can and has inspired people on the path to academic and personal paths and careers. Simultaneously the study focuses on the author, associated cultural background/landscape and society/community. There are emotions, feelings and motivations shared which can be viewed as unprofessional, unacademic, or biased. But looking at it from the opposite angle one can also call it dedicated professionalism, inspired, and a passionate methodology about a deeply personal mission, as the thesis itself is the canvas needed for the feedback involved in the process of its creation and accrument of relevant knowledge and narrative. Skálanes has been an eventual success and creating it as it was done, gave us

options and experiences difficult or simply impossible to replicate e.g., as a state conservation site or in a controlled experiment.

An experimental lived living lab.

Autoethnography is often focused as a method of research for the underprivileged and oppressed, covering subjects such as racism, gender, poverty, identity and so on. Emphasising the need of the autoethnographer to seek out their privileges and or oppression as autoethnography represents subjectivity and emotions (Hughes and Pennington 2017). I am of course unavoidably dispositioned one way or another as an individual, and the thesis work presented is a result of that, and thus a manifestation of my values through the topics covered. The founding of Skálanes was urged into action by a perceived injustice to the area I live in, a lack of regional science, an action in divergent conservation, valuing anthropogenic landscapes and a passion for my community. But in seeking out my privileges as I write in this study about subjects and topics which are the playground and concerns of mostly well-off parts of the Western world. Conservation of flowers, birds and so on being a banal middle-class affair compared to some of the other problems addressed by autoethnography, e.g., poverty, discrimination, inequality, racism, and violence. As an autoethnographic subject I am one of the luckiest people on the planet and a question worth asking in the context of privileges, is if Iceland provided me with favourable environmental and societal conditions and the town of Seyðisfjörður being a successful and growing tourist location, harbouring a tolerant community to experimental ideas? Did these factors along with my social capital of having a strong network of friend and family allow me to take uncalculated risks and dedicate myself to Skálanes? Definitely a yes to all of these questions. I am not a victim of anything at all and placing myself in a critical context as a cultural entity or an identity-based subject of the thesis does not come across as being fair. Social justice is of course a never-ending issue to work progressively towards everywhere, but the national problems of Iceland or my personal ones in context are dwarfed by comparison to larger and more complex countries.

The existential angst of being a white, able bodied, heterosexual, middle-aged, educated, relatively well-off Scandinavian male.

But as my narrative is a chosen method of packaging a story as told by me. Am I withholding a truth of some sort about my privileges or positional favouritism and somehow deflecting to look better than I deserve? The question arises then of why I ignored alternative career options, not to nurture my friendships and stray from parental and partnership roles due to commitment to Skálanes? There was at least a deep altruistic dedication to something, a sacrifice made.

My next question is then more about how well I know myself and my own role in things. Am I self-aware of what I write in a self-critical approach to and in a narrative with the intention to explore my role at Skálanes. Assessing with purpose the inconsistencies, gaps, and faults in the process. Do I remember? What and how much? Is memory from a personal experience a good quote or citation? Other references such as mail correspondence or reports map administrative and formal output, while old conversations and memory are vague relics of a possible reality. The study will never include everything, and I cross the threshold back and forth of the created output from writing a diary to a manifesto to an opinion piece and lastly an academic study. Despite these concerns, I stand firm on a personal and theoretical foundation that the narrative process described, as vague as it is. Is the strongest and most unique of the academic contributions made. Displaying how Skálanes is built up as a social construct and the deep level of agency involved in creating something like it. That every little step adds up to the sum of its current state. All the while throughout trying to not emphasise value-based differences and problems but to seek out the solutions and ways forward (Heidkamp et al. 2021). If it is difficult to identify how small local initiatives can or have had whatever impact, then this study is a tool to learn from and marshal the thoughts, aims, and progresses which were needed in this case.

Since Skálanes is past the point of make believe and we are instead currently faced with the boons of multiple positive realities to choose from, who am I and what do I want? Now, there is less emphasis on field science and data collection than in the beginning from my end. Instead, there is a desire to make sure that

Skálanes is happy, fair and people working and staying there are feeling well. Out of that good practical things come such as useful science and conservation work. I am not sure it necessarily happens in the reverse order where scientific output and conservation work generates happy people and good conditions. I am also not sure that many of the thoughts and ideals presented in the study were not already there to some degree.

But this study has allowed me to formalise them in output, as someone said something like the following to me at an early stage of writing this thesis.

*“You have already made up your mind. Go and find the necessary references to support it. You can always just point out if it is criticised that it is something that is already done (Skálanes) so therefore it is true.”*

A truth?

A true experimental lived living lab?

The spatial and temporal context of organisational hierarchy and capacity is more complicated than first meets the eye. As we founded Skálanes we understood that we lacked the knowledge and the language for what was intended to happen, but we faked it. A revealing fact is that we intentionally had the Skálanes logo and letterhead made as our first project. Before a business plan, facilities, management plan or manifesto were written down. The idea to create a logo and letterhead first worked, as the plan was to pass off as something “real” from day one of operation, dressing up all our formal correspondence, emails, and website as something legitimate and formalised. Forcing the world to react to us in interaction as a Potemkin’s reality instead of a remote mote of possibility. Considering the initial ambitious plans and the lack of capacity, funds, facilities, and knowledge then it is an obvious and utter arrogance on my behalf to simply assume one could transition academia to Skálanes. Initially being small meant flexibility and an ability to react quickly. But by being small we were also weak and lacked resources, needing to apply our focus on short-term small issues while piggybacking on bigger institutions such as international universities and colleges through projects and the elsewhere employed faculty that works with us. So how

was Skálanes independent and where are these interactions of collaboration simultaneously with up to ten educational institutions, considered small or big? A complex and unstructured process dependent on learning by doing as Skálanes transformed towards its current state as per Loorbach et al. (2017).

*“An expressive act is one that I take, not to achieve a goal outside myself but to express a conviction, a leading, a truth that is within me. An expressive act is one taken because if I did not take it, I would be denying my own insight, gift, nature. By taking an expressive act, an act not obsessed with outcomes, I come closer to making the contribution that is mine in the scheme of things.”*

(Fear et al. 2006, p. 24)

Creating Skálanes was exactly as Fear et al. (2006) describe and being constructive as new opportunities emerged in a gradual pragmatic progress as opposed to a belief in leapfrogging regime changes of technology or societal processes as per Coenen et al. (2011). Gradually it grew in all capacities to its current state of external and internal factors, and I honestly believe what I did at Skálanes in the context of carrying the legal and ethical responsibility was and has been with the best intentions, even if the outcomes have not always been perfect. I have cared for my community through actions and thought, aimed to be respectful, communicative, and reciprocal, tried to create trust and motivation for collaboration. All of which are the true tenets of successful transdisciplinary action research. Throughout this process I have had a strong social and professional network which by choice and coincidence is international, multicultural, bipartisan, and eclectic. There is a belief in an alternative positive future by actors (me and others) and values which I tried to realise by generating the momentum for meaningful public interaction and questioning the orthodoxies of the conservation movement in Iceland.

I have a plan for the future of Skálanes and a story about it, but there is no personal need to prove my point of anything nor forcing anyone to agree. Much more a will of sorts to assist in the understanding that people do have much more in common than not on things regarding their environment and conservation ideals. My belief is that to build partnerships and strengthen our work and community through Skálanes is much more important and nicer than being always

“right”. Skálanes is an example of this as it has through action, reflexive management and experimentation grown, learned, and adjusted in its path to maturity. The environment where it was founded is important and favourable but there are numerous other sites where the same could have been done within Iceland, but the fact is that due to weak domestic spatial structure in conservation in 2005 and lack of national examples of comparable sites it did not bump anyone in practicality and caused no competitive issues or strain. But even with the apparent “ease” of establishment, the learning curve and documentation of the experience is valid, as it demonstrates exactly this and then also the possible neglected challenges of slotting into a non-existent divergent format of landscape use in Iceland. The use of Skálanes as a socio-economic-nature is closely tied with multiple preconditions, and the inadvertent economic changes which occurred across Iceland from 2005 to 2023, where combined natural resources and ecosystem utilisation in the case of tourism have made it possible for it to develop and set ambitious goals into the future.

In the spirit of pragmatism, autoethnography and action research it is a civil, ethical and an activist gesture to do what we have done. Emphasising that through the specific roles that a single place can have in spatial context concerning the formation of ideas and transformation of site. I contest that one of the intended outcomes is that Skálanes has been successful, and through it assisting academics and scientists to learn and apply research towards tangible results. This does not happen automatically. To publish a peer reviewed paper is something mostly aimed at other people within academia. To get beyond that point in direct application or utilisation needs a divergent placement of scientific work. Skálanes has facilitated these processes in several cases. As Muterspaw et al. (2015) emphasise in their paper partially based on student and faculty participatory work at Skálanes - the site and its mission fulfils its role as a field station where the authors conceived, learned, re-evaluated, analysed, and synthesised while working there.

I have not seen any similar studies or papers where the author is also the founder, agent, and agency being studied within an organisation of their own creation and definitely not on the temporal or economic scale used nor through the lens of conservation or living labs. This autoethnographic study is funnelled through transdisciplinary environmental geography where multiple but

interconnected topics, theories and methods are broken down and reassembled with the intent of creating new academic output. Coupled with this is the narrative which does not have simple conclusions. There is a degree of literary evocative creative licence in the thesis. Artful engaging text is usually not the term used about academic writing by the majority of people, but I need to engage beyond academia to be “useful” by reaching out to a wider audience. Skálanes being operational, hosting students and leading educative tours in the landscape for thousands of guests annually is that outreach. This is a study which draws deeply on a personal level and lived experience of the author, writing it has been a cathartic and hurtful experience at times. Still, I am not unprofessional by applying poignance or personal expressions, emotions and feelings are not exclusive of rationality. Fear can help you avoid danger, and happiness to seek out rewards. Emotions inform us and are the basis of our rationality, not the other way around. Thus, by the merit of emotional rationality, the story of Skálanes has demonstrated that with minimal funding, the right people, a lot of help, commitment, and integrity that “something else than” can thrive in isolated rural locations. Over 1000 international students and faculty hosted. Hundreds of millions of kronur paid in salaries and services. Almost one hundred thousand guests and hikers in organised informative tours, a functional workspace, useful facilities, science, and active conservation of nature.

## **4.4 Autoethnographic Epilogue**

In 2005 I thought I might eventually become “the wise man of the mountain”. Someone who knew all the sounds of nature, smells and species names, a living breathing encyclopaedic anthropogenic fountain of knowledge about everything on the site. An old man with a long beard!

Now, eighteen years later I am of course someone else than I anticipated. The belief of what I am doing is worthwhile is still there but diminished is the arrogance and the fiery conviction of the younger me. Instead, in the meantime having gleaned something else. The breath of the years lived with guests, students, and faculty and through changes of nature and nature in oneself a different appreciation grew of the place I work in. Through the power and inspiration that

lies in the landscape, I gained a very personal relation to it, which has no exact description.

There is still an ambition and passion to move onward, fuelled now by the confidence gained in one's own capacity and experience. The ability to express and articulate, carry out actions and follow through with the philosophy chosen. The personal dedication is more quiet, discrete, personal, and much stronger. This notion of myself, of being grounded and useful in my work is reinforced by feedback from people I work with such as the following email excerpts by anonymous professors leading projects and student work at Skálanes in 2022

*"I always enjoy hearing you talk about your ideas of sustainability and how we need to be thinking about the future. So much of conservation here ... is about the past - how to restore the environment to some imaginary ideal state. You are thinking about how to set up the environment to be robust and healthy as the climate changes. Keep on it, there is good stuff in there, and people need to hear it. People also need to hear about how we balance the costs of international travel etc with the immense opportunities' we travellers gain by coming to Iceland and working there. How does one measure the intellectual benefits vs. the known carbon footprint?"*

and

*"I wanted to touch base and thank you once again for hosting my group at Skálanes in July. We had an incredible time, and you certainly made an impact on the students. Many of them wrote about you in their final journal reflection. Your simple words of wisdom resonated with them on a deep level. One of the students wrote her entire reflection centred on your statement, "live like an Arctic Tern". She said that statement touched her heart and connected with her in a way that no other statement ever had."*

To finalise and synthesise: The future is interesting and work onwards for sustainability and conservation should focus on hope for, and love of both humans and nature.

## Winter

*A full moon, snow, a familiar point of view, and the red house at the end of the road basking in the low angled February sun at 65.3N. Eider ducks on the sea serenade each other in the initial stages of bonding and courtship. Soon a summer of eggs, students, laughter, and projects.*

*This winter has been light on snow, but the weather has been ferocious with implausibly equatorial record-breaking rains. Causing a massive landslide.*

*A betrayal of reality.*

*As the mountain thundered.*

*Fracturing minds and breaking hearts.*

*It buried a part of our town.*

*By some miracle no one died.*

*We changed, worked, evolved, adapted, had to.*

*Just a few days later sustained wind speeds of 208 km per hour of a hurricane level three strength storm flung whole roofs around like kites in the air as it tore through the immense debris field of disintegrated houses. Out here at Skálanes it shattered the handrails on the footbridges and some of the firewood sheds were damaged. Door hinges bent out, the proud flagpole left, snapped in two.*

*It remains like a jagged maw of polymer canines challenging the skies to just try us more.*

*Checking in late winter, cross country skiing with food and apparel for a stay until Thursday. Thesis writing and a few practical things needing sorting out. Absolutely stunning winter views of the mountains, ptarmigans and ravens abound, reindeers grazing next to the house. Fox and mouse tracks criss crossing in the snow in patterns of straight runs, unexpected swerves, and short jumps. The 4th dimension manifests itself through these tell-tale signs of a vixen chasing its prey last night.*

*Suddenly, out of thin air a massive female gyrfalcon hurtles past. Within reach, incredibly fast. She is indifferent to my presence, no gesture nor a glance, I am inconsequential to her world of utter clarity and terminal speed.*

*Within seconds, vanished from sight.*

*Not a single wingbeat, her meteor like strike across the sky past me powered by this old storm spent days ago. I am content.*

*Some of the usual greylag couples which nest close to the house every year appeared overnight. Most likely they took off yesterday somewhere in Scotland, using the strong drag of the passing weather front to propel them here with minimal effort to their seasonal sunny vacation of sex and subsequent incubation and chick rearing.*

*They are unusually early though.*

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# 6. Appendix

	2015			2016			2017			MJ per Kg
	Cost	Weight	MJ per year	Cost	Weight	MJ per year	Cost	Weight	MJ per year	
<b>Dairy</b>										
Milk	49407	284	1676	60565	332	1959	56806	297	1752	5,9
Cream	89557	86	1634	81080	78	1482	72994	63	1197	19
Yoghurt / Skyr	224204	117	1402	337007	231	2776	143502	52	627	12
Butter	68306	77	3076	86135	96	3820	79250	86	3420	40
Cheese	375527	197	11828	192878	100	5975	182936	105	6300	60
Cottage Cheese	2805	3	33			0			0	11
<b>Total</b>	<b>809806</b>	<b>764</b>	<b>19648</b>	<b>757665</b>	<b>836</b>	<b>16012</b>	<b>535488</b>	<b>603</b>	<b>13296</b>	
<b>Bread and Pastry</b>										
Hamburger Bread	2122	2	28	2162	2	28	2162	2	28	12
Rustic Maltbread	7922	18	216	3238	8	96	3128	8	96	12
Sandwich Bread	96158	136	1770	155595	246	3198	124594	196	2548	13
Rye Bread	64606	58	1214	89965	178	3738	157917	126	2646	21
Digestive biscuits	10333	14	302	14280	19	403			0	21
Digestive biscuits w/chocolate	3978	5	198			0			0	44
Donut w/o chocolate			0	90703	8	343	146764	12	528	44
<b>Total</b>	<b>185119</b>	<b>233</b>	<b>3728</b>	<b>355943</b>	<b>461</b>	<b>7806</b>	<b>434565</b>	<b>344</b>	<b>5846</b>	
<b>Meats and Fish</b>										
Hot Dogs	4500	3	102			0			0	34
Pork	57460	31	1246			0			0	40
Pork Condiments	87094	41	1760	139037	72	3096	150122	56	2408	43
Sausages	45929	39	1321	59416	55	1873	38534	37	1258	34
Beef Burgers	11776	6	450	7507	5	360	10165	6	450	75
Mixed minced meat	9078	6	276			0			0	46
Lamb	419243	217	9349	389679	247	10604	186211	100	4300	43
Marinated Herring	18472	14	629	9440	7	290	19912	21	915	44
Smoked Salmon (aquaculture)	46874	11	912	30349	6	512	87834	26	2147	84
Cod Fillets	203818	184	19320	375107	299	31427	79301	79	8327	105
<b>Total</b>	<b>904244</b>	<b>552</b>	<b>35363</b>	<b>1010535</b>	<b>691</b>	<b>48163</b>	<b>582393</b>	<b>331</b>	<b>20081</b>	<b>14077</b>
<b>Drinks and Beverages</b>										
Tea	18283	6	216			0			0	36
Chocolate (hot drink mix)	11653	9	389	27836	4	156	33478	29	1058	44
Coffee	92343	53	1901	88522	52	1872	1982	1	65	36
Orange Juice	60125	361	3608	70586	520	5200	77953	44	1566	10
Apple Juice	62488	370	2627	50285	300	2130	41382	240	2400	7,1
Beer	185688	248	2976	266976	512	6144	28523	181	1283	12
<b>Total</b>	<b>430580</b>	<b>1046</b>	<b>11717</b>	<b>504205</b>	<b>1388</b>	<b>15502</b>	<b>364254</b>	<b>855</b>	<b>10692</b>	
<b>Fruits</b>										
Apples	47303	133	1147	51354	170	1465	37996	147	1265	8,6
Oranges	33616	115	1085	33979	138	1300	25806	103	967	9,4
Bananas	4317	167	2002	36004	161	1932	14699	88	1058	12
Jams	32547	47	750	29413	39	626	21190	17	275	16
Dades & Raisins	7816	11	259	20730	25	566	5677	9	216	23
<b>Total</b>	<b>125599</b>	<b>474</b>	<b>5243</b>	<b>171480</b>	<b>533</b>	<b>5889</b>	<b>105368</b>	<b>365</b>	<b>3781</b>	
<b>Miscellaneous</b>										
Cooking Chocolate / Candy	41852	28	1223	43566	27	1189	27317	15	660	44
Eggs	110209	120	2151	107823	105	1890	97283	98	1755	18
Sugar	13684	66	647	13047	68	666	6390	35	343	9,8
Balsamic Vinegar	2940	1	35	4450	7	178	3802	5	120	24
Vegetarian buns	19549	13	267	11226	10	210	5613	5	105	21
Cooking Oil	8002	25	375	5579	20	300			0	15
Honey	498	0	3	18663	12	70	11180	5	30	5,6
Ketchup	3454	8	57	3448	8	57			0	7,1
Valrhona Tropolia hvitt 26% 1 kg (6).	2395	1	44	6698	3	132			0	44
Pesto	37350	17	513	42118	19	574	24411	12	362	30,2
Spices	21416	6	144	28663	10	230	20161	6	138	23
Salt	4915	29	1035	5874	4	153			0	36
Yeast	1936	2	54			0	3838	3	108	36
Olive Oil	2598	5	120	3365	5	120	17814	30	720	24
Mustard			0	3205	31	0	650	1	0	
<b>Total</b>	<b>270798</b>	<b>320</b>	<b>6668</b>	<b>297725</b>	<b>330</b>	<b>5769</b>	<b>218459</b>	<b>215</b>	<b>4342</b>	
<b>Vegetables</b>										
<b>Imported</b>										
Salads	16325	22	88	20152	10	40	33796	24	96	4
Carrots and Beets	8594	38	152	31125	102	408	30363	116	464	4
Yellow Beets	29271	75	1125			0			0	15
Fresh Spices	10004	32	480			0			0	15
Green Peas	4784	18	216			0			0	12
Tomatoes (imported)	13727	62	1538	15401	52	1293	3451	4	88	25
Ginger root	677	1	15	459	1	15			0	15
Avocado	1686	2	50			0			0	25
Onions	5967	50	750	4940	45	675	3150	32	477	15
Garlic	4392	9	141	8316	6	83	2877	6	90	15
Potatoes	39640	193	886	110854	403	1854	66524	237	1090	4,6
Olives	2064	6	90	6250	18	270	2949	9	135	15
Dried Mushrooms	8820	2	72	22716	4	144	15735	3	108	36
<b>Domestic</b>										
Tomatoes (domestic)	45975	92	2310	61028	147	3673	78658	141	3520	25
Salads	30034	80	320	16790	70	280	4490	12	48	4
Cucumbers	35515	75	298	58116	121	484	34062	70	278	4
Red Peppers	32150	55	219	22151	43	170	16541	39	156	4
Red Beets	8445	75	298	1223	10	40			0	4
<b>Total</b>	<b>298070</b>	<b>886</b>	<b>9047</b>	<b>379521</b>	<b>1031</b>	<b>9427</b>	<b>292596</b>	<b>692</b>	<b>6550</b>	
<b>Cereals</b>										
Muesli	20408	42	630	24729	50	750	13030	32	480	15
Nuts	47128	10	150	104824	30	443	29079	12	180	15
Rice	8480	22	136	35057	49	299	6544	20	122	6,1
Pasta	5713	16	120	3224	10	75	4466	15	113	7,5
Wheat	8685	87	435	9088	100	500	5924	50	250	5
Chick Peas	2262	5	90	1	2	30	7948	23	460	20
Cous Cous	984	2	30	6023	9	180			0	20
Oats	7762	50	220			0			0	4,4
<b>Total</b>	<b>101.422</b>	<b>233</b>	<b>1.811</b>	<b>182.946</b>	<b>249</b>	<b>2.276</b>	<b>66.991</b>	<b>152</b>	<b>1.605</b>	

List of food ingredients, sum of their cost, weight and MJ content for Skálanes in the years 2015 to 2017.