GROWING RHODIOLA ROSEA IN UNALAKLEET, ALASKA

By
Mosaddeque Reza

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_____

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_____

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Department of Alaska Native Studies and Rural Development

Dr. Jennifer Carroll
Co-Chair
Department of Alaska Native Studies and Rural Development

4/18/16
Date

GROWING RHODIOLA ROSEA IN UNALAKLEET, ALASKA

AN APPLIED COMMUNITY DEVELOPMENT PROJECT

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By
Mosaddeque Reza

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Abstract

Rhodiola rosea is a medicinal herbal plant that grows naturally in higher altitudes and colder regions in the world including mountainous regions of southwest China and the Himalayas, and the circumpolar North, including Siberia, Iceland, Finland, Norway, Sweden, some parts of Canada, and Alaska. People use its dry roots as tea, put its extract in capsules, and eat it as a vegetable. It helps reduce mild to moderate depression and general anxiety disorder, and it enhances work performance in adverse conditions. It is an adaptogen, that is, it works in the body without affecting any biological function. Because of this, it does not have any side effects like many industrial medicines. Since it reduces depression, it could be helpful to suicidal patients, but more research and studies are needed.

Demand for *Rhodiola rosea* around the world has been increasing steadily. It is relatively inexpensive. It used to be collected from the wild. To meet increasing demands, some countries are growing *Rhodiola rosea* as an agricultural crop. Alaska has preferred weather and ecosystems to grow *Rhodiola rosea* commercially. Growing *Rhodiola rosea* in rural Alaska could bring new sources of income and economic independence. Since the rural Alaskan lands in Unalakleet under consideration have never been used for agriculture, rural Alaskan grown *Rhodiola rosea* could be certified as organic. This might create a special market. This paper looks at the possibility of growing *Rhodiola rosea* at Unalakleet, a rural Alaskan village in western Alaska.

Disclaimer

The underlying theme of this report is applied rural development. The growth and sale of *Rhodiola rosea* in Alaska could be a financial benefit to rural communities. There is a substantial body of data in the peer-reviewed literature that describes the medicinal benefits of this plant. The properties and uses of *Rhodiola rosea* or any other medication mentioned here are the author's observations and understandings based on publications in the current biomedical literature. One may or may not come to the same or similar observations as those of the author. This paper is not intended to make any medical suggestions or endorsements whatsoever. The author of this paper is not liable or responsible for any of the medical claims cited in the preparation of this report.

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1.1 Introduction

My project is to plant *Rhodiola rosea*, an herbal plant in my community of Unalakleet, and to develop the herb for commercial sale. This plant has medically proven properties. The demand for *Rhodiola rosea* has been rising steadily nationally and internationally. Unalakleet has the proper soil and environment to grow this plant. This plant is native to this area. Some people from Unalakleet saw this plant in close proximity to the village.

In 2010, National Geographic magazine mentioned that *Rhodiola rosea* is the most effective healing plant in the world (Johnson, Foster, Dog, Low and Kiefer; 2010). It requires four to five years for the *Rhodiola rosea* root to mature. Growing this plant in my community could bring economic prosperity, though it would not be an easy project at its initial stage. Some people from Unalakleet have indigenous knowledge of different herbal plants that spans thousands of years. The medicinal values of herbal plants are not a new concept and this will be helpful to this project.

1.2 How my project came about

In 2012, I needed a community development project for my rural development class at University of Alaska Fairbanks. I talked with different members of the Unalakleet community including the mayor of the city, chief operating officer of the Unalakleet Indian Reservation Act (IRA) council, the manager of the Unalakleet Native Corporation, and the director of education and training development of the

Norton Sound Economic Development Corporation (NSEDC). I came up with following the five projects:

1. Upgrade an existing eight-unit apartment building
2. Buy a boat and turn it into a floating a herring processing plant
3. Sale of local Native arts around the world
4. Bottle water commercially
5. Grow *Rhodiola rosea* commercially

The IRA council undertook project 1 and NSEDC undertook project 2. I found that selling Native art around the world and eliminating the middleman was beyond my means. I needed to travel extensively throughout Alaska, especially to rural villages, and the cost of doing so became a prohibiting factor for project 3. I finalized two of the projects from the above list. We have a virtually unbounded amount of good tasting water and there are huge markets for bottled water, but some of our community elders were uncomfortable with this idea. This left option five so, I pursued this project growing of *Rhodiola rosea* commercially in Unalakleet.

I requested one of my coworkers to partner with me in this project since I do not own property. His family owns property close to my home. He accepted my request. I bought one gram of seeds (5,000 count) and other materials from Anchorage. At the end of February, I prepared soil, put it in aluminum trays, sprayed seeds on them, wrapped them with a sheet of plastic, and buried them under the snow. This process is called winter stratification. When the snow melted at the end of May, trays were ready to be put in the sun. I had to leave the country that summer and my project partner cared for the seeds. Unfortunately the trays

were blown away in an unexpected severe storm. Then in 2013 my project partner started a new job with more responsibility than his previous job and he was not available for this project.

Germinating seed is time-consuming and difficult. I decided to purchase some seedlings and pursue a pilot project to grow *Rhodiola rosea*. I found another person whose family owns land in Unalakleet and I am currently working with him on this project. I already have seedlings and during summer of this year (2016) we plan to put at least 65 seedlings in the ground. Since I am living in Kenai, I will hand-carry these seedlings to Unalakleet and put them in the ground.

1.3 My personal relationship with this project

I have some personal stories that tie to this project. I am originally from Parnam Pur, a rural village in West Bengal, India. In my childhood, there were no physicians in or around my village. Villagers were dependent on traditional "herbalists." They could identify some plants that were available in and around the village. Some of these herbalists were illiterate. By Western definition, these herbalists would not be considered to be real herbalists, but at that time they were quite popular and were respected as village physicians in rural Indian villages. Sometimes these physicians would recommend patients to go to the closest town and seek modern medical treatments. For instance, if someone broke a bone and went to our village physician, he would provide some initial care, like wrapping up the arm, and tell him or her to go to town for further treatment. But going to town for medical treatments was expensive, and quite often it was beyond the means of our villagers at that time.

In my experience, most of their patients were cured, but some unfortunate patients died during the care of our village physicians. Villagers accepted all outcomes of the treatments of these herbalist/village physicians without any arguments. Our village treatments were inexpensive or even free. The herbal educations were guarded as secret, and our elders were very selective as to whom they would pass their herbal knowledge. I followed our herbalist around for a while and learned some properties of a few plants. They were tulsi, elephant nose, neem, and lemongrass. I grew some of these herbs in our backyard and sold them in the nearby town.

Although I moved to the United States a long time ago, I still have close ties to my family and my village, Parnam Pur in India. Some herbalists still exist there, but they are not as popular as they were when I was a child. Recently one of the herbalists from Parnam Pur complained to me that many herbs were disappearing from the area due to the changes in weather patterns.

I moved to the United States., earned my B.A. in Political Science and my B.S. in Physics at University of California Irvine. I went to work at a pharmaceutical laboratory where I modeled experimental data for bifocal eyes. Then I went back to school again, and did my M.S. in Applied Physics at California State University Long Beach. I took a year off from graduate school to accept a research position at the South Pole in Antarctica. During the long winter at the South Pole, I volunteered to work in the greenhouse inside our dome. We successfully grew tomatoes, lettuce, and several other vegetables.

When I returned to graduate school, I completed a master's thesis in the area of biotechnology. I experimented with florescent decay of bio-tissue samples. The eventual goal was to create a non-invasive glucose detector for diabetic patients. After my M.S. degree, I taught college classes in physics for a while. At the same time, my wife was completing her doctorate in psychology. Upon her graduation, she was offered a position in a rural school district in Alaska. We decided to move to Unalakleet, Alaska, in the summer of 2005. For nine years, we lived and worked in Unalakleet. It became our home and our community. In the summer of 2013, my wife accepted a position with the Kenaitze Indian Tribe and we moved to Kenai, AK, but I still consider Unalakleet my home. Besides my village in India, I never lived in one place longer than I lived at Unalakleet. I am as closely tied to Unalakleet as I am with Parnam Pur.

The people from Unalakleet consider me as one of their own. I received two semesters of tuition scholarship from Norton Sound Economic Development Corporation (NSEDC) as a resident of Unalakleet for an M.A. in Rural Development at University of Alaska, Fairbanks (UAF). My family is planning to move back to Unalakleet in the near future.

Both of these places have similarities. There are no "real" doctors in Parnam Pur, India. Only itinerant physicians are available at Unalakleet. Some people possess significant knowledge of herbal medicinal plants at Parnam Pur and mostly depend on them. Similarly, some people possess extensive knowledge of herbal medicinal plants at Unalakleet though the people of Unalakleet are not solely dependent on them. Beyond physical maladies, the people of both places share

similar mental concern. There are suicides in both villages, though the reasons of suicides are different. I know people of Unalakleet as I know people of Parnam Pur. Despite geographical differences, these rural people are similar around the world. They face similar problems and they have similar aspirations and knowledge.

According to a report by World Health Organization (WHO),[1] most of the rural areas of the world use herbal or traditional medicine. In Unalakleet, a rural Alaskan village, some people, including elders, use herbal medicinal plants. *Rhodiola rosea* grows in the wild here in the Unalakleet area, but may have fallen out of use. Its medicinal properties have been proven around the world. Growing *Rhodiola rosea* at Unalakleet would be the same as re-adding this herb to the people's choice. This project meets my goal personally, professionally, and financially.

1.4 My community

The community of Unalakleet, is located near Norton Sound in the Bering Strait region. It is a northwestern Alaska Native village of Iñupiat and Yup'ik descent. This rural Alaskan village requires travel by small planes since it is not connected to the Alaskan road system. People often refer to this kind of rural community as "Bush Alaska" or a "Bush Village." Unalakleet is located about 395 miles northwest of Anchorage and 148 miles southeast of Nome. The world famous one thousand-mile Iditarod Dogsled Race has a mandatory stop here. We have modern facilities: running water, flush toilets, electricity, phone, Internet, satellite TV and cell phones, but people still hunt and fish for subsistence as they have for many hundreds of

[1] WHO Traditional Medicine Strategy 2014- 2023. World Health Organization

years. The only difference is that we use four-wheelers, snowmobiles, and engine-propelled boats instead of dog sleds and man-powered skin boats.

The population of Unalakleet is about 650, though this number is disputed and varies seasonally. The Bering Strait School District Office (DO) is located here. The DO is one of the major employers in my community. It employs 56 permanent fulltime employees, four part-time employees, and fifteen on call as needed personnel. Two rivers, the Unalakleet River, and Two Old Women River, run by this village. The Norton Sound Seafood Processing (NSSP) plant is located in this community. The fishing and the fish processing plant together play a vital economic role. The NSSP creates full time employment opportunities during the summer. They employ more than 100 people from this community and adjacent communities. Approximately 101 Unalakleet residents own commercial fishing licenses. Fishing is one of the major sources of income for Unalakleet and its surrounding villages.

Photo 1: An aerial view of Unalakleet, AK
Photo Credit: http://www.city-data.com/picfilesc/picc605.php

At one time, there were enough moose, caribou and other animals to hunt and to trap for food and their skin to make winter clothing for personal use and for trade. Due to the decline of the moose population, the village as a whole can now hunt only 14 moose in a hunting season. Due to weather changes in pattern and snowfall, caribou do not migrate through the village any longer. The villagers have to travel fifty to several hundred miles to hunt caribou, which is not possible for all families, because travelling on a snowmachine on road-less rough terrain is extremely difficult and expensive.

The number of fish fluctuates greatly year-to-year and so does its price. People cannot depend on fishing alone. The fishing and hunting resources that were abundant a few decades ago are now diminishing. It is necessary to develop new sources of income for this community. The Native people of Unalakleet and Unalakleet Native Corporation (UNC) own approximately thirty-two square miles of land. Different kinds of berries are gathered for subsistence on this land. People hunt, trap and perform many other activities on this land. This land is pristine and undeveloped. This land could be certified as organic by its very nature. Although many families plant small personal gardens in the village, agricultural crops are not pursued with the exception of a potato patch that serves as a fundraiser for the local youth group. Although rhodiola grows in the Bering Strait region naturally, it can also be planted and grown here commercially. People think approximately ten percent of these thirty-two square miles of land could be used for agriculture.

Because of the long winter, short summer and some other ecological reasons, growing agricultural crops commercially has never been pursued. Although *Rhodiola rosea* grows here naturally, I propose that it could be also grown here commercially. I want to experiment by planting rhodiola here with minimal disruption to the local ecosystem. In 2012, I took an anonymous survey in Unalakleet where ten landowners participated. In that survey, seven out of ten wanted to grow *Rhodiola rosea* on their land. Another three had some questions and concerns but they thought it is a good idea. I have included those questionnaires in Appendix A of this report. As a result of this survey, I believe that people are willing to grow this herbal plant here on their land.

1.5 General methodology for the study of *Rhodiola rosea*

Rhodiola rosea is a flowering perennial plant belongs to *Crassulaceae* family (Germano and Zakir, 1999). It is also known as golden root, roseroot, Aaron's rod, Arctic root and king's crown. Locally, I have heard Unalakleet elders refer to the plant as "roser-root" or "Aaron's rod." I first heard about this plant at a Rural Development class from a guest speaker, Dr. Petra Illig, a physician from Anchorage. I was interested about the plant instantly. She has established Alaska Rhodiola Products, a growers' cooperative in Anchorage. This cooperative has a website: http://www.alaskarhodiolaproducts.com/

After Illig's presentation, I asked some people in Unalakleet if they knew about *Rhodiola rosea*, an herbal plant. All of them replied they never knew that plant. I also need to mention here that Unalakleet has a number of medicinal or herbal

plants and many people use them. Stinkweed (Wormwood, its scientific name is *Artemisia tilesii*) is one of them and it is quite popular in the village and its surrounding area. People use it for fever, joint pain, tumors, colds, wounds, and some other problems. I printed out some pictures of *Rhodiola rosea* and when I showed these pictures, four people recognized the plant. They told me this plant grows by the Unalakleet River and up the hillside close to the village.

Photo 2: A *Rhodiola rosea* plant at Anchor Point Greenhouse
Photo Credit: M. Reza.

It is native to the Bering Strait region[2] and grows in acidic, sandy and rocky soil. It has been recently suggested to me by Dr. Illig that the wild plant is possibly not *Rhodiola rosea* but it is *Rhodiola integrifolia*, a similar looking sister plant. Nonetheless, the plants have near identical properties.

[2] Commack, Alfred. Construction Supervisor of Bering Strait School District. Unalakleet, Alaska. Personal conversation with Mosaddeque Reza on 3/15/2012.

What is not disputed is the expectation that the Bering Strait region has a perfect ecosystem to grow this medicinal plant. For example, I interviewed Professor Stephen Brown of the University of Alaska Fairbanks at Matanuska-Susitna (Mat-Su)/Copper River, who is an agricultural agent, on this matter. He taught a class on how to grow *Rhodiola rosea* and he verified that Unalakleet has perfect weather and soil for *Rhodiola rosea*. He also mentioned that *Rhodiola rosea* grows in freezing temperatures, higher altitudes, rocky areas and acidic soils.[3] People from Anchor Point, Delta Junction, the Ma-Su Valley, Anchorage, and a few other cities are growing *Rhodiola rosea* commercially.

Interestingly, a literature search revealed that this plant might have originated in the mountainous region in southwest China and the Himalayas (Brown, Richard, Gerbarg and Zakir, 2002). It grows naturally in the circumpolar North including Siberia, Iceland, Finland, Norway, Sweden, and some parts of Canada and Alaska (Galambosi, 2006). When I searched "*Rhodiola rosea* as medicine" in the Google search engine there were 446,000 results. I found references to hundreds of publications and clinical trials in both electronic media and print media. The most unexpected thing I found in the Google search was *Rhodiola rosea's* popularity. People are certainly talking about R*hodiola rosea* around the world.

[3] Stephen Brown, Ph. D. Associate Professor. Mat-Su/ Copper River District Agriculture Agent. Cooperative Extensive Service. University of Alaska Fairbanks, Alaska. Personal communication with Mosaddeque Reza. 08/24/2015.

1.6 Methodology used to establish *Rhodiola rosea* as an herbal medicine

I found a book called *Rhodiola rosea (Traditional Herbal Medicines for Modern Times)*. This book is a collection of scholarly articles edited by Alain Cuerrier and Kwesi Ampong-Nyarko. This book was published by CRC Press in 2014, has been very helpful to me in pursuing this project.

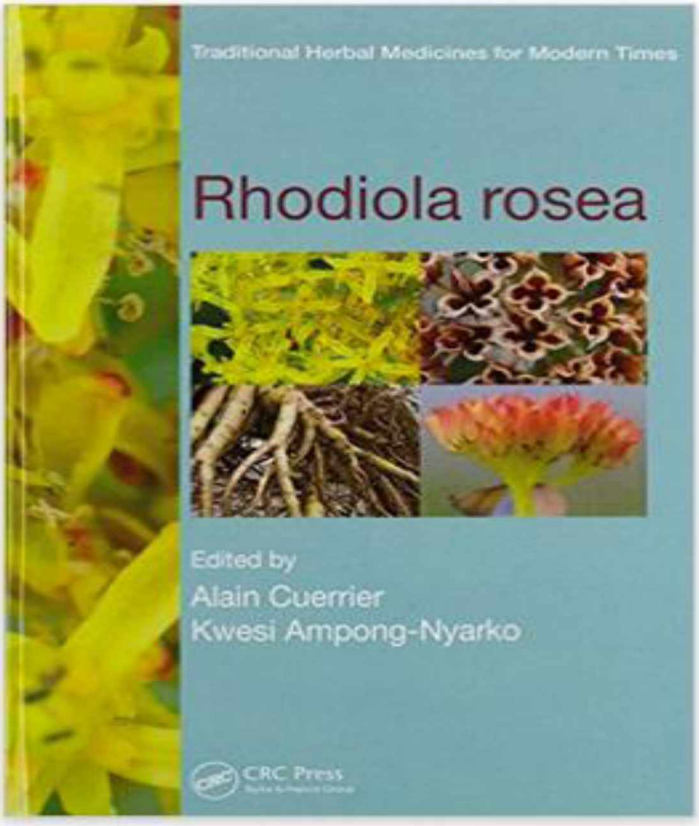

Photo Image 3: Traditional Herbal Medicines of Modern Times
Credit: http://www.amazon.com/dp/143988840X/ref=rdr_ext_tmb

In my opinion, this book is the most important publication for *Rhodiola rosea* growers and users. Articles discuss how to grow it, why to grow it, its medicinal properties and its clinical trials. Importantly, the book includes an in-depth study of *Rhodiola rosea's* markets and future markets. I found other publications also quite valuable, and these are discussed in my project.

Also, I looked up World Health Organization (WHO) websites that discussed WHO Traditional Medicine Strategy 2014-2023.[4] It is my understanding from reading this report, that approximately 90% of world populations have been using some kind of Traditional and Complementary medicine (TandCM). WHO's definition of Traditional Medicine (TM) has included knowledge, skills, beliefs, and experiences indigenous to different cultures that are used to prevent, improve, and treat physical and mental illness.[5] This same source also includes a definition of Complementary/Alternative Medicine (CAM). It includes herbal medicine, herb, herbal materials, herbal preparations and finished herbal products. TM and CAM together become TandCM. In this sense, *Rhodiola rosea* and any of its products are part of TandCM. This has been an inspiration for me to carry out this project.

I searched UAF library databases, including WorldCAT, and found that most of the medical papers on *Rhodiola rosea* were written outside the U.S. This made me question our willingness to accept *Rhodiola rosea* as a relatively inexpensive medicine that has no side effects. I read approximately two hundred abstracts. Some of these were complicated to understand for a non-health professional, and required pharmacological expertise. From these two hundred abstracts, I choose the fifty full-length articles that made the most sense to me and read them carefully. I also intentionally looked for some articles that disproved the properties and efficacy of *Rhodiola rosea* as medicine. I found only one of those—a Canadian publication (Punja, Shamseer, Olson, and Vohra; 2014). This article is a publication

[4] http://www.who.int/medicines/publications/traditional/trm_strategy14_23/en/
[5] http://www.who.int/medicines/areas/traditional/definitions/en/

of a clinical trial. Its outcome suggests that *Rhodiola rosea* is not only ineffective as medicine but also it demonstrated an adverse effect. I will discuss this clinical trial in some detail in the Chapter 2 of the project report.

I interviewed the following professionals for their expertise of *Rhodiola rosea*:

- **Petra Illig**, MD. Her expertise is in aerospace medicine, an occupational medicine whose patients/subjects are pilots, aircrews or persons involved in spaceflight. She possesses in-depth knowledge about *Rhodiola rosea*. In 2008, she developed the Alaska rhodiola growers' co-op in Anchorage named Alaska Rhodiola Product. She explained that *rhodiola rosea* could be grown anywhere in the Bering Strait region and it could be a future Alaskan cash crop.
- **Stephen Brown**, Ph. D. Associate Professor. Mat-Su/Copper River District. University of Alaska Fairbanks. He is an agriculture agent. He taught a class on how to grow *Rhodiola rosea* in Alaska. He explained to me that Unalakleet has a good ecosystem for growing *Rhodiola rosea*.
- **Al Poindexter**, MA. A former high school teacher and the owner of Anchor Point Greenhouse, L.L.C., and he is also the vice president of Alaska Rhodiola Products, Anchorage. His company produces and sells different kinds of vegetables and gardening products. He also grows *Rhodiola rosea* seedlings and sells them around Alaska. His involvement could reduce the time needed for *Rhodiola rosea* production from four-five years to three-four years. He gave me a great deal of practical advice.

1.7 Medicinal properties of *Rhodiola rosea*

Here I will briefly discuss medicinal properties of *Rhodiola rosea*, I describe them in further detail in Chapter 2 of the project report. *Rhodiola rosea* acts in our human body without disturbing normal biological functions. It is generally called an adaptogen. To clarify this term, I will use a reverse example. Metformin is a synthetic medicine that physicians prescribe for type 2 diabetic patients. It has 19 common side effects, 26 less common side effects and six rare side effects (http://www.drugs.com/sfx/metformin-side-effects.html). Some of these side effects are even life threatening. Clinical studies have shown that *Rhodiola rosea* has either negligible or no side effects. This plant has many medical benefits and some physicians believe that it can provide at least the following specific health benefits:

- Increase energy, endurance and stamina
- Uplift moods, cure mild to moderate depression
- Act as a cure of high altitude sickness
- Relieve jetlag
- Promote healthy sleep
- Help reduce stress and anxiety
- Improve attention span and memory
- Reduce mental fatigue
- Reduce hypertension; and
- Help maintain a high-level of creatine phosphate

(Brown, Richard, Gerbarg and Zakir, 2002), (Well, 2013) and (Johnson, Foster, Dog, Low and Kiefer, 2010).

I will discuss some clinical trials in detail as evidence of some of these health benefits in Chapter 2.

1.8 Methodology for market assessment of *Rhodiola rosea*

Alaska Rhodiola Products, a co-op in Anchorage can buy and market Alaskan grown rhodiola at "fair market" price. There are some buyers who want to purchase large amounts of *Rhodiola rosea* from Alaska, but they want a constant supply. These buyers turn *Rhodiola rosea* roots into capsules, powder drink, tea etc. At this time, we do not have large amounts and constant supply of *Rhodiola rosea* in Alaska. More on this subject will be discussed in Chapter 3.

It is my general observation that the price of different brands of *Rhodiola rosea* products has been increasing since 2013.[6] I read hundreds of customers' comments and found that customers are generally satisfied with *Rhodiola rosea* capsules with at least three percent rosavin, one of its active ingredients. Of course, not all people give five star ratings to this product so that needs to be taken into consideration as well. However, customers' comments are important to many Amazon consumers. When the large majority of reviews are positive, most consumers feel confident about purchasing the product. I also found that GNC herbal and health products stores have increased the price of *Rhodiola rosea* capsules by approximately 30 percent since 2013. The price increase could be the result of sellers who want to make more profits or increase in demand. But in the

[6] https://www.amazon.com/s/ref=nb_sb_ss_c_0_14?url=search-alias%3Dapsandfieldkeywords=rhodiola+roseaandsprefix=rhodiola+rosea%2Caps%2C253

end, the argument is that *Rhodiola rosea* users appear willing to pay more money for the supplement.

Some of the articles from the book mentioned previously, *Rhodiola rosea (Traditional Herbal Medicine of Modern Times),* were specifically helpful in evaluating the demand and market for this plant. This plant mostly grows in wilderness areas of Russia, Scandinavian countries, eastern Canada, Tibet, Mongolia, Alaska and other Arctic regions (Sharma and Loebenberg, 2014; Brown, Gerbarg and Ramazanov, 2014). According to these two publications, *Rhodiola rosea* that grows in the wild is overharvested. Due to its high demand, it is necessary to grow the herb commercially. Russia, Sweden, Bulgaria, Canada and recently the United States (Alaska) are growing this plant commercially (Platikanov and Evstatieva, 2008). These productions would take some pressure off the wild plant population. Moreover, growing *Rhodiola rosea* could be profitable.

1.9 Conclusion

Growing *Rhodiola rosea* commercially in Unalakleet would not be an easy task initially. It takes four years for its roots to mature and to be harvested. Maintaining a labor force in Unalakleet would be challenging during summer. We need to clear tundra first and this could be done with available heavy machinery. Then we need to put seedlings in the ground by hand. Both teens and adults are busy during the summer months, as commercial fishing and working at the fish processing plant are very popular in the community. Recruiting laborers during the busiest time of the year would require planning. I considered the possibility of engaging students through Future Farmers of America (FFA). (Another student

group, Future Teachers of America is already established in the school). In 2012, I contacted the principal of the Unalakleet School and discussed the possibility that students could join the Future Farmers of America (FFA) organization. That principal told me he would help. FFA is a national organization where interested students can learn about agriculture and leadership[7].

High school students could gain hands-on experience from working on *Rhodiola rosea* fields. An additional incentive to join this project through FFA might be ownership. Students in FFA could own a percentage of prospective profit from future sales of *Rhodiola rosea*. If students get involved, take partnership, and work together, then the labor problem could be solved. But we now have another principal and I need to talk to him about FFA. Hopefully he would agree that it would be a good idea to establish an FFA club at Unalakleet School

If my initial pilot project were a success, then I would have a village-wide meeting and discuss the commercial plan. I would plan to start small, with half of an acre, planting one thousand *Rhodiola rosea* plants. This would give me time to see the practical, ecological effects of this business endeavor.

For initial expenses, a small business grant from NSEDC was applied for. Although that request was not approved, we could re-apply. Hopefully, when people see the pilot project, they will reconsider this project commercially. I believe that growing *Rhodiola rosea* commercially would take time but can be done.

In the project, I discuss clinical studies that show the effectiveness of *Rhodiola rosea* as a medicine. I discuss its demand and availability around the

[7] https://www.ffa.org/home.

world, and present a case study of Anchor Point Greenhouse LLC., and finally I discuss how *Rhodiola rosea* could be grown commercially in Unalakleet.

Chapter 2 *Rhodiola rosea* as an Herbal Medicine

2.1 Introduction

*Rhodiola rosea (R. rosea/*rhodiola*)* is a medicinal plant that may have originated in the mountainous regions of Southwest China and the Himalayas (Brown, Gerbarg and Ramazanov, 2002) and (Galambosi, 2006). It grows naturally in the circumpolar North, including Siberia, Iceland, Finland, Norway, Sweden, some parts of Canada and Alaska. People drink the dried mature root (which takes four to five years to mature) as tea or grind the root and put it in capsules.

Rhodiola is a popular herbal medicinal plant because of its adaptogenic property (Ramazanov, 2003). Adaptogens help to protect physical and mental health from a wide range of external and internal stress. It can help people function adequately with mild to moderate depression (Darabinyan, Aslanyan, Amroyan, Gabrielyan, Malmstrom, and Panossian, 2007). In the seventeenth century, Chinese people believed that rhodiola had many health benefits (Djuro et al. 2013). Accordingly, some people think rhodiola is a "magic" medicine. In Alaska, the Iñupiat use Aaron's rod (another name for *Rhodiola rosea*) as vegetables (Galambosi, 2006). They eat this vegetable to maintain good health and general wellbeing.

Photos 4: *Rhodiola rosea*. Courtesy of Alaska Rhodiola Products. http://www.alaskarhodiolaproducts.com

Regardless of the long history of rhodiola, its use in the western world is relatively new. Clinical trials and publications are limited in the United States, though in recent years its popularity has been slowly growing. Dr. Andrew Weil, a prominent physician and a popular health book writer, agrees that rhodiola is an adaptogenic herb (Weil, 2013). It acts in our bodies without disturbing normal biological functions. (Please see the health benefit list in Chapter 1, page 14 and15)

2.2 Chemical compounds in rhodiola

Phytochemistry revealed that rhodiola has the following six distinct groups of chemical compounds (Brown, Gerbarg and Ramazanov, 2002), (Germano and Ramazanov, 1999), (Ahmed, Filion, Saleem, Ammar and Arnason, (2015) and (Barnes, Anderson and Phillipson, 2007). They are:

- Phenylpropanoids: rosavin, rosin, and rosarin
- Phenylethanol derivatives: salidroside (rhodioloside) and tyrosol
- Flavonoids: rodionin, rodiosin, acetylrodalgin, and tricin

- Monoterpernes: rosiridol and rosaridin
- Triterpense: daucosterol and beta-sitosterol; and
- Phenolic acid: clorogenic, hydroxycinnamic, and galic acid.

Due to limited understanding of biochemistry it is difficult for me to explain the above chemical compounds and their individual effects on the human body. But a standard chemical extract of rhodiola contains 3.6 percent of rosavin, 1.6 percent of salidroside, less than .1 percent of tyrosol. This extract is called SHR-5. It is found that this extract (chemical compound) is effective for protecting humans and animals against various stress conditions (Barnes, Anderson and Phillipson, 2007). Phenolic acid compounds have strong antioxidant properties, which decrease toxicity and increase anti-carcinogenic effects (Brown, Gerbarg and Ramazanov, 2002). Hence it could be used to treat tumors and other cancers (Barnes, Anderson and Phillipson, 2007).

The following figure shows the possible action of rhodiola beginning in the brain stem (Brown, Gerbarg and Ramazanov, 2002). From the figure we can see that the chemical compounds in rhodiola increase attention, memory, and learning.

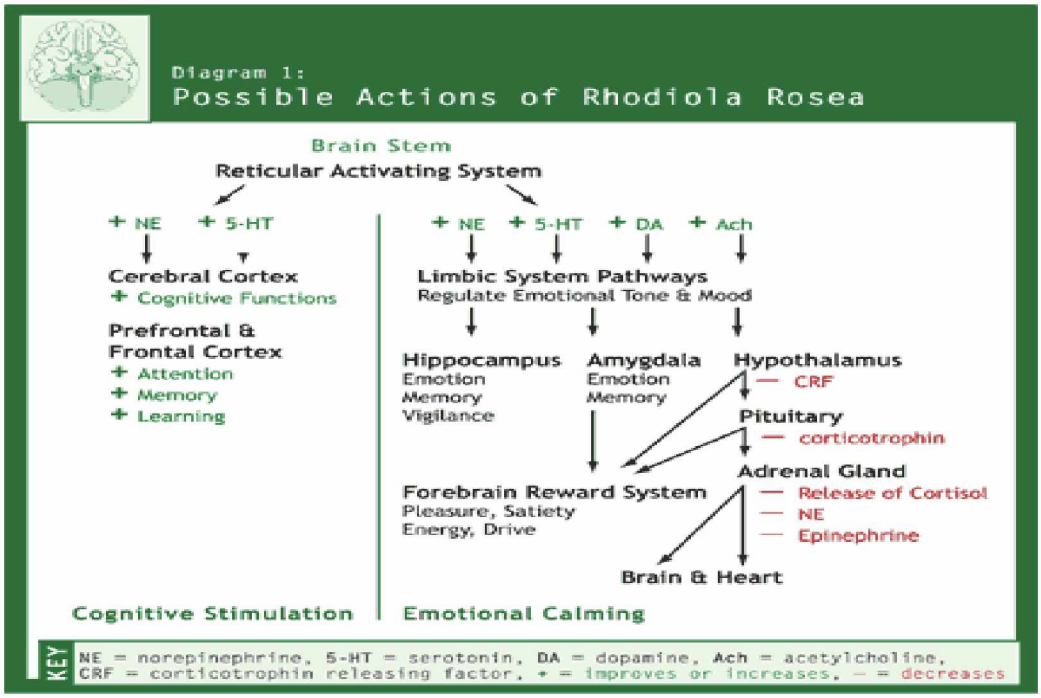

Figure 5: Brain stem. Courtesy of Herbal Gram 56
Figure Credit: http://cms.herbalgram.org/herbalgram/issue56/article2333.html

Next, this paper will summarize some published clinical trials that explore the effectiveness of rhodiola. The summary will clarify the objectives of the clinical trials, the countries where the trials took place, methods used, and results. I also make some comments regarding the trials to demonstrate the practical applicability of these trials and use of rhodiola as medicine in real life situations. According to the website https://www.ciscrp.org/education-center/important-information/, a well-designed and properly conducted clinical study is the fastest way to discover treatment effectiveness for a particular medicine in human bodies. I used the trials that I mention in the following pages, which appear to have been well conducted. I looked at the statistical summary table, to determine whether a particular trial suggests that we could use rhodiola as a medicine. Similarly, I also attempted to determine if a particular study is in favor of rhodiola as medicine or if it opposes its

use as medicine. In addition, I show in this chapter, that one clinical study disapproved the effectiveness of rhodiola as medicine.

2. 3 Clinical Trial 1

Clinical trials of rhodiola extract SHR-5 in treatment of mild to moderate depression (Darabinyan, Aslanyan, Amroyan, Gabrielyan Malmstrom and Panossian, 2007). The objective of this trial is to determine the effectiveness and safety of standardized rhodiola extract SHR-5 in patients who are suffering from mild to moderate depression. For purity, the Swedish Herbal Institute in Gothenburg, Sweden, provided the SHR-5 for this study. This study was conducted at the Erebouni Medical Center Department of Neurology at the Armenian State Medical University in Yerevan, Armenia. The exact date of this study is not mentioned in the publication. This creates some concerns, but I chose to include this article. This is because the article was published in "*Nord J Psychiatry*" and this journal is part of an online government database: http://www.ncbi.nlm.nih.gov.

2.3.1 Methods

In this study, 91 patients, both male and female, participated. Their symptoms included mood disturbance, lack of mental energy, low self-esteem and a wide variety of somatic complaints. According to the paper, 10 percent of the general population suffers from these symptoms. The subjects were not suicidal. The process of the clinical study was explained to the participants in both Russian and Armenian. They gave full legal consent for the study.

First, their baselines were determined according to the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) Criteria. Their scores were more than 13. Where score of 11 to 20 means that the subject poses some danger to harm self or other, but is not suicidal.[8] They were cross-referenced with the Hamilton Rating Scale for Depression (HAMD)[9] and their scores were more than 21. HAMD is a more complex mental disorder scoring system than DSM-IV. It consists of 20 different questions and each question scores from zero to three/four and then these raw scores are added to produce the HAMD score. In the HAMD system, a higher score means the condition of the subject is relatively worse. Two of the patients were excluded for their severities. Prior to this study all subjects went through rigorous medical testing, including blood pressure and a blood test. All subjects were cut off from medications for two weeks. Then they were randomly divided into the following three groups:

Group A: 31 subjects were given two SHR-5 tablets (349mg) a day.
Group B: 29 subjects were given four SHR-5 tablets (680mg) a day.
Group C: 29 subjects were given two placebos tablets a day.

The study continued for 42 days. During the period of this study expert physicians checked the subjects regularly for physical wellness and interviewed them for their mental health. Further, they were questioned in accordance with HAMD questions on day 1 and day 42 of the study.

[8] http://faculty.fortlewis.edu/burke_b/Abnormal/Abnormalmultiaxial.htm
[9] http://healthnet.umassmed.edu/mhealth/HAMD.pdf

2.3.2 Results and comments

At the end of the study it was found that Group A and Group B improved significantly. Group C did not improve; this group's scores were close to their baseline, which is where they started on day 1. Even non-health professionals can look at the numbers and statistics of the following "summary" data table and can see the differences between day 1 and day 42 of the study. They are significant and a conclusion can be drawn in favor of rhodiola.

Table 1: Scores of treatment according to HAMD

	Group A		Group B		Group C	
Day	1	42	1	42	1	42
Number of patient	31	31	29	29	29	29
Mean HAMD Score	24.52	15.97	23.79	16.72	24.17	23.41
Standard Deviation	2.249	4.637	1.698	4.174	1.692	3.803
Lower Limit	23.69	14.27	23.15	15.14	23.53	21.97
Upper Limit	25.34	17.67	24.44	24.44	24.82	24.86
Coefficient of Variation	9.17%	29.04%	7.14%	24.96%	7.00%	16.24%

This study also showed that the patients' mood, insomnia, and lack of mental energy were improved. There were no adverse side effects found in patients in this study. This is also important, because most of the industrial medicines have moderate to severe side effects (please see an example in Chapter 1 page 10).

In HAMD (please see brief discussion of HAMD in page 22), reducing the index means the subjects are doing better. Group A was given 349 mg of SRH-5 in a day for 41 days and this group's index went down from 24.52 to 15.97; that is a 42 percent difference. (The percent difference equation was used from website: https://www.mathsisfun.com/percentage-difference.html) Group B was given 680 mg of SHR-5 and this group's index went down from 23.79 to 16.72; that is a 34 percent difference. Similarly, the percent difference for Group C is only three percent and this group was given a placebo. From here, I can safely state that SHR-5 has positive effects on the subjects. It is confusing to see that an increased amount of SHR-5 does not increase its effectiveness, but rather reduces effectiveness from 42 percent to 34 percent. It seems like the correct amount of SHR-5 is required for maximum effectiveness. Another question I have involves the duration of this study. Is 41 days enough time for a clinical study to discern rhodiola's effects? I do not know this answer; it is something for experienced health researchers to answer.

2.4 Clinical Trial 2

A Pilot Study of Rhodiola rosea (Rhodax) for Generalized Anxiety Disorder (GAD) (Bystritsky, Kerwin, and Feusner, 2008). The objective of this pilot study was to evaluate whether rhodiola is effective at reducing symptoms of GAD. The University of California Los Angeles (UCLA) Anxiety Disorder Program at the Semel Institute for Neuroscience and Human Behavior conducted this study for ten weeks between November 2005 and May 2006. GAD symptoms include overall stress,

fatigue and irritability. Five to seven percent of the general population suffers from GAD.

2.4.1 Methods

There were 10 participants male and female between the ages of 34 and 55 years. The participants were recruited from a distribution of flyers. This was a three-part study. In the first part, the patients were screened for their eligibility and then their baseline was set up. The patients' baselines were determined according to DSM-IV and they were checked in accordance with Hamiltonian Anxiety Rating Scale (HARS), Four Dimensional Anxiety and Depression Scale (FDADS), and Clinical Global Impression of Improvement (CGI-I). The patients were studied using all four scales at the base level, the 3rd week, the 6th week, and the 10th week.

In the second part, the patients were given two bottles of Rhodax (rhodiola extract) and were instructed to take one capsule in the morning and one capsule in the evening. Each capsule of Rhodax was standardized to contain 30mg each of rosavin, rosarin, salidrosides, rosin, rhodalgin, acetyl rhodalgin, rosaridin, and rosiridol, which are the active ingredients in rhodiola. The Rhodax was made by Phoenix Laboratories, Bodyonics Ltd. in Farmingdale, New York. In the third part of the study, the patients were given a 30-day post-study follow up.

2.4.2 Results and comments

For clarity the results were summarized in the following table.

Table 2: GAD study result using rhodiola (Rhodax)

	Age	HARS baseline	HARS End point	HDRS baseline	HDRS End point	FDADS anxiety base line	FDADS anxiety endpoint	CGI endpoint
Mean	44	23.40	14.10	8.50	5.30	68.70	53. 90	2.8
SD	7.37	6.0	8.06	1.95	2.54	6.7	7.2	

There were only ten subjects in this study. I did not find any clinical study literature that stated any minimum number of subjects requirement. Ten subjects may have served the purpose of the study, but statistically speaking, more subjects would have been better for this study. The UCLA medical school conducted this study. US News and World Report regularly ranks UCLA medical school as one of ten top medical institutions in the US[10].

The UCLA study used also four different methods to determine the effectiveness of Rhodax. These different methods, used as cross-references, signify that this is a valuable study. The percent decrease of HARS index between endpoint and baseline is 44 percent. Then, the percent decrease of HDRS between endpoint and baseline is 46 percent. Next, percent decrease of FDADS between endpoint and baseline is 24 percent. All different methods showed positive differences between the baseline and end point. From these numbers, both health professionals and non-professionals can see the positive effect of rhodiola.

[10] https://www.uclahealth.org/news/ucla-ranks-in-nations-top-10-medical-schools-reports-2016-survey-by-us-news--world-report

In this study four participants (40 percent) stated that they had dry mouth and two participants (20 percent) said that they felt dizziness. According to this paper these side effects are minimal and acceptable. The results of this study are in favor of rhodiola.

2.5 Clinical Trial 3

A randomized trial of two different doses of a SHR-5 Rhodiola rosea extract versus placebo and control capacity for mental work (Shevtosov, et al., 2003). The objective of this study was to determine the anti-stress effects of a single dose of SHR-5 to young subjects under conditions of fatigue and stress. The Center of Sanitary and Epidemiology Inspection of the Russian Federation Ministry of Health in Moscow conducted this study. The scientists who conducted this study were from Russia and Sweden. This study was performed from May 18-23, 2000.

2.5.1 Methods

The 141 subjects of this study were between 19 and 21 years old, were non-smokers, and were assigned night shift work. All of these subjects were living in similar conditions and all of them had good mental and physical health. They were legally selected and the study procedures were explained to them both verbally and in writing. This study was conducted in accordance with the revised Declaration of Helsinki. It is a code that the European Union adopted to respect human beings and their dignity. The participants were randomly placed in four groups and they were given the following doses of SHR at 4:00AM each day:

Group 1: 41 subjects – 2 capsules 275mg of SHR-5.

Group 2: 20 subjects – 3 capsules 351mg of SHR -5.

Group 3: 40 subjects – 2 capsules of 275 mg of placebo.

Group 4: 20 subjects untreated control group.

An hour after each dose they were asked the following three questions:

- Q1: In this test the subjects were to find pre-assigned symbols embedded among many relevant symbols to create distractions. This is a test of processing speed and visual memory.
- Q2: The subjects were told 3 to 12 digit numbers once and they had to write down these numbers. It was test of short-term memory.
- Q3: The subjects were given a table of numbers and they had to arrange these numbers in ascending order. This is a test to evaluate attention span and ability to switch their attention.

2.5.2 Results and comments

Here is the summary table of the numerical results of the study.

Table 3: The number of mistakes Groups Q1, Q2 and Q3 made before and after:

Group	Q1 Before	After	Q2 Before	After	Q3 Before	After	Feeling better at the end
2 SHR-5	14.3 ± 1.7	14.6 ± 1.7	5.8 ± .3	6 ± .27	19.7 ± 1.2	17.6 ± 1	53.7%
3 SHR-5	11.3 ± 1.6	12.5 ± 1.4	5.9 ± .22	6.5 ± 3	20.4 ± 85	20.8 ± 8	45%
Placebo	13.7 ± 1.6	21.2±3	6.1 ± .2	6.1 + .3	18.6 ± .7	17.6 ± 1	17.5%
No medication (Control)	12.4 ± 1.4	21 ± 3.1	6.1 ± .3	5.3 ± .3	19.7 ± 1.2	17.6 ± 1	5%

In addition to the questions, the subjects were also asked if they were feeling better or worse. They were also evaluated in accordance with a standard anti-fatigue index (AFI). The group that had two and three capsules had a mean value of AFI 1.0385 and 1.0195 respectively. But the group with placebo had a mean value of AFI 0.9046. The study claims that this result is statistically significant. Rhodiola proved to be a valuable medicinal plant that can enhance mental performance under stress.

The study did not mention any side effects. The duration of this study is rather short. We need to address the question: What would happen if this study were done for much longer periods? However, by looking at numerical results in the data table one can conclude that rhodiola has some positive effects when people are working under stress, which most people do in the modern world.

Specifically, students often work under stress. They have to write papers, prepare for their midterms and finals and often balance jobs with their education. This study was conducted rather short term. But a semester consists of 14 weeks and a quarter consist of ten weeks. I believe that it would be better if this study had lasted at least ten weeks longer. As of now, there is no known prescription medicine or over-the-counter medicine for students that can help them to cope with their stress. A longer study is needed in order for the result to be conclusive. If this study was repeated over a longer time period and produced a similar result, then rhodiola could be a "miracle medicine." Students could take SHR-5 (which is rhodiola extract) before their finals and do better.

2.6 Clinical Trial 4

Rhodiola rosea for Mental and Physical Fatigue in Nursing Students: A Randomized Controlled Trial (Punja, Shamseer, Olson and Vohra, 2014). The objective of this study is to compare the effectiveness of rhodiola with a placebo. The subjects were nursing students who were placed on night shift work. The Government of Alberta, Canada, employs 33,000 nurses. One-third of them are placed on night shift work, and 19–20 percent of these workers reported experiencing fatigue. This study was conducted at the University of Alberta, Canada, for 41 days between January and September 2011.

2.6.1 Methods

There were 48 4th year nursing students between 18 and 55 years old who participated in this study. These students were working the night shift and had work related additional stress, but otherwise they were healthy. Female participants were blood-tested to ensure that they were not pregnant at the beginning of the trial. The University of Alberta ethics committee oversaw the integrity and respect for its human subjects in this study. They were randomly divided into two groups. Group 1 was given 182mg capsules of rhodiola root containing 2.8 percent of rosavins, 28 percent of microcrystalline cellulose, and 0.5 percent of silicon dioxide. For purity, these roots were collected from the Alberta Agriculture and Rural Development Department. Group 2 was given a safe and

identical in taste placebo. All subjects were instructed to take two capsules at the beginning of their work shift. The study coordinator contacted each participant three days after they took their first dose to evaluate initial outcomes. Then there was a phone interview between days 14 and 20 to find any potential adverse effects and remind participants to finish the doses and to complete the final assessment forms. Next there was a final phone interview between 35 and 41 days. Data on fatigue level was reported at day 1, 14, 28 and 42. The participants were given a password to enter data into the system. Eight participants quit the study for unspecified reasons. The Epidemiology Coordinating and Research (EPICORE) Center at the University of Alberta collected the data.

2.6.2 Results and comments

Here is the summary table of the numerical result of this study.

Table 4: The index at base line and at day 14, 28 and 42 of the study.

	Rhodiola (S=21) Mean (SD)	Placebo (S=19) Mean (SD)	p-Value
Base Line Index	5 (0.5)	4.4 (0.5)	
Day 14 Index	5.4 (0.5)	4.5 (0.5)	0.185
Day 28 Index	5.7 (0.5)	4.2 (0.5)	0.052
Day 42 Index	6.2(0.5)	3.7 (0.6)	0.002

Table 4 shows that those who received rhodiola increased their index number by day 42 by nine percent. But those who received a placebo decreased their index number by 17 percent. This study showed that the subjects who took rhodiola were worse off with regard to their sense of fatigue than those who took the placebo. There is certainly room for doubt in this study; the subjects who took a

placebo improved their fatigue index during the study. The result of this study is completely opposite of trial 3 previously described in this paper. The authors of this publication suggested that these results be interpreted with caution and suggested further research with larger doses and a greater sample size. But no further clinical trial was found in the database search from the same institute.

Four participants (16 percent) complained that they had headaches, two participants (eight percent) complained they had diarrhea and two participants (eight percent) complained they had dark stool.

2.7 Other studies

There are numerous other trials that have proven the efficacy of rhodiola. I have included three more trials without details to limit the length of this paper.

One: The Erebouni Medical Center, Department of Neurology at the Armenian State Medical University in Yerevan, Armenia, carried out another study to determine the effectiveness of a low dose of rhodiola at the workplace regarding fatigue and mental work performance (Darbinyan, Kteyan, Panossian, Gabrielian, Wikman, Wagner, 2000). 54 young healthy physicians, both male and female, were the participants of this study, and were 24 to 35 years old. They were working the night shift. They were divided into two groups. One group was given a low dose of SHR-5 (rhodiola extract), and another group was given an identical placebo. This study was carried on for two weeks and then for the next two weeks participants did not take any doses. This is called a "white washout period." They then took

another two weeks of their doses. At the end of the 2nd week, 4th week and 6th week they were given five different tests and also their clinical duties were monitored closely without their knowledge. Those who took SHR-5 performed better in the test and carried out their clinical duties better than those who took the placebo.

Two: There were 60 foreign high school students studying at a Russian high school. They volunteered to participate in double blind placebo control study. They were given rhodiola extract (*Rodxon*) at 660mg per day. As a result they increased their work capacity, coordination, kinesthetic sensitivity, and general wellbeing along with a decrease in psychic fatigue and situational anxiety in comparison with the group who received the placebo (Brown, Gerbarg and Ramazanov, 2002).

Three: 60 Indian students who were studying medicine in Moscow, Russia, participated in another double blind placebo study. They were given SHR-5 at 100mg per day for 20 days during their final exam. This SHR-5 was made by the Swedish Herbal Academy and contained 3 percent rosavin and .8 percent salidroside. The students who took SHR-5 did much better in their final exam than those who took the placebo (Brown, Gerbarg and Ramazanov, 2002).

All of these trials showed that rhodiola contains effective medicinal properties, except for one trial conducted in Alberta, Canada ((Punja, Shamseer, Olson and Vohra, 2014). We can also see that most of the studies are conducted outside the United States. The U.S health care system may not be ready yet to accept herbal medicine. One of many reasons could be a political will of our elected "leaders." Two of the world's most populous countries, India and China, have three standard medical practices but the U.S. does not. The Food and Drug Administration

(FDA), a government agency, has oversight on all foods sold in the US (as far as I know) but herbal supplements are not under their scrutiny. Armenia, Sweden, Russia, and some other countries around the world have oversight of their herbal medicine. (Please see more on these on Chapter 3). The lack of government oversight in the U.S. is problematic. If there were no government control on standardization and approval of any medicine, then clinical study itself would not be helpful. This is because in general people may not trust the medicine and the medicine will not be legally liable to cure any particular disease.

2.8 *Rhodiola rosea* and cancer research treatment experiments

Physicians and scientists are experimenting with rhodiola for cancer treatment. Studies showed that a homogenous polysaccharide (RRP-ws), a complex protein that was prepared from rhodiola through a rigorous chemical process, was capable of containing growth of tumors in experimental mice (Chai, et al., 2012). Another similar study carried out at the University of California, Irvine, showed that use of salidroside, a bioactive compound of rhodiola, contained tumor cell growth in the human bladder (Liu, Li, Anne, Jafari, and Zi, 2012). These two experiments show that chemical bioactive chemical compounds of rhodiola could be useful in cancer treatments. Cancer treatment can be expensive and may have many side effects, while rhodiola is "relatively inexpensive" and has no known side effects. More health science and pharmacological experiments and clinical trials are needed to confirm those results. Specifically, bladder cancer is a common problem among

relatively older populations ("baby boomer" generation). This population is retiring in higher numbers in the US.

2.9 What is the effectiveness of *Rhodiola rosea* compared to other pharmaceutical medicines?

The clinical trials mentioned in this paper did not compare prescribed medicine with rhodiola. However, in an interview with clinical psychologist Dr. Maryam Bassir, she explained that working under stress or working night shifts is generally not considered a medical condition; nor is fatigue on its own.[11] In other words, a physician may not prescribe any medication if the person is otherwise healthy. "Mild depression is generally best treated with psychotherapy, exercise and social support. Individuals with moderate to severe depression may benefit from adding an antidepressant to these recommendations," said Dr. Bassir. Popularly prescribed anti-depressants include Wellbutrin, Prozac, and Lexapro. These medicines have side effects, whereas rhodiola is not known to have any side effect. "Rhodiola is not currently recommended by mental health professionals because 1) it is relatively unknown, 2) it lacks rigorous clinical trials, and 3) like all herbal supplements, it suffers from lack of governmental regulation – purity and standardization of dosage is not guaranteed. She also told me, "If I knew that rhodiola worked, I knew what dosage was effective, and I knew where to buy it to guarantee purity and standardization, I would certainly take it myself." It is very

[11] Personal conversation with Maryam Bassir Psy. D. (licensed clinical psychologist of Kenaitze Indian Tribe, Kenai, Alaska) on July 1, 2015.

affordable and it is a promising herbal remedy, especially because it has multiple proposed health benefits. The costs of anti-depressants depend largely on the type of insurance one carries. If paying out of pocket, people may have to pay thousands of dollars a year, Bassir explained.

However, rhodiola has properties similar to popular prescription anti-depression drugs such as Wellbutrin, Prozac etc. For instance, a study (Bystritsky, Kerwin, and Feusner, 2008) shows that the rhodiola extract Rhodax could help reduce General Anxiety Disorder (GAD) similar to Prozac and Wellbutrin. [12,13] There is no direct literature on this subject. This is my own conclusion from above clinical trials following two footnotes (4 and5), but I am not a health professional.

Another website: http://www.drugwatch.com/prozac/ states that in 2010 there were 24.4 million prescriptions for Prozac and its generic brand and those drugs have the potential for severe side effects, and may cause birth defects when pregnant women take them.[14] Are patients better off taking rhodiola for their mental health conditions? That could be a further subject of study.

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[12] Selling Prozac as the Life-Enhancing Cure for Mental owes. (No author's name). The New York Times. September 21, 2014.

[13] Psychiatric Medications. Bupropion Brand Name: Wellbutrin, Budeprion XL, Budeprion SR, Buproban, Wellbutrin SR, Wellbutrin XL, Zyban. http://whatmeds.stanford.edu/medications/bupropion.html (No author's name. No publication date. Accessed on 8/1/2015).

[14] Prozac is an SSRI antidepressant manufactured by Eli Lilly. The drug is linked to birth defects when taken during pregnancy. http://www.drugwatch.com/prozac/ (No author's name. No publication date. Accessed on 8/1/2015).

2.10 Is there any magic in *Rhodiola rosea*?

The **Clinical Trial 1** and **Clinical Trial 2** of this paper showed that rhodiola extract SHR-5 helps to reduce "mild to moderate depression (MMP)" and "general anxiety disorder (GAD)." When do people become suicidal? The explanations of this question are very complex, but it is generally accepted that a person who is suicidal suffers from depression (Reiss, and Dombeck, 2015). According to the website: http://www.calmclinic.com/anxiety/difference-anxiety-depression, depression and anxiety are different but they have some common ground. Accordingly, extreme anxiety may create depression. In this sense, a hypothesis could be drawn that rhodiola may help prevent suicide if the symptoms are detected early. More research and studies are needed to prove the validity of this hypothesis.

Alaska has the highest suicide rate in the nation. According to a government study, those who committed suicide in Alaska had depression and other forms of mental illness. [15] **Alaska Suicide Facts and Statistics** stated that many Alaska Native men between the age of 15 and 24 committed suicide. Could rhodiola be beneficial to Alaskan residents? Rhodiola grows naturally in Alaska and it has been previously mentioned that Alaskan Natives use Aaron's rod (another name for *Rhodiola rosea*) for wellbeing (Galambosi, 2006). Psychological and psychiatric treatments are very expensive and often they are beyond the means of the people of rural Alaska. These services are difficult to find in rural Alaska. Suicides are both

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[15] Alaska Suicide Facts and Statistics. http://dhss.alaska.gov/SuicidePrevention/Documents/pdfs_sspc/AKSuicideStatistics.pdf (Published date is not available. Accessed on July 9, 2015).

frequent and unexpected in rural Alaska (Yardley, 2007). Seven suicides occurred during my nine years of residence in Unalakleet.

Can rhodiola help to reduce the number of suicides in rural Alaska? We need rural Alaskan level clinical studies and research to find that answer. This type of trial or research would have other benefits as well. It would serve as an advertisement of rhodiola and people would know that there are some herbal medicinal plants that could perhaps help prevent suicide as over-the-counter herbal medicine. That could create an extensive market for rhodiola. Rural Alaskan people might grow rhodiola commercially and be economically benefitted.

Furthermore, students are always working under stress. Stress is part of our daily lives. Four out of five studies in this paper showed that rhodiola extract could enhance mental work ability under stress. Specifically, one of the studies showed that Indian medical students who were studying at Moscow took rhodiola during their final exam and their test scores were better than those who took a placebo. If students know this for sure, then rhodiola would be popular among students. Even an undergraduate student of psychology would be able to carry out this type of study. This is because the students of psychology learn how to give different types of psychological test like HARS, HDRS, AFI and many others. They also learn how to analyze clinical data statistically. If this study proved to be effective, then it would be helpful to the general student population. They may take rhodiola during their final or whenever they are under extreme stress. The sale of rhodiola would be effective from this kind of study. In these regards, rhodiola would prove to be a unique medicine. No other known medicine would be as helpful for test taking

among those available over-the-counter as of now. But all of this would require research to verify these suppositions.

2. 11 Conclusion

This paper is not medical advice by any means; rather it summarizes four clinical trials and three brief trials of the medicinal use of rhodiola. Among them are four detail summaries and three brief statements, which suggested that rhodiola could treat depression for those whose symptoms are mild to moderate, and could help to reduce fatigue and increase stamina when people work under pressure. One of the studies disproved the effectiveness of rhodiola. Nonetheless, the authors of that study suggest that their result should be viewed with caution and further research is recommended. I reviewed 200 articles for this project report; 199 of them (that is 99.5 percent) showed positive effect of medicinal use of rhodiola.

A few experiments have shown that rhodiola could be used to treat tumor and bladder cancer with minimal expense and side effects (Liu, Li, Anne, Jafari, and Zi, 2012) and (Chai, et al., 2012). It has the potential to lower the suicide rate. We have yet to prove this hypothesis. If true, it would very helpful in Alaska because the Alaskan suicide rate is the highest in the nation.

There is a Bengali saying that the Creator gave us diseases and also sent us medicine in nature in form of trees and plants. These plants and trees have the power to cure many diseases. Our job is to find them and use them. Could *Rhodiola rosea* be one of these medicinal plants? It is really up to us to find that out.

Chapter 3 Market Assessment and Viability of *Rhodiola rosea*

3.1 Introduction

Rhodiola rosea (R. rosea/ rhodiola*)* is a perennial herbal medicinal plant that grows wild in the higher altitudes and colder regions of the world including Russia, Scandinavia, eastern Canada, Tibet, Mongolia, Alaska, and other Arctic and Subarctic regions (Sharma & Loebenberg, 2014). People have been collecting and using rhodiola for centuries (Brown, Gerbarg & Ramazanov, 2002) in many forms including as fresh root, dried root, and as extract. **In Chapter 2**, I discussed *R. rosea* clinical trials, medicinal properties, and use. Its popularity in the U.S. as an over-the-counter herbal supplement and around the world as herbal and traditional medicine has been rising.[16]

This herbal plant was collected solely from the wild for centuries. Wild collection of rhodiola in Asia and Europe is extensive, which put pressure on the wild population (Brown, Gerbarg & Ramazanov, 2002). Increasing worldwide demand for rhodiola has led some countries to grow rhodiola as a commercial crop (Sharma & Loebenberg, 2014). These countries include Russia, Sweden, Bulgaria (Platikanov & Evstatieva, 2008), Canada (Alberta) and very recently the United States (Alaska) (Laskow, 2015). This production can take the pressure off the wild population of rhodiola (Galambosi, 2005). According to Galambosi, over 46

[16] Herbal Medicine. University of Maryland Medical Center. (There is no author name) http://umm.edu/health/medical/altmed/treatment/herbal-medicine (There is no publication date. Accessed on 7/19/2015).

companies around the world sell rhodiola products and 36 companies supply them as food supplement ingredients. Galambosi did not mention the names of the companies. The Alaska Dispatch News, published an article on February 7, 2011 that explains that the demand of rhodiola is much higher than its current supply (Medred, 2011). The numerical amounts of this demand were not found in literature searches.

3. 2 Demand and supply of Rhodiola *rosea* Around the World

In this part of this paper, I will look at the demand and supply in African countries, China, European countries, India, and here in the United States. Since my major is Rural Development, I also will look at the demand of rhodiola in rural areas of the world.

3.2.1 African Countries

A study by the World Health Organization (WHO) suggested that up to 80 percent of African populations use traditional medicine (TM)[17] or traditional African medicine (TAM). TM includes herbal medicine like rhodiola (Please see more on TM in Chapter 1, Page 12). How much rhodiola African countries use was not found in the literature search, but nine websites and magazines published advertisements for rhodiola and its products (Ferlow, 2015). South Africa produces small amounts of rhodiola, but one of these websites explained that the Africans need more rhodiola.[18] The popular medical journal, the African Journal of Traditional

[17] http://www.who.int/mediacentre/factsheets/2003/fs134/en/
[18] http://www.naturefresh.co.za/stress.aspx

Complementary and Alternative Medicine (AJTCAM), published a few research articles.[19] Could we take these studies and articles as evidence that there is some use and demand for rhodiola in African countries? There could be further worldwide demand analysis done on this herbal plant.

3.2.2 China

I already mentioned that rhodiola naturally grows in China. Specifically, it is found in the higher altitudes in China, including the Hengduan mountain region and the Tibetan mountain region (Galambosi, 2006).

Photo 6: Rhodiola in the Hengduan Mountain Region, China.
Photo Credit: Harvard University Herbaria.

Rhodiola rosea is used in traditional Chinese medicine TCM (Gerber, Illig & Brown, 2014). According to Brown, the Chinese emperor used to send people to collect golden root (another name for rhodiola) from northern mountain regions of

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19 http://journals.sfu.ca/africanem/index.php/ajtcam/search/search?simpleQuery=rhodiola+&searchField=query

China and Siberia (Brown, Gerbarg & Ramazanov, 2002). The same article also notes that rhodiola used to be prescribed for tuberculosis and cancer during the eighteenth century.

Data on how much rhodiola is used in China in a given year was not found, but the World Health Organization publication *WHO Traditional Medicinal Strategy 2014-2023* mentioned that TCM accounted for 40 percent of the Chinese healthcare system in the year 2005. During the same year, Chinese herbal sales reached U.S. $4 billion (Watchel-Galor & Benzie, 2011).

The Chinese government regulates all types of medicines sold in China. This may increase public confidence in TCM. The Chinese have been using TCM for three thousand years. I found four research articles on rhodiola from different Chinese universities. Petra Illig, M.D., president of the Alaska rhodiola grower co-op (Alaska Rhodiola Products) mentioned that China produces and consumes the largest amount of rhodiola in the world. They mostly collect it from the wild and it is overharvested (Galambosi, 2005). Galambosi explained in his paper that China might need to import rhodiola soon. If that happens, the Chinese market would be the largest rhodiola market in the world.

US consumers can purchase Chinese rhodiola from the online market place Amazon. They are also available from the following websites:

- http://www.superfoods-for-superhealth.com/rhodiola-benefits.html
- http://www.medicinehunter.com/rhodiola

3.2.3 India

India is the second most populous country in the world. 70 percent of its citizens depend on traditional medicines (Watchel-Galor & Benzie, 2011). Rhodiola grows naturally in the Himalayan region of India.[20] But according to the "Times of India" (a popular newspaper read worldwide), only in recent years have Indian scientists shown interest in this plant. The Indian Defense Institute of High Altitude Research (DIHAR) is interested in the research and development of the rhodiola plant as an herbal medicine. The Indian government has a keen interest in introducing rhodiola to their troops, who serve in the high altitudes of the Himalayan region.

Photo 7: Rhodiola in the Himalayas
Photo credit: "http://www.thehindu.com/sci-tech/health/medicine-and-research/scientists-say-himalayan-herb-is-modernday-sanjeevani/article6348112.ece"

However, it would be a difficult task for Indians to harvest rhodiola from the Himalayas because of its rough terrain. The Times of India mentioned that they are not sure about the quantity available in the Himalayas. Most of India's ecosystems

[20] Indian scientists find a 'wonder herb' in high Himalayas. (No author's name). The Times of India. August 25, 2014.

are not particularly favorable for the cultivation of rhodiola as a commercial agricultural crop. Due to a ready global market and more marketing systems in India, it would not be too difficult to introduce rhodiola to common Indian citizens where herbal and traditional medicines are already popular. Besides modern medicine, India fosters homeopathy, Ayurveda and herbal medicine, and all of them are under standard Indian government regulations. As the second most populous country in the world, Alaskan rhodiola growers could easily access the Indian market.

3.2.4 Europe

Europe and Russia produce a significant amount of rhodiola. The former Soviet Union used to give rhodiola to their troops during World War II to enhance their performance in the cold and harsh environment (Germano & Ramazanov, 1999). The Soviets used to keep the properties of rhodiola secret. But now there are many research papers and clinical trials published from Russia, Sweden, Norway, Armenia, Scandinavia, Greenland, Iceland and a few other European countries. Some of these countries collect rhodiola from the wild and they are observing serious reductions in wild rhodiola populations.

In 2009, Norwegian rhodiola sales were approximately U.S. $25 million (Gravellines, 2009). Bulgarian farmers have been growing this plant commercially since 2008 (Platikanov & Evstatieva, 2008). Russian farmers from Siberia region have been growing this plant for over fifty years (Galambosi, 2006).

Seeing the demand and projected demand, European countries have been trying to come up with an automatic irrigation process, weed control and harvest

process. These processes could cut production costs. The European Medicines Agency Committee on Herbal Products (HMPS) published an assessment report on rhodiola in 2011. The HMPS oversees the European production and supply of rhodiola and its purity. It is a multimillion-dollar agricultural industry throughout the world and the European growers want to assure the quality of rhodiola to their consumers.

3.2.5 The United States

I did not see any advertisement for rhodiola in the U.S. but its demand is rising, perhaps gaining popularity by "word of mouth." In my personal experience, ten years ago no one was aware of the existence of this plant in his or her backyard in the Bering Strait region. Since I started this project about four years ago, many people have begun using rhodiola during the winter months. Though I do not have any data on this use except for discussion about rhodiola in daily workplaces, the number of discussions of its use is growing. Using herbal plants is one cultural aspect of Alaskan Native cultures. Eating Aaron's rod (rhodiola) to stay healthy is one of the cultural practices that have been neglected for many years. Discussion of rhodiola has been bringing back forgotten cultural values, which may increase its popularity even further.

Healthcare costs in the U.S. have been rising significantly. Some insurance companies are denying or offering generic brand medication to some people if they do not have an immediate need for a particular medicine, though they have been taking the medicine for years as a preventative measure. Instead of generic medication or no medication, people are looking for herbal medication as a

substitute. But there are two problems: One is that there is no guarantee of its purity, since there is no government oversight on any herbal products sold in the US. Secondly, nobody knows the right amount to use.

Yahoo Finance in the United Kingdom (U.K.) predicted in 2013 that herbal remedies in the global market would reach US $107 billion in 2017 (King, 2013). This is because the aging population is willing to try herbal medicine on their own and the global aging population is increasing, including in the US. They will drive the price of herbal medicine higher than it is now.

3.2.6 Demand for Herbal Medicine around the Rural Areas in the World

According to a publication by the Arizona State University School of Life Sciences, 80 percent of the world's population still uses traditional remedies and herbal medicine. This is because they cannot afford to purchase modern/industrial medicine from pharmaceuticals. It is also because they recognize the health value of traditional and herbal medicine. It is very expensive and difficult to find modern (western) medication in rural areas of the world (Beth, 2015). According to Beth, this trend is increasing as many poor people of the world survive on less than two U.S. dollars a day. These poor people mostly live in rural areas of world.

3.3 Market Creation for Rhodiola for US Consumers

According to the Anxiety and Depression Association of America (ADAA), approximately 40 million American adults aged eighteen and over (that is roughly

14 percent of the U.S. population) suffer from anxiety disorder. (http://www.adaa.org/about-adaa/press-room/facts-statistics.) This website also stated that depression is highly treatable, but that only 33 percent of those who suffer from anxiety receive treatment. Accordingly, drugs and analysis cost $42 billion (28 percent) of the $148 billion mental health bill in the US. According to another website (http://www.drugwatch.com/prozac/) U.S. physicians write 24.4 million prescriptions for Prozac and its generic brand each year. Can the other 67 percent of patients use rhodiola (which is relatively inexpensive and often available)? Only healthcare professionals can answer this question. But it is unfortunate that a large numbers of these patients go untreated.

Another argument is that there are many studies and clinical trials showing that Rhodax (similar to rhodiola extract SHR-5, but different name brand) helps people to cope with stress, mild to moderate depression, anxiety and many other mental health problems without severe side effects. These papers were mostly published outside of the U.S. and pointed out that rhodiola is a promising herbal medicine used to fight general anxiety disorder (please see Chapter 2, page 21-31) with minimal or no side effects (Bystritsky, Kerwin, & Feusner, 2008). In some countries, including Armenia and Russia, physicians prescribe rhodiola extract SHR-5 for anxiety and depression (Darbinyan, Aslanyan, Amroyan, Gabrielian, Malmstrom, & Panossian, 2007) & (Darbinyan, Kteyan, Panossian, Gabrielian, & Wikman, 2000).

U.S. physicians very rarely prescribe any herbal medicines. According to a report by *WHO Traditional Medicine Strategy 2014-2023*, China and India are two of

the most populous countries in the world and they have standard herbal medicines that the government controls like industrial (western) medicine. We are all concerned about the healthcare costs in the U.S., but we never discuss standardizing herbal medicine and alternate medicines like China and India. Is there any political and economic consideration for this? The US healthcare system is one of the most complex and expensive in the world. We need to address the concerns and questions of gigantic insurance companies' involvements in our healthcare business. Is there any "play" by the health insurance company that prohibits inexpensive herbal medicine to enter as standard and government scrutinized medicine in the US healthcare system? Answering these questions could be itself a significant research paper. I briefly described this intertwined problem in Chapter 2 page 37.

One popular economic theory states that demand creates supply. This theory is true, but its opposite is also true. Supply can create demand. An analogous example is that ten years ago, there was no demand or supply for the iPhone. But its supply and marketing created its demand. Would it be possible to create a viable market for rhodiola in the US and around the world similarly? That could be the subject of further study. But the producers have to give assurance to grow highly potent rhodiola. We need to have more clinical trials in the U.S. and the Food and Drug Administration (FDA) needs to regulate rhodiola's purity.

3.4 Cultivation of *Rhodiola rosea* from Alberta, Canada

In the face of growing demand, the Alberta Agriculture and Rural Development began an initiative to grow rhodiola commercially as an agricultural crop in 2004 ("*Rhodiola rosea*: A High Value Crop," 2010). In 2007, the rhodiola

farmers formed a co-op group (http://arrgo.ca/about-rhodiola), the Alberta *Rhodiola rosea* Grower Organization (ARRGO) in Alberta. In 2010, they had 140 co-op members and that number is growing. According to ARRGO's website, they have 30 Albertan scientists, agronomists, and farmers on a five-year mandate to bring the best quality rhodiola and rhodiola-based product to the world markets. This organization has a one-stop help center for their growers. They have automated tractors to put seedlings into the ground and harvest, and machines are used to wash, dry, and slice the rhodiola.

Photo 8: Putting rhodiola seedlings on the ground
Photo Credit: http://arrgo.ca/about-arrgo

Photo 9: Mature rhodiola plants.

Photo 10: Rhodiola roots
Photo Credit: http://arrgo.ca/about-arrgo

Photo 11: Automated rhodiola-processing plant
Photo Credit: http://arrgo.ca/about-arrgo

ARRGO has the first known primary processing plant for rhodiola in the world. They can assure the potency of their product and they are under the scrutiny of the government of Alberta. Norway, Finland and Alberta, Canada are at the forefront of the modernized rhodiola growers and processors in the world. According to ARRGO, their rhodiola sales exceeded U.S. $80 million in 2012. Cultivation of rhodiola creates fulltime, part-time and seasonal employments in Alberta—another positive prospect for growing rhodiola commercially.

3.5 Cultivation of *Rhodiola rosea* from Alaska, USA

Recently Alaskan farmers have been showing interest in growing rhodiola. Alaska has better weather for growing rhodiola commercially (Ampong-Nyarko, 2014) than Alberta, Canada. That is because Alaska has colder weather and summertime daylight is longer than in Alberta. Professor Stephen Brown, Agriculture/Horticulture Agent for the Mat-Su and Copper River District, UAF Cooperative Extension Service, Palmer, Alaska, stated that Alaska is a natural habitat

for rhodiola. This medicinal plant shows great promise as a new Alaskan agricultural crop. Dr. Brown offers a rhodiola grower class through UAF Palmer Extension for minimal cost. The class covers hands-on and experiential education on how to grow rhodiola and process crops. Alaskan farmers from Bethel, Delta Junction, Anchorage, Anchor Point, the Matanuska-Susitna Valley and Trapper Creek are growing rhodiola. There is also a plant development and cultivation farm at the University of Alaska Fairbanks (UAF). Currently, I am experimenting with how to grow rhodiola in Unalakleet, a rural village on Norton Sound in the Bering Strait region.

Al Poindexter is one of the Alaskan rhodiola growers from Anchor Point, Alaska. He explained to me that he has an assured market to sell his rhodiola because he sells directly to the Alaska rhodiola co-op. The co-op will buy or market in any quantity rhodiola from its members. It is currently experiencing a supply shortage for its market. Large buyers would need assurance that a large amount of rhodiola could be supplied to them constantly, and the co-op is unable to provide that assurance. That is because Alaska is not growing rhodiola in a large consistent quantity that could supply a viable market.

Photo 12: Al Poindexter's rhodiola field. Anchor point, AK
Photo: M. Reza.

The Peninsula Clarion newspaper of Kenai Peninsula, Alaska published an article on April 20, 2015, stating that the Swedish Herbal Institute wants to purchase 5,000 pounds of dry rhodiola root from the Alaska Rhodiola Products. That equates to roughly 25,000 pounds raw rhodiola roots. This is because the Swedish Herbal Institute has to set up their rhodiola products lines and those need large investments. To be profitable, the Institute needs to produce a large quantity of rhodiola products and needs to have constant sales in the world market.

3.6 Alaska rhodiola growers Co-op and UAF involvement in effort to grow rhodiola in Alaska

The Alaskan rhodiola growers established a co-op in Anchorage, Alaska, which has been led by Petra Illig, MD, since 2010 (http://www.alaskarhodiolaproducts.com). Dr. Illig is an aerospace physician who

is interested in growing rhodiola in Alaska and has been working on different projects. The co-op currently has twenty members and they are growing. The co-op buys rhodiola from its members at a "fair" market value. It also supports its growers and helps with seed and technical education and other advice. In 2014, the Alaskan growers harvested enough rhodiola to dry and process 380 pounds of rhodiola products. That is not enough to market nationally or internationally. The co-op sells the rhodiola products as tea, flaked, granular, and powder from their online store.

Photo 13: Different kinds of rhodiola products sold by Alaska Rhodiola Products
Photo Credit: http://www.alaskarhodiolaproducts.com/#!store/c1lj

Accordingly, there is no shortage of customers but commercial rhodiola needs to contain the highest possible percentage of its active ingredients (at least 3.6 percent of rosavin, 1.6 percent of salidroside and about .1 percent of tyrosol).

The processing equipment and facilities would cost a significant amount of money. The Alaska Rhodiola Product co-op is hopeful that they can reach their growth target by 2020 (Illig, 2014). UAF is also making an effort to grow rhodiola in Alaska. They have an experimental farm where they carry out research on how to grow rhodiola from seedlings and maintain its potency. They also set up an

automated washing system for harvested rhodiola from the land, and then they chop them properly, and dry them to make them ready for the market. These efforts are well worth it in the long run. One might argue that these machines are not bringing in revenue now. This paper has shown that there is a growing demand for rhodiola in the world market. Alaska has excellent weather for rhodiola and has millions of acres of lands. Alaskan rhodiola growers could do similar or better than Canada.

Photo 14: Processing at UAF Experimental farm at Palmer, AK
Photo Credit: Petra Illig.

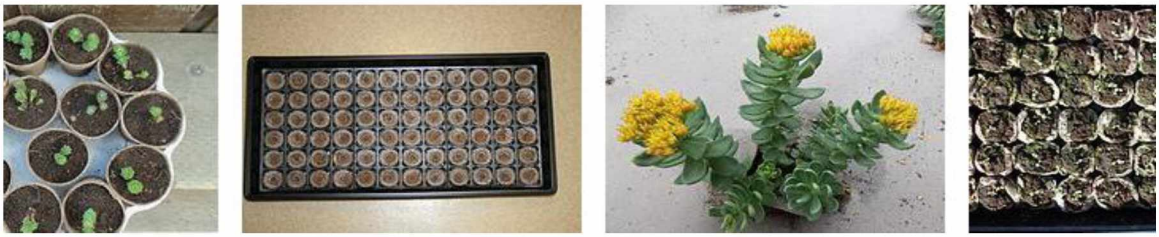

Photo15: Plant Development and Cultivation
Photo credit: http://www.alaskarhodiolaproducts.com/#!photo-gallery/c14l3

3.7 Growing rhodiola would be beneficial to rural Alaska

Due to the long winters and short summers, most commercial agricultural crops are not possible. Most of the Alaska Native people live in rural areas in Alaska.

They have been living as hunters and gatherers for centuries. They hunt moose, caribou and fish in the rivers. But the climate is changing slowly. Numbers of wild animals are declining. For instance, in Unalakleet, a rural Alaskan village located on the Norton Sound coast of the Bering Sea, people have to limit themselves in hunting moose. Caribou migration patterns have changed due to comparatively short winters. Fish populations are also depleted. It is an opportune time for the people to find new sustainable sources of income. Growing rhodiola commercially with particular attention to the rural Alaskan ecosystem could be a possibility. But as I mentioned before it would not be an easy task.

3.8 Conclusion

Most of the rural Alaskan landscape is pristine, and rural Alaskan grown rhodiola would be very similar to wild grown. This could be the reason that the Swedish Herbal Institute showed interest in purchasing Alaskan-grown rhodiola. Alaskan Rhodiola Products in Anchorage virtually guaranteed that they would purchase all rhodiola that could be grown in Alaska, but they need about 200 acres of consistent growers. They have a plan to make their own energy drinks and create other products for the consumer market.

Rhodiola helps the body to cope with stress and anxiety without disturbing other biological activities. It is a relatively inexpensive adaptogen. A clinical trial by the University of California Los Angeles showed that rhodiola extract, Rodax, was helpful for general anxiety disorder. But more clinical trials are needed to gain public confidence to use Rodax in the U.S. Asia, Africa and Europe have

standardized herbal medicine, but the U.S. does not show any genuine interest in herbal medicine.

Fourteen percent of Americans are mentally depressed and 63 percent of that population do not receive any treatment[21]. They may benefit from rhodiola, especially since it does not have side effects (Darabinyan, Aslanyan, Amroyan, Gabrielyan, Malmstrom, and Panossian, 2007) and it is relatively inexpensive. Rhodiola also may bring down the suicide rate in rural Alaska. Elected officials should be lobbied regarding support for FDA regulation in herbal medicines like rhodiola. The World Health Organization (WHO) has guidelines for quality herbal medicines with references to contaminants and residue but the US does not follow them[22]. China, India, and some other countries around the world follow these guidelines[23]. These are my opinions, and not any medical advice of any kind, but it has been shown that, elsewhere in the world, there are studies of rhodiola regarding its benefits and its use. This may be the reason that its demand is increasing steadily.

[21] http://www.adaa.org/about-adaa/press-room/facts-statistics
[22] http://apps.who.int/medicinedocs/documents/s14878e/s14878e.pdf

[23] WHO Traditional Medicine Strategy 2014-2023. World Health Organization

Chapter 4 Growing *Rhodiola rosea* in Unalakleet

4.1 Introduction

Nobody has tried to grow any agricultural crops commercially in the entire Bering Straits region in recent history, but a literature search revealed that Unalakleet was "world famous" for its vegetable gardens in 1920 (Rader, Brown, and Van Delden, 2012). Today we only see a few small vegetable gardens for personal use. One family grows potatoes and rhubarb and uses them all year long. There was a potato field approximately 10 miles away from the main village. High school juniors and seniors used to work on that field and sell potatoes to the villagers to make some money for their senior trip. But for unspecified reasons, that program ended in 2009. Then in 2012, Unalakleet City opened up a community garden in the village by the airport. Nobody grew anything in that community garden for the next three years, but last year (2015) Covenant Youth of Alaska (CYAK) of Unalakleet grew approximately seventy-five pounds of potatoes. This youth group's gardening activities could have been inspired from past youth growing projects. CYAK supports the Unalakleet Bible Camp during summer. This camp is popular among the religious minded people both nationally, and internationally. For more information about this group and this Bible camp please see the following link[24].

[24] http://www.covenantbiblecamp.org/

Photo 16: Potatoes grown at Unalakleet by CYAK
Photo Credit: Adam London [Facebook]

4. 2 A Survey at Unalakleet Regarding this Project

In 2012 I conducted an anonymous survey in Unalakleet. The questionnaire from that survey is included in Appendix A (pages 82-83). Eleven people participated in that survey and ten of those people owned land. The result of that survey shows the following:

- Four out of eleven people (36 percent) who saw the picture of *R. rosea* recognized the plant. They told me that they saw this plant by the Unalakleet River and in the proximity to Unalakleet. They call it "Aaron's rod." People of the Bering Straits region eat Aaron's rod as vegetables to stay well, especially during winter. *R. rosea* grows here naturally and some people already know its properties.
- Upon hearing an explanation of my project, four out of ten (40 percent) of the landowners showed strong interest in growing *R.* rosea on their land. Another five out of ten (50 percent) told me that they might grow *R.* rosea commercially on their land, but that they needed more information. For example: How are they cultivated? How much money is required for an initial investment? Where would they sell *R.* rosea? Where would they find laborers? Realistically, labor in the summer would be one of the biggest

barriers to growing *R.* rosea commercially in Unalakleet. In Chapter 1 (page 17-18) I discussed the possible solution for the labor problem.

- It takes four to five years to mature *R. rosea* root. Once we put *R. rosea* seedlings in the ground, could landowners wait? In response to this question, all ten landowners responded that they could wait. Landowners did not seem concerned about the length of time the land would be use.
- At first glance, it looks like Unalakleet lands are unused, and nothing of commercial value grows there. But in reality people hunt and trap on this land during the winter. Many different kinds of berries grow on this land. Many people pick berries during summer months and eat them all year long. Five out of 11 (45 percent) expressed their concerns, that *R. rosea* should not be grown in berry picking areas. My response is that if we plan carefully, the berry population would not be affected by ten to fifteen acres of *R. rosea* production.

Photo 17: Blueberry patch at Unalakleet
Photo Credit: M. Reza

It is appropriate to raise an ecological concern here. Any large-scale commercial project in an eco-sensitive area like the Bering Strait region would require careful consideration and long term planning. Even though *R. rosea* grows in the wild in this area, its large-scale production may have some ecological effects. Speculations of such problems are beyond this paper, but

careful planning and a slow progress toward large-scale production are advised.

- One person wondered who would be in charge of growing rhodiola commercially in Unalakleet. This was a valid concern. But I do not have an answer to this question at this time.

However, if my pilot project is a success, then I may form a *R. rosea* growers' co-op in the Bering Strait region. Then all responsibilities would be on the board members of the projected co-op. I also talked to the manager of the Unalakleet Native Corporation (UNC) regarding this project. The UNC has businesses that include a grocery store and a few apartment complexes in Unalakleet. They own the majority of the lands in Unalakleet. The UNC manager responded that he needed more information to present to the board members and that they then would decide. The board members of UNC are elected individuals. If UNC decides to grow *R. rosea* commercially then the board members would be in charge of the project. I have not had the opportunity to present this project to the manager of the UNC yet, but I believe that it would be a socio-economically and ecologically sustainable project, if we carry it out responsibly (please see more on this in Chapter 2 pages 37-38).

4.3 Environment of Unalakleet

Alaska has the preferred weather and environment for growing *R. rosea* as an agricultural crop. Professor Stephen Brown of UAF is an agricultural agent at the UAF School of Natural resources and Extension and he is located at the Matanuska-Susitna agriculture experiment station. He explained that Unalakleet's soil is mostly

acidic and sandy, and that it stays covered with snow for six months of the year and the summer has long, sunny days. These are all ideal conditions in which to grow *R. rosea*.[25] I mentioned before that some Alaskan farmers already started rhodiola-growing endeavors. We can learn from them how to grow *R. rosea* in Unalakleet.

4.4 Anchor Point Greenhouse LLC (a case study)

Anchor Point Greenhouse is a success story of small-scale horticultural business in Alaska. It was established in 1976 by Mr. and Mrs. Poindexter[26]. According to their website, they started with one 28 x 96-foot greenhouse. They produced cucumbers and tomatoes, and a few other vegetables, but did not find any market for their produce initially.

Then they decided to make potting soil that was a compost of fish waste and seaweed. Since both fish waste and seaweed are native to the area, the compost did not disturb the ecological system. They called it "fishy peat," which is still popular today. People came to purchase their compost from faraway places like Anchorage, Wasilla and some other towns in Alaska. They tested the quality of their compost with test plants. Eventually, these test plants also became popular.

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[25] Stephen Brown, Ph. D. Associate Professor. Mat-Su/ Copper River District Agriculture Agent. Cooperative Extensive Service. University of Alaska Fairbanks, Alaska. Personal communication with Mosaddeque Reza. 08/24/2015.

[26] http://anchorpointgreenhousellc.com/

Photo 18: Beulah Poindexter and a few of her products
Photo Credit: http://anchorpointgreenhousellc.com/

When the original founder of the Anchor Point Greenhouse, Charles J. Poindexter passed away, Al Poindexter, the original founder's oldest son, continued the business with his mother. Al Poindexter used to be a teacher and he had to leave his job to join his mother. He explained to me that he was not a farmer and he had very little experience when he started farming with his mother. He sacrificed his teaching career to become a farmer[27]. In 2009, Beulah Poindexter passed away. Currently, Al Poindexter and his wife Grace Poindexter run the greenhouse as their family business.

[27] Poindexter, Al. Owner of Anchor Point Greenhouse LLC. Anchor Point. Alaska & V. P. Alaska Rhodiola Products. Personal Communication with Mosaddeque Reza. 7/26/2015.

4.4.1 Products and Sales

Al Poindexter sells potting soil, different kinds of fruits, animal feeds, vegetables, potted flower plants, and some other gardening equipment. He grows cucumbers and tomatoes in his greenhouse and his business is growing every year.

Photo 19: Tomatoes are growing inside a greenhouse
Photo Credit: M. Reza.

There are other small towns near Anchor Point that depend on Anchor Point Greenhouse for their gardening supplies. Poindexter said that small-town people like gardening and that most local people in that area have enough land and most of them grow a portion of their fruits and vegetables. It saves money and they have homegrown healthy food on the table. Anchor Point Greenhouse LLC has been an inspiration for the local people. Poindexter also teaches how to grow fruits and vegetables locally. His teaching and encouragement have created a healthy economic impact on the local area. Using land resources economically, effectively,

and wisely is sound ecological practice (Kassam, 2009). In this context, Poindexter is promoting good ecological practice in the area.

4.4.2 Economic Impacts in the Community

Anchor Point Greenhouse LLC has made a significant impact in their community. It is difficult to find employment in a small town. Specifically, young people have hard time finding work. Poindexter employs sixteen high school students. They work part time and seasonally. He also has five full-time employees. These employments are significant for the city of Anchor Point, which has a population of about 2,000. Poindexter has also been supporting the student organization Future Farmers of America (FFA) at Anchor Point School. The FFA has three educational activities, including school-based agricultural education, service and work based learning, and personal growth and career success[28]. Poindexter teaches all three of these components of FFA. He said that students learn to lead their team and those who went to college are doing well.

4.4.3 New product

The Anchor Point Greenhouse also grows *Rhodiola rosea (R. rosea/*rhodiola*)*. For last the five years it has been their major crop. According to Poindexter, it is profitable to grow rhodiola commercially. He re-confirmed that Alaska has the ideal ecosystem to grow these plants as one of the Alaskan crops (please see for more on Chapter 3, pages 51-53). Poindexter cultivates three different fields of *R. rosea*. It

[28] https://www.ffa.org/about/what-is-ffa

takes four to five years to mature *R. rosea*. Poindexter's first field of *R. rosea* will be ready to harvest in the fall of 2016.

Photo 20: Al Poindexter's *R. rosea* field. Anchor point, AK
Photo Credit: M. Reza

He produces seeds and seedlings and sells them. Poindexter sells his *R. rosea* seed to the co-op members for $100 a gram and non-members pay $200 per gram. The seeds look like sawdust. He also sells *R. rosea* seedlings. It is difficult to germinate seeds because it has to go through winter stratification. In this process, seeds have to spread thinly on dirt in a tray or place one seed per "dirt bulb" in a special tray. Next, these trays are wrapped with thin plastic, so that water does not get on the tray and destroy the seeds. Then the trays are buried for the entire winter under the snow. After the snow has melted, the trays need to be under the sun and kept moist. At end of summer the seeds should be germinated. Then the germinated seeds have to be transferred to a secondary tray to spread out, so the seedlings can come up. Then, again these seedlings need to be moist and wrapped

with plastic and buried under snow. Then the seedlings come up in summer. This process requires two years. Poindexter sells seedlings for 20 cents each and these seedlings are ready to put in the ground. It is much easier to buy seedlings and put them in the ground and this process reduces *R. rosea* maturity time.

Photo 21: About 5000 *R. rosea* seeds
Photo Credit: M. Reza

Photo 22: *R. rosea* seedlings

Poindexter has special machines that he has purchased and modified to sow one seed per bulb. In 2015, he sold 30,000 seedlings to other *R. rosea* growers in Alaska. Poindexter is not worried about the sale of his *R. rosea*. "We need a lot more steady Alaskan *R. rosea* growers, we already have customers and other plans to sell *R. rosea*," Poindexter said. The last few years his *R. rosea* projects have brought a "reasonable amount" of revenue for his farm.

4.4.4 Some Advice from Al Poindexter

Poindexter said that it would be possible to establish a horticulture farm at Unalakleet and create a local market. He thinks cultivating *R. rosea* itself may be difficult initially, without a horticulture farm. This is because it takes four to five years to mature the *R. rosea* roots. The most difficult part of growing *R. rosea* is the

germination of seeds and developing the seedlings, Poindexter explained. Once I put the seedlings in the ground, the plants grow by themselves, but every summer I need to clear weeds from the *R. rosea* ground until its roots get mature. *Rhodiola rosea* is perennial plant. In the winter, they would look withered, but when summer comes, they would be alive. When the roots get mature, and they contain the right amount of rosavin, they are ready to be harvested. The time between putting seedlings in the ground and harvesting is about three to four years. In this time rhubarb, potatoes, and green peas could be grown and sold in the local market to cover part of the cost of commercially grown rhodiola. According to Poindexter, it will require a greenhouse to store and maintain produce and materials for a projected horticulture farm. Poindexter believes that some of the local materials could be used to build a greenhouse in Unalakleet. There are some good logs that float and wash up on the Unalakleet beach. Frames and basements of a greenhouse could be built with those logs, but it also requires some additional steel frame, screws, and plastic to make a roof for the green house. The following website[29] sells plastic and other materials for greenhouses.

The reason for a greenhouse requirement is that we could store germination trays, seedlings, and some other equipment and materials. It is not an absolute necessity. I could store them in a car garage. Alternately, I could build greenhouses similar to smokehouses that already exist in Unalakleet. They were built with locally available materials. Since they were locally built with local materials, the cost of the smokehouses was not known.

[29] http://www.greenhousemegastore.com/product/4-year-greenhouse-film/plastic-greenhouse-film

Photo 23: A typical smokehouse at Unalakleet
Photo Credit: http://www.collegefund.org/blog/?p=960

Poindexter also suggested not growing more than an acre of *R. rosea* initially. This is because I need to find out the real costs and the availability of the labor. In Unalakleet, commercial *R. rosea* cultivation has to be a long-term project, and he suggested that this project could be economically sustainable in the long-term but this project's progression has to be incrementally slow. Poindexter also thinks that since there were no previous agricultural activities on the land in the Bering Strait region, the rhodiola from this region could be readily certified as organic.

However, an extensive problem is that Anchor Point is on the Alaskan road system but Unalakleet is not connected with the Alaskan road system. This makes enormous differences in any business endeavor in Unalakleet. For eight months of a year, everything needs to be flown in and out from Unalakleet. Another four months (summer seasons) of a year, some cargo boats come to Unalakleet. These boats mostly bring fuels. Sometimes people purchase cars from Anchorage and

send them by boat, which is much cheaper than a cargo flight. As an example of commercial production in Unalakleet, all fish from the Norton Sound Seafood Processing (NSSP) in Unalakleet ship by Northern Air cargo. NSSP has wholesale shipping prices and a long-term contract with Northern Air cargo. Processing rhodiola roots in Unalakleet would be beyond the capacity of the operation. I would have to send rhodiola roots to Anchorage or somewhere else. If I send *R. rosea* by cargo flight, this entails a higher price than NSSP. That would reduce the profit margin from prospective sales of *R. rosea* that would grow in Unalakleet commercially, but careful planning may be helpful.

In my personal experience, when I moved from Unalakleet to Kenai, Era Air cargo services quoted $2.00 per pound for our cargo from Unalakleet to Kenai. But Ryan Air cargo service has some (back-haul) flights. Those return from Unalakleet to Anchorage empty, but they are not regularly scheduled flights. They carried our cargo for 49 cents per pound. The problem is that *R. rosea* shipments cannot wait for a long time. We will need to consider all transportation options from and to Unalakleet for commercial cultivation of *R. rosea*.

Poindexter's final suggestion is not to start germination of *R. rosea* seeds and develop seedlings in Unalakleet. It is time-consuming and risky; instead he suggested purchasing seedlings from his farm or from somewhere in Anchorage or Wasilla. This way I could reduce *R. rosea* growing time by a year and save some cost of labor, but we pay for cargo. The cargo may cost $200 and it will cut one year of production time, and I may have close mentorship from the vendor of the seedlings. I believe these will be well worth it.

4.5 Field Preparation and Weeding the *Rhodiola rosea* Field

R. rosea cannot grow in marketable quantities in tundra or in weeds. Most of the land in Unalakleet is covered with tundra. To prepare the ground we will need to use heavy machinery to clear the tundra. Then the land needs to be tilled to prepare to put "baby" *rhodiola rosea* plants in ground. When tilling, I may put some fish remains in the ground to increase the land's fertility, but this is not required. I could get fish remains from NSSP for free. Unalakleet land is always moist, and I do not need to water the *R. rosea* plants.

Photo 24: Tundra of Unalakleet
Photo Credit: M. Reza

There are a few types of heavy machinery in Unalakleet that could be rented to clear the land. Reese Huhta, a resident of Unalakleet and a partner of this project earlier suggested that this would not be difficult but this machine consumes significant amounts of fuel. Huhta estimated that one acre of land preparation may cost $1,000, but this is only a one-time expense. At the second planting and beyond, this process would not be required. Commercial production costs of rhodiola could be less in the long term. Once I plant rhodiola, I will have to pull weeds out from the rhodiola plantation for the next four years. Poindexter pulled all weed from his

plantation by hand. This process is labor-intensive. Please see Appendix C for estimated cost and projected profit for one acre of *R. rosea* in Unalakleet. The following photograph was taken from Anchor Point Greenhouse rhodiola field after they hand-pulled the weeds from their field.

Photo 25: Anchor Point rhodiola field after weeding
Photo credit: M. Reza.

In between planting and maturity, we would need to pull out weeds three times (three summers). The fourth time, I need to harvest. These tasks would require labor, and this would be one of the major problems for commercial cultivation of rhodiola in Unalakleet. I have a rough estimation of this labor cost in Appendix C. This is because I do not have a clear idea regarding the time that it will take for weeding. As I mentioned before, no one has undertaken this business initiative before. Poindexter could not provide any ideas on this because the land topology of Anchor Point and Unalakleet are different. I already discussed partial solution of the labor problem in Chapter 1. There is an alternative to the weeding

problem and that is to cover the field with black plastic garbage bags or biodegradable black sheeting as shown in the photo following.

Photo 26: The ground is covered with garbage bags to prevent weed growth
Photo credit: M. Reza

This process may reduce some labor requirements, but I am not sure what kind of ecological effect it might have on the land. I do not think it wise to follow this path. We need to think long-term survivability and let people decide this.

4.6 This pilot project

Growing rhodiola from its seedling is time-consuming but not complex. I am working with Reese Huhta[30] on this project. His family owns lands in Unalakleet. We will not germinate our own seed. I previously mentioned that in my first trial of this project, germination of rhodiola seed was not a success (please see Chapter 1 for detail). At this time I already have approximately 60 "baby" plants that I received from Poindexter for free.

[30] Reese Huhta is the General Manager (GM) of Unalakleet Valley Electric Cooperative. He is originally from Minnesota but is now a permanent resident of Unalakleet. He is a former Unalakleet High School science teacher, and he is also former GM of NSSP.

The picture below was taken in the summer of 2015.

Photo 27: *Rhodiola rosea* seedlings
Photo credit: M. Reza

My specific goal is to hand-carry these seedlings to Unalakleet in the summer of 2016 and put some of them in the Unalakleet community garden and some of them in Huhta's land. For the next four years Huhta will take care of the weeding process. In the final year, I will travel to Unalakleet for harvesting *R. rosea* roots.

4.7 Conclusion

In a 2012 survey, the people of Unalakleet showed their interest in growing *R. rosea* commercially. The drawbacks are that it would take four years to mature the roots of this plant, and labor is needed to clear weeds from the *R. rosea* field during the busy summer season. Those farms that are growing *R. rosea* commercially in Alaska have been expecting economic prosperity. It would be a

long-term project that the people of Unalakleet need to come together as one and work together on this project for socioeconomic prosperity.

Alaska has the preferred climate and ecological systems to grow *R. rosea*. Using the roots of this plant could reduce depression and general anxiety. We have the highest suicide rate in the country, and this medicinal plant may ultimately bring down the suicide rate. It also has a high earning potential. In Chapter 3, I showed that it has a ready market around the world. *R. rosea* grows naturally in the Bering Strait region. We could grow this plant commercially at Unalakleet. Since our subsistence sources are declining due to depleted numbers of fish and animals, we need to diversify our income resources. Growing *R. rosea* commercially may create that prospect.

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Appendix A

The following is the Anonymous Survey at Unalakleet in 2012:

Form: Mosaddeque Reza (Resident of Unalakleet)
A General Anonymous Survey at Unalakleet (03/07/2012)

Photo 28: Commercially grown *Rhodiola Rosea*, Bethel, Alaska
Photo Credit: http://www.alaskarhodiolaproducts.com/#!photo-gallery/c14l3

Rhodiola rosea is a medicinal plant that grows in the Bering Strait region naturally. Clinical trials found that it helps reduce stress, mental fatigue, anxiety and depression. Besides these, it has many other health benefits. Some experiments showed that it could be used to contain tumors and bladder cancer. It has worldwide demand. Farmers from Alberta, Canada, have been growing *Rhodiola rosea* for past ten years commercially. Their annual sale reached $80 million US. Unalakleet has better soil and ecosystems to grow *Rhodiola rosea* than Alberta. We could grow *rhodiola rosea* on our vast unused land. It might take four to five years to grow and mature roots of *Rhodiola rosea,* but the economic possibility is enormous.

1. Have you ever heard the name of *Rhodiola rosea* / Aaron's rod/ roser root/ Arctic root/golden root, or have you see any plant like the above picture?
   a. Yes b. No

2. Seeing this economic opportunity, do you like to grow *Rhodiola rosea* on your land?
   a. Yes b. No c. Maybe d. Need more information

3. Once we put *Rhodiola rosea* seedlings on your land, you cannot use your land for next five years. Can you wait for five years?
   a. Yes b. No c. Not sure d. Need more information

4. Do you have any concern about your land and the ecology that may be destroyed in the process of growing *Rhodiola rosea*?
   a. Yes b. No c. Concern regarding berry picking
   d. Other (please write them):

5. Do you have any comment? (Please write in):

Appendix B

Some helpful websites:

The website that sells *Rhodiola rosea* seed:
https://www.strictlymedicinalseeds.com/product.asp?specific=488

A Canadian website that may be helpful for rhodiola cultivation education and plan:
http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex13054

This website has some suggestion of how to stratification perennial plant seed in general:
https://www.restorationseeds.com/blogs/news/7211932-germinating-perennial-seeds

This website has information for winter stratification of *Rhodiola rosea* seed:
http://homeguides.sfgate.com/cultivate-rhodiola-rosea-21776.html

This website sells seeds and seedlings and they also provide information that will helpful to grow *Rhodiola rosea* commercially anywhere in Alaska:
http://anchorpointgreenhousellc.com/

This website can be use as one-stop shop for *Rhodiola rosea* growers in Alaska:
http://www.alaskarhodiolaproducts.com/

This website sells materials for greenhouses:
http://www.greenhousemegastore.com/product/4-year-greenhouse-film/plastic-greenhouse-film

Appendix C

Estimated cost of one acre of *Rhodiola rosea* at Unalakleet

One acre of land preparation	$1,000
Seedlings (5000)	$1,000
Cargo 200lb (From ANC to UNK)	$200
Labor (80 hours *$10) 1st Year*	$800
Labor (60 hours*$10) 2nd Year	$600
Labor (40 hours*$10) 3rd Year	$400
Labor (1000 hours *10) 4th Year**	$1,000
Total	$5,000

*Putting the seedlings in the ground

**Harvesting *Rhodiola rosea*

Assuming that we harvest 5,000 pounds of *Rhodiola rosea.*

We will have to pay another $5000 for shipping from Unalakleet to Anchorage.
So, the cost would be $10,000 for the first harvest of an acre of *Rhodiola rosea*.
We can sell for $15 per pound *5000lb = $75,000.
Projected profit = $65,000

In the next growing season (four years later) and in following season, our cost would be less. Because we would have our own seeds and be able to grow our own seedlings. We can also sell seeds.

Labor (80 hours *$10) 1st Year*	$800	
Labor (60 hours*$10) 2nd Year	$600	
Labor (40 hours*$10) 3rd Year	$400	
Labor (1000 hours *10) 4th Year**	$1,000	
Total	$2,800	

Please note this is a rough estimation. For a relatively large project please see the Rhodiola Feasibility Worksheet at the following website[31].

[31] http://www.alaskarhodiolaproducts.com/#!why-grow-rhodiola/c24jx