Applying the concept of eco-restoration enshrined in Convention on Biological diversity combined with traditional ecological knowledge in the Arctic: Case Study- Ecological restoration of Näätämo River

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In this study, focus will be put on how the concept of eco-restoration has been used in the eco-restoration of Näätämo River local in the Finnish Arctic region to show that combining scientific data for eco-restoration with traditional knowledge can bring about effective results at local level. To provide an insight to the matter, the concept of eco-restoration and how the Convention on Biological Diversity has provided a significance for eco-restoration will be considered.

Eco-restoration

Activities of human beings are causing depletion to ecosystems at an unprecedented rate.[1] Despite the efforts made globally in favor of nature conservation, many ecosystems involving those critical for human well-being have been either damaged or destroyed. [2] It has been realized that human beings are not capable of conserving the earth's biological diversity by protecting the critical areas, exclusively. [3] It is understood that ecosystem restoration should be a significant element of conservation programmes so that livelihoods of people relying on these degraded ecosystems can be sustained.[4] Ecological restoration has been receiving an increased amount of attention from both scientists and policy-makers due to its focus on the 'long-term holistic recovery of ecosystems'.[5] Ecological restoration is commonly used as a tool of reversal

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[1] Anastasia Telesetsky, An Cliquet and Afshin Akhtar-Khavari, *Ecological Restoration in International Environmental Law* (Routledge, 2017).

[2] Anastasia Telesetsky, An Cliquet and Afshin Akhtar-Khavari, *Ecological Restoration in International Environmental Law* (Routledge, 2017).

[3] IUCN, Ecosystem restoration, https://www.iucn.org/commissions/commission-ecosystem-management/our-work/cems-thematic-groups/ecosystem-restoration accessed 30 August 2017.

[4] IUCN, Ecosystem restoration, https://www.iucn.org/commissions/commission-ecosystem-management/our-work/cems-thematic-groups/ecosystem-restoration accessed 30 August 2017.

[5] Anastasia Telesetsky, An Cliquet and Afshin Akhtar-Khavari, *Ecological Restoration in International Environmental Law* (Routledge, 2017).

against environmental degradation caused by human actions like deforestation, pollution and land use practices which cause soil erosion although variant ecosystems will recover at different rates.[6]

The most widely used definition of Ecological Restoration is provided by Society for Ecological Restoration (SER) in its Primer and for the purpose of this article, we will be using this definition. It has been defined as the 'process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed'.[7] The reference to the terms assist and recovery have importance and they were meant to be general enough to accommodate diverse activities designed to make ecosystems regain their health, integrity or other ecological functions.[8] It is further elaborated by the SER Primer that, 'Ecological restoration is an intentional activity that initiates or accelerates the recovery of an ecosystem with respect to its health, integrity and sustainability…Restoration attempts to return an ecosystem to its historic trajectory'.[9] What is termed as ecological restoration or ecosystem restoration is not to be confused with 'restoration ecology' as per the SER Primer.[10] It is essentially an interdisciplinary process of undertaking restoration task, which must be inclusive of the experiences, political ideals and cultural practices held by people as well as their communities.[11] This makes ecological restoration specifically inspiring. Thus, it is not astounding that interest in ecological restoration is growing at a fast pace all over the world and that in most cases, cultural beliefs and practices are drawn upon to assist in the determination and shaping of what should be conducted under the umbrella of restoration.[12]

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[6] José M. Rey Benayas, et al. 'Enhancement of Biodiversity and Ecosystem Services by Ecological Restoration: A Meta-Analysis' (2009) Science 325, 1121.

[7] Society for Ecological Restoration Science and Policy Working Group, 'The SER Primer on Ecological Restoration' (2002) available at https://nau.edu/uploadedFiles/Centers-Institutes/ERI/_Forms/Resources/ser-primer.pdf accessed 30 August 2017.

[8] Stuart K. Allison, *S. Ecological Restoration and Environmental Change: Renewing Damaged Ecosystems* (Routledge 2012) 5.

[9] Society for Ecological Restoration Science and Policy Working Group, 'The SER Primer on Ecological Restoration' (2002) available at https://nau.edu/uploadedFiles/Centers-Institutes/ERI/_Forms/Resources/ser-primer.pdf accessed 30 August 2017.

[10] Society for Ecological Restoration Science and Policy Working Group, 'The SER Primer on Ecological Restoration' (2002) available at https://nau.edu/uploadedFiles/Centers-Institutes/ERI/_Forms/Resources/ser-primer.pdf accessed 30 August 2017.

[11] Anastasia Telesetsky, An Cliquet and Afshin Akhtar-Khavari, *Ecological Restoration in International Environmental Law* (Routledge, 2017) at 24.

[12] Society for Ecological Restoration Science and Policy Working Group, 'The SER Primer on Ecological Restoration' (2002) available at https://nau.edu/uploadedFiles/Centers-Institutes/ERI/_Forms/Resources/ser-primer.pdf accessed 30 August 2017.

Nevertheless, the idea held in the SER Primer as to the matter that ecological restoration should 'return an ecosystem to its historic trajectory' is not free from controversies. Ecologists have commonly noted that it is generally that returning to past ecosystems is not possible per se, i.e. history cannot be repeated.[13] What is meant by ecological trajectory has been described by SER as the 'developmental pathway of an ecosystem through time... The trajectory embraces all ecological parameters. Any given trajectory is not narrow and specific. Instead, a trajectory embraces a broad yet confined range of potential ecological expressions through time'.[14]

The legal basis for positing the significance of eco-restoration is contained in the Convention on Biological Diversity. Article 8(f) of the Convention on Biological Diversity provides that: 'Each Contracting Party shall, as far as possible and as appropriate…rehabilitate and restore degraded ecosystems and promote the recovery of threatened species, inter alia, through the development and implementation of plans or other management strategies'.[15] In addition to that Article 10(d) of the convention provides that each contracting party should so far as possible 'support local populations to develop and implement remedial action in degraded areas where biological diversity has been reduced'. Gardner has explained that when speaking of remedial actions as to degraded wetlands, it would be inclusive of restoration of the site to its previous condition [16] and it would obviously apply to other kinds of ecosystems.

A specifically significant development with regards to restoration has been noticed in the CBD Strategic Plan for Biodiversity 2011-2020, adopted as Decision X/2 at the 10th COP[17] where it has been recognized as a crucial component. The vision of the Plan is a world of 'Living in harmony with nature' where 'by 2050, biodiversity is valued, conserved, restored and wisely used, maintaining ecosystem services, sustaining a healthy planet and delivering benefits essential for all people'.[18] As can be seen restoration is a part of this mission and it is also the

[13] J. van Andel and J. Aronson, 'Getting started', in J. van Andel and J. Aronson (eds), Restoration Ecology: The New Frontier (2nd Edn, Wiley-Blackwell 2012).
[14] Society for Ecological Restoration Science and Policy Working Group, 'The SER Primer on Ecological Restoration' (2002) available at https://nau.edu/uploadedFiles/Centers-Institutes/ERI/_Forms/Resources/ser-primer.pdf accessed 30 August 2017.
[15] Article 8(f), CBD.
[16] RC Gardner, 'Rehabilitating Nature: A comparative review of Legal Mechanisms that Encourage Wetland Restoration Efforts' (2003) 52 Catholic University Law Review 573.
[17] CBD, Decision X/2 (The Strategic Plan for Biodiversity 2011-2020 and the Aichi Biodiversity Targets).
[18] CBD, Decision X/2 (The Strategic Plan for Biodiversity 2011-2020 and the Aichi Biodiversity Targets).

central topic of two separate targets within the Aichi Biodiversity Targets and it states that: 'By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks have been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification'.[19] In addition to that the Aichi targets also include: 'By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable'.

The COP decision very clearly highlights the significance of restoration equivalently to the prevention approach and states that, 'While longer-term actions to reduce the underlying causes of biodiversity are taking effect, immediate action can help conserve biodiversity, including critical ecosystems, by means of protected areas, habitat restoration, species recovery programmes and other targeted conservation interventions'.[20]

The significant role restoration can play was even more expressly emphasized at the COP in 2012 whereby contracting parties adopted Decision XI/16 noting that, 'ecosystem restoration will play a critical role in achieving the Strategies Plan for Biodiversity 2011-2020, including conservation of habitats and species'.[21]

Combination of eco-restoration and traditional ecological knowledge

Extensive knowledge is held by the traditional people of the world regarding the natural resources they use. [22] The Convention on Biological Diversity asserts that it can be used as a source of information which can be used for conservation, management and sustainable use of natural resources and traditional knowledge has also been regarded to significant in informing scientific approaches to management of natural resources.[23] The collaboration of indigenous traditional knowledge and science can contribute to adaptive management according to Berkes, Colding and Folke.[24] Science, at present

[19] Target 15 of Aichi Targets.
[20] CBD, Decision X/2 (The Strategic Plan for Biodiversity 2011-2020 and the Aichi Biodiversity Targets).
[21] CBD Decision XI/16 (Ecosystem Restoration, Preamble, para 2.
[22] F. Berkes, *Sacred Ecology* (Routledge 2008).
[23] Gadgil, M., F. Berkes & C. Folke, 'Indigenous knowledge for biodiversity conservation' (1993) *AMBIO*, 22: 151–156.
[24] F. Berkes, J. Colding & C. Folke, 'Rediscovery of traditional ecological knowledge as adaptive management' (2000) *Ecological Applications*, 10: 1251–1262.

has limited effectiveness with respect to environmental issues of increasing magnitude and complicacy has also made room for the acknowledgement of substitute sources of knowledge.[25] There are many examples where indigenous traditional knowledge has complemented ecological data collected previously by contributing concordant and additional information at a more specific geographic scale compared to scientific data.[26] The current interest in ecological restoration is increasing and it is recognised more and more that ecological restoration must consider cultural practices by the indigenous population in the same way as ecological processes.[27] It has also been suggested that traditional knowledge has co-evolved with ecosystems [28] and thus, provide a solid base for ecological restoration.[29] Nevertheless a number of scholars have been sceptic about the scientific legitimacy of traditional knowledge and its effectiveness beyond the local level whereas others are concerned about the ethical issues of exploiting traditional knowledge for the purpose of academic or policy matters.[30] As such, integrating traditional knowledge within top-down approaches to ecological restoration still appears to be a great challenge. [31] However, community participation is very important throughout the restoration process, specifically when it concerns societies with important traditional knowledge that is inherently connected to biodiversity and natural resources management. [32] In those landscapes where the influence of traditional people has been given recognition, cultural and social features of ecological restoration become

[25] M. Stevenson, 'Traditional knowledge and sustainable forest management' (2005) Sustainable forest management network, Edmonton, Alberta.

[26] H. Moller, F. Berkes, B. O. Lyver & M. Kislalioglu, 'Combining science and traditional ecological knowledge: Monitoring populations for co-management' (2004) *Ecology and Society*, 9: 2.

[27] E. S. Higgs, *Nature by Design: People, Natural Process, and Ecological Restoration* (MIT Press, Cambridge, Massachusetts 2003)

[28] J. Long, A. Tecle & B. Burnette, 'Cultural foundations for ecological restoration on the White Mountain Apache Reservation' (2003) *Conservation Ecology*, 8: 4.

[29] N. J. Turner, M. B. Ignace & R. Ignace, 'Traditional ecological knowledge and wisdom of aboriginal people in British Columbia' (2000) *Ecological Applications*, 10: 1275–1287.

[30] N. Chalmers and C. Fabricius, 'Expert and generalist local knowledge about land-cover change on South Africa's Wild Coast: Can local ecological knowledge add value to science?' (2007) *Ecology and Society*, 12: 10.

[31] J. He, Z. Zhou, H. Weyerhaeuser & J. Xu, 2009. Participatory technology development for incorporating non-timber forest products into forest restoration in Yunnan, southwest China (2009) *Forest Ecology and Management*, 275: 2010–2016.

[32] P.S. Ramakrishnan, 'Participatory use of traditional ecological knowledge for restoring natural capital in agroecosystems of rural India' in J. Aronson, S. J. Milton & J. N. Blignaut (eds). *Restoring Natural Capital: Science, Business and Practice* (Island Press, Washington, DC 2007).

particularly significant.[33] The role of indigenous traditional knowledge for the purpose of ecological restoration has been acknowledged in recent years[34] but its probable contribution has not been studied properly.[35]

Case Study: Ecological Restoration of Näätämo River, Finland

The Näätämo watershed is located in the Finnish-Norwegian borderlands and it is a major Atlantic salmon stream[36] and it has a wide diversity of fish species.[37] It is the home of Skolt Sami people and they live in Sevettijärvi area of Finland. Currently, management of the Näätämo salmon fishery is governed by the Atlantic Salmon Management Bilateral Agreement between Norway and Finland. The Skolt Act of Finland implies responsibilities on the state towards the recognition of Sami rights. The Act provides for user rights as to traditional lifeway of hunting, herding and fisheries but it has been poorly executed.[38] The Eastern Sami people have expressed that their cyclical and non-linear view of the world has not been sufficiently accounted for in the management of natural resources by the State.[39] They claim that partly due to this, the ecosystems have faced their demise and it is threatening their way of life, accordingly.[40] As a response, the Skolt Sami got involved in a community-based initiative supported by Snowchange Cooperative to comprehend the status of and to undertake ecological restoration of the damaged parts of the Näätämö basin. The process began in 2011 and it was the first attempt for a formal process of co-management by combining indigenous knowledge and science in Finland. It focused on responding to negative

[33] Garibaldi, A. & N. Turner, 'Cultural keystone species: Implications for ecological conservation and restoration' (2004) *Ecology and Society*, 9: 1.

[34] M. K. Anderson, 'The contribution of ethnobiology to the reconstruction and restoration of historic ecosystems' in D. Egan & E. A. Howell (eds). *The Historical Ecology Handbook: A Restorationist's Guide to Reference Ecosystems* (Island Press, Washington, DC 2001).

[35] M. Perrow, and A. J. Davy (eds), *Handbook of Ecological Restoration, Volume 2: Restoration in Practice* (Cambridge University Press, Cambridge 2002).

[36] Tero Mustonen and Pauliina Feodoroff, 'Ponoi and Näätämö River Collaborative Management Plan' (2013) *Waasa Graphics Oy*.

[37] J. Marina Apgar, Tero Mustonen, Simone Lovera and Miguel Lovera, 'Moving Beyond Co-construction of Knowledge to Enable Self-Determination' (2016) *IDS Bulletin* Vol. 47 No. 6.

[38] J. Marina Apgar, Tero Mustonen, Simone Lovera and Miguel Lovera, 'Moving Beyond Co-construction of Knowledge to Enable Self-Determination' (2016) *IDS Bulletin* Vol. 47 No. 6.

[39] Skolt Sámi Nation and Snowchange Cooperative (2011) Sevettijärvi Declaration, www.snowchange.org/pages/wp-content/uploads/2011/10/SEVETTIJARVI_DECLARATION.pdf accessed 30 September 2017.

[40] Skolt Sámi Nation and Snowchange Cooperative (2011) Sevettijärvi Declaration, www.snowchange.org/pages/wp-content/uploads/2011/10/SEVETTIJARVI_DECLARATION.pdf accessed 30 September 2017.

impacts of climate change and the need to tackle previous ecological damages.[41] Co-construction of the process was expedited by combining indigenous knowledge and science in a joint process of comprehending the changes in the ecosystem and by relating them to livelihood strategies. It began with thorough baseline work which involved the preparation of the Eastern Sami Atlas.[42] The Atlas included information on indigenous governance of water bodies which was in practice before large-scale colonial presence. Interviews conducted by Snowchange Co-operative with local fishermen and women in Skolt language contributed to the process by providing information about salmon, names of places and past environmental change which assisted in documentation of traditional knowledge.[43] Based on the historical baseline, local fishermen and women from the area were leading the environmental monitoring of the watershed between 2013 and 2014.

Throughout the summer field season, they were recording what observed with digital camera and continuously shared them with the science team. This developed a new field method which was called visual-optic histories. [44] It amounted to the detection of new species entering the ecosystem. For instance, they recorded for the first time that there was the southern Potosia cupra scarabaeid beetle and this was recorded through oral communication. Observations and hotographs from the field by Skolts were put together with a species identification by a specialist on insects which confirmed the new geographical discovery. Furthermore, observations of water level and temperature fluctuations which are connected to salmon movement patterns and changes in quality of water like algae blooms and foam were co-constructed by sharing the monitoring data with limnological data available publicly for the basin.[45]

Throughout the Atlantic salmon fishing season, records were kept regarding the catches by the Skolts. These statistics were compared with scientific surveys of the quantities and qualities of salmon

[41] Tero Mustonen and Kaisu Mustonen, 'Näätämö River Collaborative Management Efforts by the Skolt Sami' (2015) *Snowchange Cooperative*.

[42] Tero Mustonen and Kaisu Mustonen, 'Näätämö River Collaborative Management Efforts by the Skolt Sami' (2015) *Snowchange Cooperative*.

[43] Tero Mustonen and Pauliina Feodoroff, 'Ponoi and Näätämö River Collaborative Management Plan' (2013) *Waasa Graphics Oy*.

[44] Tero Mustonen, 'Communal Visual Histories to Detect Environmental Change in Northern Areas: Examples of Emerging North American and Eurasian Practices' (2015) *Ambio* 44.8: 766–77.

[45] J. Marina Apgar, Tero Mustonen, Simone Lovera and Miguel Lovera, 'Moving Beyond Co-construction of Knowledge to Enable Self-Determination' (2016) *IDS Bulletin* Vol. 47 No. 6.

coming up in the river.[46] For instance, the Skolt records noticed an increase in the number of northern pike to stream sections of the river proximate to Opukasjärvi. No observation science records have been detected yet but it could assist in understanding the warming up of waters. It also recorded on maps what was thought to be lost salmon spawning areas.[47] These sites were lost because of state-sponsored management actions, particularly the forestry experiments which were conducted in 1960s and 1970s and also the development of new boating routes. The recording of sites of erosion on lake and river banks which are sign of possible climate change impact were vital for facilitating ecological restoration activities.[48]

This process amounted to the revitalization of Sami knowledge by creating a community-based traditional knowledge archive to assist the community and research work in future. Moreover, using indigenous knowledge in monitoring has resulted in new management options and actions for the watershed. Although the co-management is yet not made formal but national institutes like Metsähallitus, the local Centre for Economic Development, Transport and the Environment have shown their interest in learning about novel management alternatives by a Skolt research agreement.[49]

Conclusion

The case study is one of the examples where the concept of eco-logical restoration has been successfully used at local level for the restoration of the Näätämo river. It would not be possible to achieve such an effective result without combining scientific data with indigenous traditional knowledge. At local level, such practice might lead to effective restoration of ecological processes which has been disturbed by the impacts of climate change.

[46] Tero Mustonen and Kaisu Mustonen, 'Näätämö River Collaborative Management Efforts by the Skolt Sami' (2015) *Snowchange Cooperative*.

[47] Tero Mustonen and Kaisu Mustonen, 'Näätämö River Collaborative Management Efforts by the Skolt Sami' (2015) *Snowchange Cooperative*.

[48] Marina Apgar, Tero Mustonen, Simone Lovera and Miguel Lovera, 'Moving Beyond Co-construction of Knowledge to Enable Self-Determination' (2016) *IDS Bulletin* Vol. 47 No. 6.

[49] Marina Apgar, Tero Mustonen, Simone Lovera and Miguel Lovera, 'Moving Beyond Co-construction of Knowledge to Enable Self-Determination' (2016) *IDS Bulletin* Vol. 47 No. 6.