Name of the case study	Uummannaq - Impact of sea ice reduction and rationalization policies -Greenland [Loss of Resilience]	
What about this case makes it interesting? How does this case contribute to understanding of resilience and/or regime shifts in the Arctic?	Greenland is considered one of the regions most impacted by climate change. Uummannaq, Greenland, is located on a small island in a fjord along the middle of the west coast of Greenland. The area has a predominantly Inuit population and has historically been able to adapt to changes in the environment. Uummannaq community is strongly influenced by memories of previous adaptation to extreme climatic conditions in an isolated place. Social-ecological memory gives community members the feeling they will be able to adapt in the future. Hunting, fishing, dog sledding, and camping are frequently mentioned and serve as examples of reference points participants use to assess their daily lives. These activities are central to their culture and the core values of the community. Thick coastal sea ice in winter provides the requisite conditions for the professional and cultural activities at the heart of the Uummannaq community's worldview, cultural values, livelihood needs, and interests. Today, participants integrate climate/meteorology into their lives through their outdoor hunting practices, fishing, and traveling by dogsled/snowmobile as an adaptation strategy. Furthermore, they are characterized to have strong informal institutions and social-ecological solid memory. However, socio-political changes are constraining their adaptive capacity. Among Danish colonization, current policies implemented by the government have rationalized services and promoted urban demographic concentration to reduce administrative costs and support Greenland independence. This change has led to a loss of political autonomy to influence policies.	
Templated completed by: *Main contributor	Carla Lanyon, Stockholm Resilience Centre Juan Rocha*, Stockholm Resilience Centre	**Key references: Cite in the text using (1), (2), (3) etc. and provide a reference list at the bottom of the template.** (1) Baztan J, Cordier M, Huctin J-M, Zhu Z, Vanderlinden J-P (2017) Life on thin ice: insights from Uummannaq, Greenland for connecting climate science with Arctic communities. Polar Science 13:100–108. (2) Berman, M., J. Baztan, G. Kofinas, J.-P. Vanderlinden, O. Chouinard, J.-M. Huctin, A. Kane, C. Mazé, I. Nikulkina, and K. Thomson. 2020. Adaptation to climate change in coastal communities: findings from seven sites on four continents. *Climatic Change* 159(1):1–16. **(*) Mainly all the information comes from (1). Otherwise, is explicit cited**

Reviewed by (name and affiliation)		

Category	**Resilience/ Adaptability**	**Loss of resilience**	**Transformation**
		X	

Case study details:	**Country**	**Place**	**Scale – space**	**Scale – time**	**Sector(s)**	**Other (e.g. disturbance)**
	Greenland	Uummannaq		2005-2016	Hunting	

Drivers (mark with X in appropriate boxes)	**Climate**	**Geopolitical**	**Mineral/ oil extraction & infrastructure**	**Tourism**	**Shipping**	**Biological invasion**	**Rapid demographic change**	**Other:**
	x	x						

	Biophysical:	**Social:**
1. Basic description of coupled social-ecological system in focus **(**What are the key components and stake holders) If possible draw a systems diagram or conceptual map of the case – this can be a series of diagrams to capture different periods in the case and the drivers/	a) What types of ecosystem(s) and other major biophysical features are present? Arctic Marine Ecosystem, coastlines, sea ice, fjord. b) How are the case boundaries defined in terms of ecosystems or biophysical characteristics? The boundaries of the system are defined according to the traditional practices, which involve coastline.	c) Who are the key groups of people in this case? The coastal community has 90% Inuit descent recognized themselves as Kalaallit. They lived in seven settlements across a large bay in Uummannaq, Greenland´s west coast. d) What kinds of livelihoods are important in the system? Town-based jobs and traditional livelihood such as hunting, fishing, dogsledding. These traditional livelihoods provide income and local food. e) What institutions are key to this case?

actors/ events that characterize the period.		Local Institutions (informal) Danish Government f) How are the case's boundaries socially defined, and how do these social boundaries relate to biophysical boundaries? The social boundaries of the traditional practice extend beyond the physical area of the geopolitical area of Uummannaq.

2. Timeline Draw a timeline of *key* events/ developments to the case. Define the time period (decades – centuries) over which change is considered, Provide a brief description of event/ actors, and ecological impacts Is it possible to identify periods of change from one type of system to another, transformations? Identify disturbances or events that challenged, built, or reduced resilience or adaptive capacity in the system. Consider both biophysical and social dimensions. Mark particularly significant events with *.	1920-1930: Community recognized similar climate conditions with equivalent effect, thickness, and less sea ice extension.

3. Disturbances What are the key disturbances in the system (present and past)	a) Have there been major biophysical disturbances that are relevant for the case? Changes in seasonality: longer, colder, and snowing wintertime Increase of temperature Coastal sea ice is thinner and remains for a shorter period Weather variability Marine ecological change	b) Have there been major social disturbances that are relevant for the case? - Loss of public service jobs - Decrease in traditional livelihoods
4. Drivers of change Clarify what impacts these drivers have on the SES and if these are direct or indirect	a) What are the key biophysical drivers of change? The increase in temperature and the change in seasonality have affected the sea ice thickness. Among these, winds are becoming more potent and unpredictable.	b) What are the key social drivers of change? -Rationalization Policies: Service delivery and administrative cost were rationalizing. Government promotes urban demographic concentration to reduce administrative cost -Local government reorganization: The local government was displaced from Ummannaq to Ilulissat. -Resource development
5. Sources of adaptive capacity: What factors allow(ed) the system to adapt to disturbances in the past and present? Give a brief assessment	a) Within the ecosystem? (+) Similar climate conditions in the past. Climate change phenome nous since to be a periodic event that Ummannaq communities have faced.	b) Within society (e.g. people, social capital, management, institutions, infrastructure): (-) Decrease in the mobility of the community, affecting the reproduction of social ties and their traditional livelihoods. (-) Out-migration of young population

of recent or on-going changes (+/-/0 = increasing/ reducing/ not affecting adaptive capacity)		(-) Change in livelihoods, wage jobs orientated. (-) Top-down governance and lack of power in local authorities. No coordination across governance scale reduces the capacity to solve local issues.
The next two sections break down the information in Section I. While it is not necessary to fill these sections, if you have additional information pertinent to specific rows below feel free to enter the material.		
II.1-8 SES, resilience and adaptive capacity		
	Biophysical	**Social**
II.1. Where do we find change and resilience in the face of change?	a) Within nature: Change: The thickness of sea ice has decreased due to warmer temperatures and seasonality changes. Longer and earlier summers and short winters. It is crucial the thickness of sea ice. Without this, Uummannarmiut cannot practice activities such as dogsledding to visit friends and family on other islands and villages or hunting and fishing on sea ice. The hunters cannot go with either dogsled because the ice is too thin or sail because it is still too thick. Resilience: Similar climate conditions in the past had to make communities adapt. Therefore, they perceive this as a periodical event, and their social-ecological memory is a foundation to deal with the ecological disturbance.	b) Within society: Change: The system is going through and outmigration of young population to urban areas looking for jobs opportunities. There is a loss of traditional knowledge and a decrease in traditional livelihood. Administrative change has decreased the autonomy of local institutions to deal with the climate change impacts. Resilience: Uummannaq community is influenced by memories of previous adaptation to climate conditions. This memory gives them the strength to face future adaptation challenges.
II.2. What are the system's key components?	a) Key Ecological components (e.g. lakes, coastal zones, caribou) Lakes, rivers, fjords, coastlines, sea ice.	b) Actors in society (e.g. individuals, groups, public or private organizations)? How are people organised – by geography, livelihood, family, etc.? The core organization is the family. Although the mains source of income is wage labour, the community is attached to traditional livelihoods to sustain their cultural identity.

		Hunters and fishers have an essential role in the community.
II.3. What are the key linkages? E.g. ecosystem services, resource extraction. These linkages should exist. If there are not mutual links between social and ecological components the case is not a social-ecological system.	a) From nature to society (e.g. ecosystem services) - Primary production - knowledge and educational values - traditional livelihoods.	b) From society to nature – modifying nature, extracting resources (e.g. hunting, mining, water pollution) - Fishing - Hunting
II.4. What are key interactions?	a) What are the key ecological interactions within the case? Due to warmer stream ice doesn't get thick, affecting traditional and cultural practices. b) What are the most important biophysical tele-connections to distant systems?	c) What collaborations, conflicts, or other key linkages exist between actors? Sharing local seafood with family and friends d) Between local actors and distant actors? The conflict between local actors and institutions with the administration of the area in Ilulissat. Possible conflict between community and national government that implement rationalize policies.
II.5. Culture	a) How is the relationship between society and nature viewed? Thick coastal sea ice in winter provides the requisite conditions for the professional and cultural activities at the heart of the Uummannaq community's worldview, cultural	c) What are key cultural features of relevance for the case? Traditional activities such as hunting fishing, dogsledding and sharing networks. Traditional ecological knowledge

	values, livelihood needs, and interests. b) What meanings are attributed to nature and to interactions with nature? Community rely on the weather conditions to reproduce their culture and traditional livelihoods. “Weather is our boss,” a member of the community mention. They have incorporated climatology knowledge in their own life, to deal with climate change.	d) What are key cultural practices and beliefs related to nature? Traditional activities evocate ancestors and their cultural identity. Social-ecological memory of historic adaptive capacity.
II.6. Disturbance What are important types of stress & shock	a) Describe important biophysical or ecological shocks and stresses (e.g. floods, storms, etc). 1920-1930 similar conditions, high temperatures, and a decrease in the thickness of the sea ice conditions. March 2018: Warmest temperature ever recorded in the area	b) Describe important social shock and stresses (e.g. austerity policies, changes in government policy, introduction of new technologies, etc) Fishing and hunting quotas Rationalization Policies Reorganization of the administrative institutions
II.7. What are key slow variables Changes that occur over decadal or longer time scales	a) What types of ecological processes (e.g. loss of permafrost, shifts in species composition) are driving important long-term changes in ecological structures and processes? Thinning of the ice sheet	b) What types of slow social processes (e.g. aging, population growth, loss of language) are driving important changes in social institutions and behaviours? The outmigration of young people is getting more common due to the lack of wage jobs and the national policies that promote migration to urban areas. As a result, the community is aging, risking a loss of traditional knowledge and cultural identity.
II.8. Relationships with ecological regime shifts	a) Are ecological regime shifts driving further ecological	c) Can social stresses or major changes be attributed to

	change or pressure? No b) Are external or internal ecological dynamics potentially or actually producing ecological regime shift(s)? Potentially the total melt of sea ice	ecological regime shifts? The change in weather conditions and sea-ice affected the reproduction of traditional livelihoods, impacting their cultural identity. The shorter season has made young people to use snowmobile instead of dogs leading to be more efficient. d) Are there specific social practices that might be contributing to ecological regime shifts
II.8 Regime shifts	**If a regime shift exists and is important to this case describe it below.** Please indicate whether the regime dynamics are well-established, contested, or speculative.	
II.8.a. Detailed description of alternate regime shifts A case study can contain more than one type of regime shift	Briefly describe the structure of each regime. What does each regime look like? What are differences in ecosystem structure and function? (e.g. permafrost loss, vegetation change)? How do the properties and behaviours of regimes differ? (e.g. collapse of subsistence food sources, fundamental change in types of livelihoods, change in governance institutions, new actors with significant political power who transform decision making)	
II.8.b. Feedback mechanisms within the system that maintain each regime	Ecological feedback mechanisms	Social feedback mechanisms

II.8.c. What key changes drive regime shifts? Describe how these changes alter the state of the system or feedback processes.	a) Drivers of ecological regime shifts (either social or ecological). b) How do these changes alter biophysical feedback processes?	c) Drivers of social regime shifts (either social or ecological). d) How do these changes alter the social feedback processes?
II.8.d. Ecosystem services substantially impacted by regime shift	a) Changes in ecological processes that produce ecosystem services	b) Changes in demand for ecosystem services (market and non-market) c) Changes in the institutional context of ecosystem services e.g. changes in access and changes in how ecosystem services are valued as expressed by rules and regulations.
II.8.e. What is (+/-) impacted by changes in ecosystem services directly or indirectly	a) Impacts from regime shift on ecological components	b) Impacts from regime shift on social actors .
II.8.f. Potential cascading effects	Describe, if any, the likelihood of potential ecological cascading effects to other SES	Describe, if any, the likelihood of potential social cascading effects to other SES
II.8.g. Where do actors intervene to alter regime shift dynamics and who can do the intervening? This can be listed here or marked with (*) in the table above	Ecological oriented interventions .	Socially oriented interventions
REFERENCES/ SOURCES CITED:		

(1)	Baztan J, Cordier M, Huctin J-M, Zhu Z, Vanderlinden J-P (2017) Life on thin ice: insights from Uummannaq, Greenland for connecting climate science with Arctic communities. Polar Science 13:100–108.
(2)	Berman, M., J. Baztan, G. Kofinas, J.-P. Vanderlinden, O. Chouinard, J.-M. Huctin, A. Kane, C. Mazé, I. Nikulkina, and K. Thomson. 2020. Adaptation to climate change in coastal communities: findings from seven sites on four continents. *Climatic Change* 159(1):1–16.
(3)	

GLOSSARY OF TERMS IN THE TEMPLATE

Actor	We use this term generally to look for individuals, groups, organisations, and so on that structure actions and/ or are stakeholders.
Adaptive capacity	Is the capacity of actors in the system to manage resilience in order to stay within a desired state during periods of change. This is related to the diversity in the system behind the provision of a function.
Disturbance	This refers to any disturbance to the system, regardless of scale, duration, intensity and frequency. See shock and stress.
Driver	Actor or process that directly or indirectly affects change in a social-ecological system. External means that the system in question (the scale being looked at) is unable to affect the driver in question – there is no feedback from the system to the driver.
Ecosystem services	The goods and services humans derive from ecosystems. These include: provisioning, regulating, cultural ecosystem services respectively.
Feedbacks	A change within a system that occurs in response to a driver, and that loops back to control the system. A feedback can help to maintain stability in a system (negative or balancing feedback), or it can speed up processes and change within the system (positive or enhancing feedback). Feedback processes play a very important role in determining system thresholds and in maintaining system resilience.
Institution	Here we refer to the humanly devised constraints that shape human interactions, such as rules, norms and laws. These can be formal or informal. Note that we are not referring here to institutions as organisations.
Regime shift	For complex systems, a substantial and enduring reorganization of the system, where the internal dynamics and the extent of feedbacks undergo change.
Resilience	This is a property, in this context of social-ecological systems. It relates to the capacity of a system to cope with disturbances and recover in such a way that they maintain their core function and identity. It also relates to the capacity to learn from and adapt to changing conditions, and when necessary, transform.
Shock	A sudden, unexpected disturbance. This kind of disturbance is often punctual, and has important impacts on large parts of the system.
Slow variable	When analysing complex system is often useful separating “fast” and “slow” variables. Fast variables often represent the primary concern of ecosystem users, for instance game or crop production. Slow variables shape the behaviour of fast ones but change slowly with respect to the overall dynamics of the system. Examples of slow variables might include permafrost thawing for a social-ecological system of Arctic hunters where the fast variable is game, or soil organic matter for an agricultural system where the fast variable is crop production.
Stress	This is a disturbance that has long persistence and often low intensity in impact.

Social-ecological system	This is an interwoven system of human societies and ecosystems. This concept emphasises that humans are part of nature and that these components function in interdependent ways. In the template identifying these interactions between the components aims to identify the processes and actors/ components that interact and particularly the feedbacks between the human-related components and the ecosystems/ biophysical components.
Stakeholder	See “actor”
Systems Diagram	This is using a diagram to illustrate the configuration of a system. This is done by defining its structure, function, and feedbacks. For a case there may be more than one diagram if the system changes in character (actors, processes, drivers, disturbances, feedbacks etc.) over time.
Timeline	The goal with the timeline is to capture important events – both punctual and over longer periods of time, identifying the causes of these events and the actors/ processes involved. This should be done chronologically and distinguishing events.