Name of the case study	Great Northern Peninsula – Cod fishery collapse – Newfoundland, Canada [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?	While this case is set in the sub-Arctic, cod fishing has been important in many parts of the Arctic and the causes and impacts of the cod fishery collapse is relevant to many areas around the Arctic. Cod fishing was the economic focus of Newfoundland and essential to the well-being of the communities of the Great Northern Peninsula. The rich natural resources, especially fishing, have been the driving factor for settling under the last 4500 years and life was built up around the fishing industries in the later years (Ref 6). The high fishing pressure of growing fleets and development towards capital-intensive fishing along with the arrival of cold waters in the late 80s and early 90s led to the collapse of the cod fishing industry and the moratorium in 1992 (Ref 4). Crustaceans were already on the rise before the cod stocks collapsed, but the disappearance of the cod (and other commercially and non-commercially caught fish) (Ref 4) resulted in a lack of predators in the North Atlantic, which probably contributed to a shift towards an invertebrates-dominated regime. Fishing for shrimp and snow crabs has replaced fishing for cod. The Northern Peninsula was allocated a special shrimp quota in 1997 that helped this region immensely. However, many jobs were lost which led to a strong outmigration of young men and women to more urban centers. In turn, this loss of human capital deprives the region of the basis to form new diverse livelihoods for a resilient community. The downstream effects of an ecological disaster (both natural and man-made) on fishing communities with lacking resilience are described below**.**		
Template completed by:	Dries Stevens, Stockholm Resilience Centre Cornelia Ludwig, 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) Hamilton, L.C., L.M. Haedrich, and C.M. Duncan. 2003. Above and below the water: Social/ecological transformation in Northwest Newfoundland. *Population and Environment* 25(3):195–215. (6) Gibson, R. 2013. *Regional profile of the Northern Peninsula region, Newfoundland*. [online] Canadian Regional Development - A Critical Review of Practice, and Potentials: Canada. URL: http://cdnregdev.ruralresilience.ca/wp-content/uploads/2013/05/NorthernPeninsulaProfile.pdf [Accessed 23 April 2015] (7) Hamilton, L. C., and M. J. Butler. 2001. Outport adaptations: Social indicators through Newfoundland's cod crisis. *Human Ecology Review* 8(2):1-11.	
Reviewed by (name and affiliation)			
Category (mark with X)	**Resilience/ Adaptability**	**Loss of resilience**	**Transformation**
		X	

Case study details:	**Country**	**Place**	**Scale – space**	**Scale – time**	**Sector(s)**	**Other (e.g. disturbance)**
	Canada	Newfoundland: Great Northern Peninsula & Gulf of St Lawrence	17500 km^2 (on land)	Pre-1965-date	Fisheries	Collapse of cod, cold waters late 1980s-early 1990s

Drivers (mark with X in appropriate boxes)	**Climate**	**Geopolitical**	**Mineral/ oil extraction & infrastructure**	**Tourism**	**Shipping**	**Biological invasion**	**Rapid demographic change**	**Other:** ***state here***
	X colder waters bad for cod						X collapse of industry resulted in emigration	Overfishing; Shift in ecosystem to shrimp has uneven benefits in fishing fleet.

	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/ actors/ events that characterize the period.	a) What types of ecosystem(s) and other major biophysical features are present? Newfoundland's Great Northern Peninsula and the adjacent Gulf of St. Lawrence delimit this case. Specifically, the transformation of the fishery industry constitutes the focus of this case and thus attention is mostly directed towards the marine ecosystem. Key components include the commercially interesting species: - Cod (*Gadus Morhua*): Subdivided into *Northern Cod* and *Gulf Cod*; Cod are the top predators and thus dominate the ecosystem. - Redfish (*Sebastes*) - Greenland halibut (*Reinhardtius hippoglossoides*) - Northern Shrimp (*Pandalus borealis*) - American lobster (*Homarus americanus*) - Snow crab (*Chionoecetes opilio*) (1) b) How are the case boundaries defined in terms of ecosystems or biophysical characteristics? Newfoundland's Great Northern Peninsula and the adjacent waters of the Gulf of St. Lawrence delimit this case. Newfoundland's Great Northern Peninsula is approximately 25 km long and 80 km wide at its widest point and encompassing an area of 17 483 km² (2). The on-shore and in-sea fisheries constitute the main focus areas. The Gulf of St. Lawrence is located to the east of the peninsula. Until the massive decline in the 20th century, these waters were known as one of the most productive fishing grounds in the	c) Who are the key groups of people in this case? The communities living on the Great Northern Peninsula of Newfoundland constitute the focus of this case. As fisheries are very important for the economy and the overall wellbeing of these communities, **fishermen** are a key group of people that will be focused on (1). d) What kinds of livelihoods are important in the system? Newfoundland is the poorest and most fishery dependent province of Canada. Newfoundland's Great Northern Peninsula in turn, is the poorest and most fisheries-dependent region of Newfoundland (1). **Fisheries** and related industries (such as fish processing) constitute prime economic activities in this region along with forestry. The major four economic categories are: Sales and Service, Primary/Natural resource (fishing, forestry, mining), Construction and related industries, as well as Processing and Manufacturing (6). However, after the collapse of the cod stock, the necessity for diversification of the region's economy became more apparent. Different kinds of livelihoods such as **tourism** are being explored (1). e) What institutions are key to this case? If possible, define what scale it addresses. - The Canadian 200-mile exclusive economic zone (EEZ) established in 1976: Made the waters surrounding Newfoundland exclusively Canadian. Canadian

	world (1). Coordinates : 50°27′48.6″N 56°46′7.1″W	fishermen were incentivized to fish more due to grants and benefits whereas foreign fishers were restricted due to quotas (1). - The 1992 moratorium - Canadian Government - Regional Government of Newfoundland and Labrador NB: The government is responsible for the establishment of fishing quotas and permits. - Smallwood resettlement project: *Resettlement was only one component of Smallwood's plans to modernize Newfoundland and Labrador and establish a higher, yet equitable standard of living for all its residents.* (http://www.heritage.nf.ca/law/resettlement.html) This project created population growth in the 1970s. - Great Northern Peninsula Joint Council - Regional actors - Subsidies and income assistance (Northern cod adjustment and recovery programme (NCARP), The Atlantic groundfish strategy (TAGS), other assistant packages) (7, 6) f) How are the case's boundaries socially defined, and how do these social boundaries relate to biophysical boundaries? Newfoundland is the poorest and most fishery dependent province of Canada. Newfoundland's Great Northern Peninsula in turn, is the poorest and most fisheries-dependent region of Newfoundland (1). Currently, the Great Northern Peninsula includes 69 distinct communities that lie in close proximity to one another and share public facilities, such as schools. According to the government's

		website approximately 16 859 people are now living in the Great Northern Peninsula (2). Includes also external fishing companies that make use of quotas allocated to communities on the Peninsula and who have agreements to process their catch in local processing plants. Fishing policies and quotas from the federal government as well as licenses directly influencing the livelihood of communities.

2. Timeline Draw a timeline of *key* events/ developments to the case. Points to include: Make clear the period of time over which the change is being considered. Provide a brief description of event/ actors, and ecological impacts. Mark particularly significant events with *. Consider both biophysical and social dimensions. Additional points that can be considered: Is it possible to identify periods of change from one type of system to another, transformations?	The key source (1) distinguishes between four different periods. *1. Traditional Era (pre-1965)* Fishing happened *traditionally* and was self-sustaining. Seasonally, different species were caught depending on their availability. - 1949: Newfoundland joined Canada. Tertiary economy bloomed. However, as to date, Newfoundland's still Canada's poorest province. - Late 1950s: Advent of factory trawlers. Coined as one of the reasons for the depletion of the cod stock. *2. Technological Change (1965 – mid 1970s)* - After 1965: Technological intensification of Northern peninsula fishing as more accessible inshore stocks became depleted. Introduction of trawling gear. As a result individuals with small boast could not compete with organizations that had the ability to invest money into new gear and bigger boats. - 1968-70: Peak catches of Canadian and foreign fleet in the region. *3. Boom period (mid 1970 – mid/late 1980s)* - 1975: Canada establishes exclusive economic zone (EEZ) in the region to limit foreign fishermen. Quote for foreign fishermen. Subsidies for domestic fisheries - Late 1970s – early 1980s: Canadian catches reached new highs - 1982-1987: *Glory Years* of the Newfoundland fisheries. High catch and revenues *4. Bust and Change (late 1980s to present)* - After 1988: Decline of the cod catch - 1992: Collapse of the great cod population - 1992: Moratorium on Northern Cod fishing* - 1993: Temporary Northern Gulf cod fishery - 1994: Moratorium on northern gulf cod - As a result of the moratorium, the 400 employees of the Outport Fish Processing Plant were left without a job overnight - 1997: Shrimps quota was to allocated a number of communities on the Northern Peninsula (3000mt), St. Anthony Basin Resources Inc. (SABRI) was founded with the mandate to govern the quota (3) - investments of royalties, etc. into both fishery and non-fishery related sectors for community development - 2003: Canada closed the cod fisheries in Newfoundland. Both species have become endangered. - Generally, landings dipped around 1992-1996 and rose again due to substitution of fishing for crab and shrimp. This led

Identify disturbances or events that challenged, built, or reduced resilience or adaptive capacity in the system.	to equal or higher landings than in the mid 80s in the Northern Peninsula (4) - In recent years, quotas for shrimp have been cut due to decline of stocks, which is threatening the economy of the Northern Peninsula yet again

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? - Depletion of the cod stock and other fish species – first by international fleets, then after the EEZ establishment by Canadians - Compounded by adverse climate (unusually cold waters reflected North Atlantic Oscillation (NAO) circulation /circulation abnormalities) during late 1980s and early 1990s (4, 5) probably led to reduced recruitment and growth of cod	b) Have there been major social disturbances that are relevant for the case? - The collapse of the cod fisheries and moratoria in 1992 and 1994 for fishing of northern and Atlantic cod - Sudden increase of unemployment - Higher than ever dependency on governmental financial support/subsidies – although this has always been a big part of income - Increased outmigration of young adults - Increased average age (7) - Recent quota cuts for shrimp fishing in the Northern Peninsula and other regions in Newfoundland (9, 10) due to dwindling shrimp stocks, affecting also processing plants that have not enough shrimp to process

3. 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? - Lack of predatory pressure due to cod and other fish stocks depletion played some role in the increase of crustaceans on Newfoundland's shores and in off-shore waters, i.e. shrimp and snow crab - Climate change is linked to variability in NAO leading to changes of water temperature (8) and therefore changing breeding and growing conditions for cod and crustaceans. Colder waters are advantageous for crustaceans and disadvantageous for cod (4, 5).	b) What are the key social drivers of change? - Shift from labor to capital intensive fishery and jobs in general - Allocations of shrimp and crab fishing quotas by the government - Market value and demand for crustacean products (Japan is strong force on market) - Location of crustaceans, not all communities have access to crustacean-rich waters - Small boat owners disadvantaged for shrimp fishing - Capital concentration/uneven wealth distribution - Mortality due to fishing: following the reopening of the fishery, removals exceeded surplus production; discarding, misreporting, poaching, and unreported catches; uncertainty about the level of by-catch in a number of domestic and foreign fisheries - Lack of control by Canada, and through NAFO, over abusive and destructive foreign fishing practices (overfishing, discarding, excessive by-catch, illegal, unregulated and unreported (IUU) fishing) - Poor strategic choices regarding conservation in an overall atmosphere of no long-term vision and strategy (for example, permitting harvesting in areas where cod were congregating to spawn) - Lack of knowledge - Destructive gear/technology - Lack of recognition of the structure of northern cod stocks (11)

4. Sources of adaptive capacity: What factors allow(ed) the system to adapt to disturbances in the past and present? Give a brief assessment of recent or on-going changes (+/-/0 = increasing/ reducing/ not affecting adaptive capacity)	a) Within the ecosystem? - (-) Biodiversity and healthy populations would provide resilience to the marine environment, but the fishing pressure is preventing a return to the former regime, and the new regime is threatened by natural fluctuations and short lifespan of shrimps and strong fishing pressure making the system vulnerable and potentially unstable (7)	b) Within society (e.g. people, social capital, management, institutions, infrastructure): - Human capital: increased outmigration of young adults (-) and increased average age (-) - (+) SABRI - (+) New innovative projects to diversify the Northern Peninsula's economy (12) - (0) Lots of local actors for services and business (potential to increase, does not influence adaptive capacity) (6) - (+/0) Currently more people stay longer in school and get college education – but many leave the region after they get a degree instead of contributing to human capital, skills and driving change in home area - (+) "Household production" has always been a big part of informal economy in Newfoundland and acts as buffer against troubles of the formal economy - (+/0/-) Department of Fisheries and Aquaculture (have the power to go either way) - (+) Fish Food and Allied Workers Union (7)
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 changes and resilience in the face of change?	a) Within nature - Cod stocks have seemingly started to recover, though very slightly, with some larger and older fish appearing in the waters (13)	b) Within society - Communities try to diversify local economy - Innovation (12) - Investments of fishery-derived capital into social and cultural sectors (SABRI) - "Household production" as buffer against troubles of the formal economy (7)
II.2. What are the system's key components?	a) Key Ecological components (e.g. lakes, coastal zones, caribou) - Coastal and off-shore waters around Newfoundland - Cod - Shrimp - Snow crab	b) Actors in society (e.g. individuals, groups, public or private organizations)? How are people organized – by geography, livelihood, family, etc.? Citizens of the Northern Peninsula organized in: • Families • Individuals that try to find innovative solutions and livelihoods • Local government (incorporated municipalities and unincorporated areas as well as Local Service Districts), for provision of services • Regional actors, to name a few: RED boards, Rural Development Associations, Rural Secretariat Regional Council, Northern Peninsula Regional Collaboration Pilot Initiative, Northern Peninsula Waste Management

		Service Board [NorPen], NORTIP Development Corporation, Viking Trail Tourism Association, SABRI Fishing companies are tied to the Peninsula through agreements for fish/shrimp/crab processing and royalties.
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) - Resource extraction: mainly fish, crustaceans, but also forestry and there used to be zinc mining (1975-1990) - Now increasingly: natural beauty and recreational space for tourism - Provision of food for households (game, fishing, fire wood) (7)	b) From society to nature – modifying nature, extracting resources (e.g. hunting, mining, water pollution) • Fishing (overfishing) of cod, other fish species, partially deep sea, crustaceans • Mining (more important in the past)
II.4. What are key interactions?	a) What are the key ecological interactions within the case? • Climate i.e. NAO circulation/circulation abnormalities that leads to reduces recruitment and growth of cod (1, 4, 5) • Predator/prey relationships between cod and shrimp (11) b) What are the most important biophysical tele-connections to distant systems?	c) What collaborations, conflicts, or other key linkages exist between actors? • People want cod fisheries to come back, but to be sustainable • Link between communities with allocated shrimp quotas and (external) harvesting companies bound by royalties and processing agreements • Collaboration between communities for diversification of livelihoods (though not enough)

	• Like above, climate i.e. north Atlantic circulation /circulation abnormalities	• Regional government groups at various levels that work together with communities to solve problems and develop alternative and diverse livelihoods • SABRI d) Between local actors and distant actors? • Federal government and policies, Quotas: communities, companies and individuals want higher quotas for fish (cod) and crustaceans, while researchers advise against it for sustainability reasons. Resource decline leads to loss off special allocation quota for shrimp in Newfoundland. Government acts sometimes on researchers' advice regarding quotas, and sometimes quotas exceed recommendations, which can threaten the future livelihood for communities (14) • Federal government trying to reduce costs for economically non-viable communities (i.e. cut off services and resettlement) • Japan and market demand influence the viability of the fishery-related industries in the Great Northern Peninsula/Newfoundland • Also, market demand influences the viability of forestry products, another key natural resource in Newfoundland/Great Northern Peninsula
II.5. Culture	a) How is the relationship between society and nature viewed? b) What meanings are attributed to nature and to interactions with nature?	c) What are key cultural features of relevance for the case? Natural resource extraction has always been the major reason for people to settle there. Natural resources are traditionally the core of community livelihood. To a large extent that is still true today for the Great Northern

		Peninsula/Newfoundland. d) What are key cultural practices and beliefs related to nature?
II.6. Disturbance What are important types of stress & shock	a) Describe important biophysical or ecological shocks and stresses (e.g. floods, storms, etc). • Overfishing of cod and now also of crustaceans • Changes in water circulation bringing colder waters	b) Describe important social shock and stresses (e.g. austerity policies, changes in government policy, introduction of new technologies, etc.) • Change from labor to capital intensive fisheries • Technical advancement of fishing equipment, bigger boats, etc. • Introduction of destructive fishing practices, like trawling • Cod moratorium • Sudden increase in unemployment • Increased dependency on governmental support • Outmigration of young adults • Reduction of human capital
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? • Warming of oceans: good for cod recruitment, bad for cold-water shrimps • Climate change leads to increased variability of NAO and hence water temperatures	b) What types of slow social processes (e.g. aging, population growth, loss of language) are driving important changes in social institutions and behaviours? • Aging population due to outmigration of young adults and reduced birthrates due to more women entering the workforce in non-fishing related areas. Economic downturn also discourages having more children • Reduction of human capital

II.8. Relationships with ecological regime shifts	a) Are ecological regime shifts driving further ecological change or pressure? b) Are external or internal ecological dynamics potentially or actually producing ecological regime shift(s)? • Climate change can influence dynamics of growth and recruitment for fish and crustaceans, as well as zooplankton, affecting other trophic levels (5)	c) Can social stresses or major changes be attributed to ecological regime shifts? • A change in human demand for fish/eating behavior/increased wealth created a demand for more cod and therefore intensification of fishing efforts which led to overexploitation • Technological changes: larger boats with bigger nets and more destructive fishing methods contributed to the depletion of cod stocks and possibly influenced the shift towards a crustacean-dominated regime • Allocations of shrimp and crab fishing quotas by the government • Mortality due to fishing: following the reopening of the fishery, removals exceeded surplus production; discarding, misreporting, poaching, and unreported catches; uncertainty about the level of bycatch in a number of domestic and foreign fisheries • Lack of control by Canada, and through NAFO, over abusive and destructive foreign fishing practices (overfishing, discarding, excessive bycatch, illegal, unregulated and unreported (IUU) fishing) • Poor strategic choices regarding conservation in an overall atmosphere of no long-term vision and strategy (for example, permitting harvesting in areas where cod were congregating to spawn) d) Are there specific social practices that might be contributing to ecological regime shifts? Intensive and destructive fishing practices led to the regime shift

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)? - The regime in the waters around the Northern Peninsula used to be groundfish-dominated with cod, halibut and sole, but the changes in water temperature due to changes in NAO/climate change, and to a lesser degree the removal of predator species, allowed for a steep increase in crustaceans, such as shrimps and snow crab, which led to this new crustacean-dominated regime 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) - If cod-fisheries were part of a regime on land, then there was a regime shift towards crustacean-fisheries, but different requirements for gear and boat size, as well as new licenses, meant that crustaceans could not be fished by the same people as cod previously. While cod is accessible to many even with small boats ("cod are a democratic fish" (7)), shrimp fishing could only be carried out by those who had already access to bigger boats or funds to buy appropriate gear and licenses. On land there were different winners and losers based on the regime-shift in the water. Capital was concentrated further and more unevenly distributed. New geographical advantages developed for some areas, due to access to rich invertebrate resources. Population in the Great Northern Peninsula has been on a constant decline since the collapse of the cod fisheries.	
II.8.b. Feedback mechanisms within the system that maintain each regime	Ecological feedback mechanisms - Change in water temperature creates more or less favorable conditions. Cold waters are favored by shrimp and snow crab, while warmer waters are better for cod recruitment and growth - In part, lack of predatory pressure due to the disappearance	Social feedback mechanisms • Market demands for crustaceans and fish keep the fisheries going • Subsidies • Quotas and policies that favor certain groups and people

	of cod stocks and other groundfish allows for an increase in crustacean populations - Possibly a growing population of seals is slowing the recovery of the cod stocks (11)	
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). • Market demands for cod and crustaceans • Policies and quotas for fishing cod and crustaceans • New fishing techniques and intensification • Climate change, and increased greenhouse gases, lead to a change in ocean temperatures and circulation patterns, which influence the biomass of species, and influence the balance between regimes and dominating species b) How do these changes alter biophysical feedback processes? • Climate change has been linked to a change in variability for the NAO and other circulation patterns that bring warmer or colder water, which has direct effects on biomass of cod and crustaceans • All of the above influence the biomass of species and the balance between regimes and dominating species	c) Drivers of social regime shifts (either social or ecological). • Cod-stock depletion • Rise in unemployment d) How do these changes alter the social feedback processes? • Depletion of cod stocks led to a shift towards crustacean fisheries, which was favorable for owners of larger ships and those with funds to invest in appropriate gear • Outmigration due to unemployment leads to loss in human capital, which affects the adaptability of the area • On the other hand, young people stay in school longer which has the ***potential*** to increase human capital and adaptability (7)

II.8.d. Ecosystem services substantially impacted by regime shift	a) Changes in ecological processes that produce ecosystem services The marine system is still providing biomass for harvest, but the majority is now crustaceans, and less groundfish.	b) Changes in demand for ecosystem services (market and non-market) There is a high demand for crustaceans from Japan, but worldwide shrimps have gained popularity (4, 7). 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. Different quotas were allocated to different parties for shrimp and crustacean fishing, compared to when cod was available for harvesting.
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 • (-) Loss of employment and dependency on governmental funds for many citizens • Need for formation of new groups of locals (e.g. SABRI) to best govern community-based quotas • (potential for + and -) Need to form new policies and distributions of quotas by the government • (-) Demographic changes: population got older due to outmigration of young adults • (+) More young people stay at school longer and get college education as becoming a fishermen is no longer an attractive option for many

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?	Ecological oriented interventions The moratorium is still in place for cod fishing and is maintained by the government, even though the stocks seem to have recovered slightly since the collapse. Quotas and management by the federal government based on accurate scientific knowledge can influence the dynamics of the marine ecosystem. Governmental control of unreported fishing. Fishermen can continue to use/develop fishing gear with less detrimental effect on non-targeted populations.	Socially oriented interventions • Resettlement has been carried out by the government for some communities in order to deal with dying villages • Subsidies by the federal government • Newfoundland in general: trying to attract immigrants and newcomers to the region

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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.