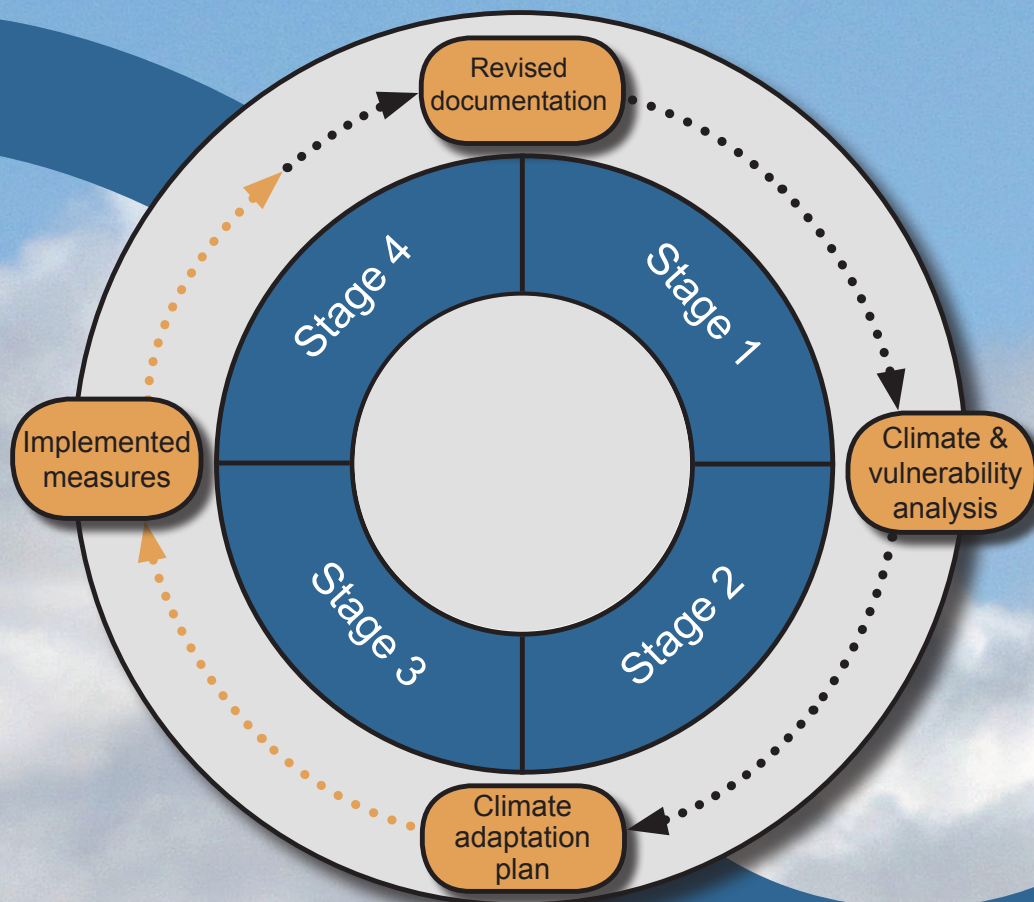


Structuring tools for municipal climate adaptation planning – process and impact analysis



..... Cross-administrative level
..... Administration level



County Administrative Board

Structuring tools for municipal climate adaptation planning – process and impact analysis

Tools are important to the planning and analysis work of municipalities when the impact of climate change on the community and environment need to be taken into account. The poster presents a **process tool** that addresses the complex nature of the climate change issue. The tool covers structuring, analysis, follow-up and evaluation in a constant process.

The tool manages **several decision levels** and **dimensions such as time and space**. Lengthy time frames, the entire geographical area of the municipality and the municipality's various goals and plans are considered. The tool supports the **holistic approach** that is necessary in order to make well-founded decisions that encourage good planning.

A politically anchored **climate strategy/policy** and clear **process responsibility** are key requirements for the results of the process. This means that an expression of intent must be obtained from the municipal management, and thus a mandate to pursue the issue is granted. Achieving a holistic approach requires a working group with broad and relevant skills. The level of detail of the work is selected according to the needs and resources of the municipality.

Time factor: The time period should be long enough to ensure that the entire lifespan of a value/system and the change in climate is apparent, and it should extend to at least the end of this century. The processes of change in the community and adaptation requirements must be included.

Geographical factor: In addition to the impact of climate on the municipality as far as it extends geographically, the impact outside the municipality must also be taken into account, along with the effects of measures both within and outside the municipality.

Examples of documents: Comprehensive plan, water and sewage plan, storm water strategy, green structure plan, policy for municipal infrastructure, risk and vulnerability analysis, nature conservation programme, and regional and national documentation.

The process comprises **four main stages**:

- 1: Specify and analyse vulnerabilities
- 2: Assess measures, costs and responsibility
- 3: Prioritise and implement measures
- 4: Follow up, evaluate and revise

In stage 1, understanding of various values/systems, their sensitivity and exposure to climate change, is developed. Based on the vulnerabilities identified, an assessment is made in stage 2 of whether measures are necessary to protect an area/value/system/object, what each measure costs and who is responsible. Stages 1 and 2 lead to a cross-administration **climate and vulnerability analysis** and **climate adaptation plan**. Concretisation and practical **implementation of measures** takes place in stage 3. Stage 4 involves the process being driven forward and plans being kept up to date.

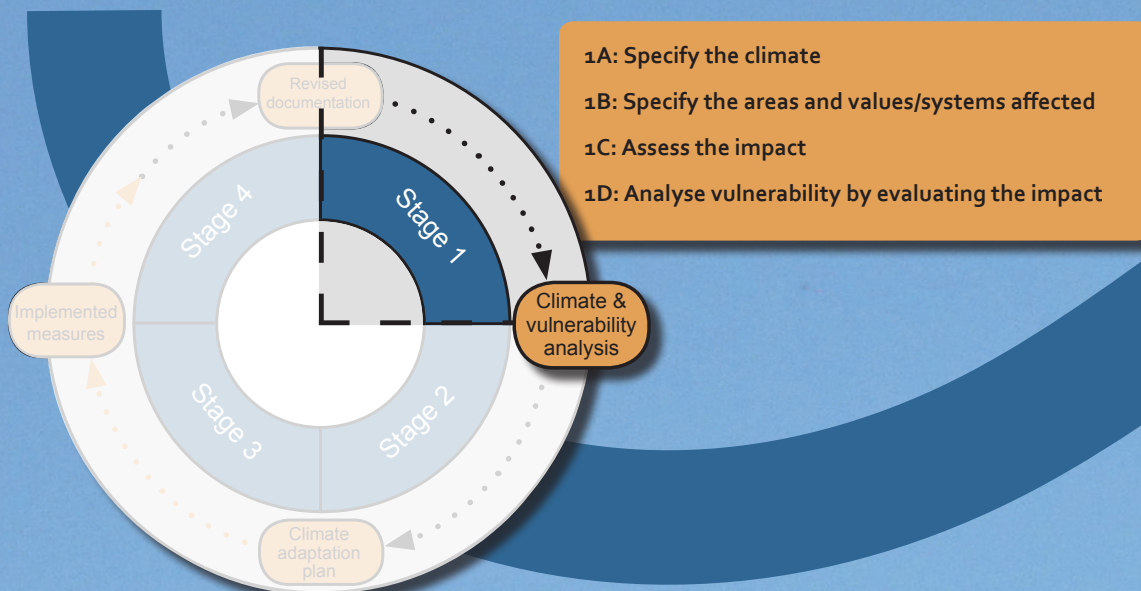
The stages are implemented at different levels. Stages 1 and 2 are managed at **cross-administrative level** in order to gain a crucial holistic perspective. Stage 3 takes place at **administration level**, along with follow-up and evaluation in stage 4. The revision links back to the cross-administrative level.

MORPHOLOGICAL ANALYSIS

Morphological analysis, MA, is an effective tool for problem structuring and analysis. It is used to create structure in complex contexts using parameters of various natures that interact in a manner that is difficult to grasp and in which there is often a large measure of uncertainty. Using MA, it is possible to effectively delimit, concretise and clarify problems.

Firstly, the most important perspectives of the problem, known as parameters, are identified. After that, the conditions relevant to each parameter are defined. This provides a delimited and concentrated picture of the problem. Below in stage 1, some examples of problem structuring are shown in the form of **MA matrixes with parameters and their conditions** for the three aspects of the impact analysis: Climate, Values/Systems and Impact. In this systematic and structuring way, the climate changes are analysed in their entirety in municipal operations, and plans are kept up to date.

Stage 1: Specify and analyse vulnerabilities



1A ANALYSIS QUESTIONS: How is the climate changing? Which climate factors are relevant? Which parameters are significant in terms of the various climate factors? Which conditions are important to each parameter and how may they vary?

The *Climate* MA matrix encompasses parameters and conditions that provide a general picture of the climate. It is important to not only consider extreme events. Many systems are sensitive to gradual, slow changes in climate. Use climate documentation that is as detailed as possible about your own municipality, together with information about events that have already occurred.

Climate MA matrix

CLIMATE FACTOR	INTENSITY	FREQUENCY	DURATION	TIME FRAME	SEASON
Temperature	Min. value	Annually	Minutes	2030	Month
Precipitation	Mean value	10-year	Hours	2050	Winter
Wind	Max. value	50-year	24 hours	2100	Spring
Flows	Specific limit values.....	100-year	Week/Weeks	.....	Summer
Sea level		.....	Year		Autumn
.....		

1B ANALYSIS QUESTIONS: What operations, key community functions, objects, natural and man-made values, population groups, etc. may be affected, now and in the future? What are these like? Where are they geographically? Which level of protection do they have? What are the land conditions? Which objects, functions and values are of central significance to the community?

The parameters system type and system level, including their conditions, are specific to each value/system. Other parameters and conditions are general and independent of the value/system. Below is an example of the *Drinking Water Supply System* and its system types and levels. The municipality has a large number of relevant documents such as system descriptions and studies, GIS documents, geotechnical documents, land use maps, and stability and flooding surveys.

Value/System MA matrix, Drinking Water Supply System

SYSTEM TYPE	SYSTEM LEVEL	GEOGRAPHICAL CONDITIONS	LIFE-SPAN	REDUNDANCY/RESILIANCE	DEVELOPMENT	DEPENDENCIES
Catchment area	Municipal/Regional association	Rural area	Short	Yes	Weak	Yes
Surface water source		Urban area	Average	Certain	Strong/short term	Certain
Ground water source	Municipality	Town/city	Long	No	Strong/long term	No
Protection zone	Community	Alp/mountain district			.....
Waterworks	Individual	Islands				
Water piping	.....	Proximity to sea				
Booster pump station		Proximity to lake/watercourse				
Water reservoir		Land conditions				
Water reserve		.....			
.....						

1C ANALYSIS QUESTIONS: What are the exposure and sensitivity of the various values/systems? What will be the impact on various areas and values/systems of different climate factors, given the other parameters of the climate matrix? How serious will this impact be? Does the impact only affect a value/system or does it create indirect effects? Does the ability to handle impact have significance for its severity?

In order to assess impacts, the parameters and conditions in the *Climate* and the *Value/System* MA matrices are weighed against each other and analysed. The Impact matrix is of a general nature. The redundancy (flexibility) and resilience (ability to recover/adapt) of the value/system has a bearing on the nature of the impact.

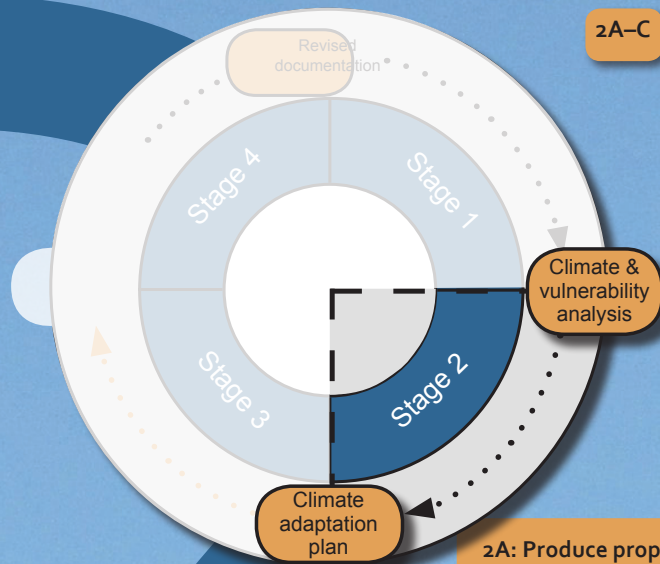
Impact MA matrix

SEVERITY	INFLUENCE	IMPACT VALUE	VALUE/SYSTEM AFFECTED
Scope	Direct	Positive	People/animals
Extent	Indirect	Negative	Infrastructure
Intensity	None	Neutral	Settlement
Duration		.....	Industries
.....			Natural environment
		

1D ANALYSIS QUESTIONS: Is the impact acceptable or not? What weight does the value/system hold in the community? To what extent does the community depend on the value/system? Is there inbuilt flexibility, can the value/system recover? Is the impact spread through several stages? Are there other vulnerabilities that may interact with the impacts and exacerbate them?

A qualitative assessment is made of the impacts in order to evaluate the vulnerability of the value/system. It is important that the climate and vulnerability analysis is documented, compiled and illustrated in e.g. maps.

Stage 2: Assess measures, costs and responsibility



2A–C

ANALYSIS QUESTIONS: In which areas is adaptation necessary? Which studies and vulnerability-reducing measures are necessary to protect the existing settlement, environment, values/systems and population groups? Which areas should not be developed? Which values/systems are relevant in which areas? Which studies and measures are required for new development? When do the measures need to be taken and what will they cost? Are urgent measures required or is gradual adaptation appropriate?

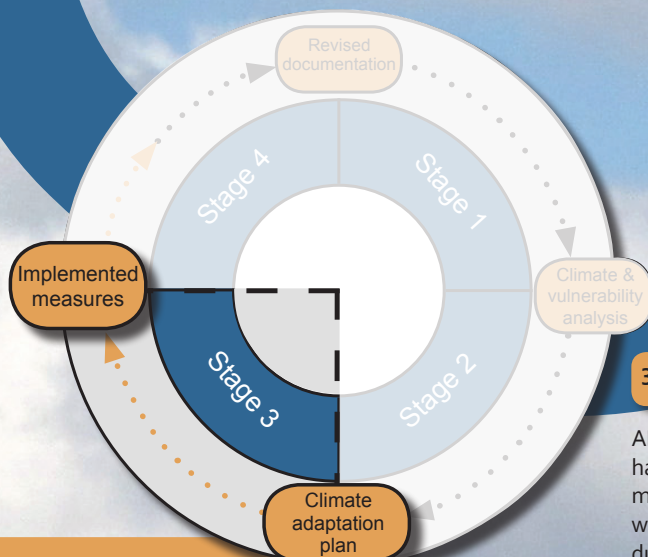
Consider the change in climate over time in relation to the lifespan and current status of the value/system. The cross-administration climate adaptation plan contains a list of measures indicating the function, administration, etc. responsible for each measure. Weigh in legislation, decisions on land use, and municipal goals, visions and strategies in the analysis.

2A: Produce proposals for adaptation measures and land use on the basis of the climate and vulnerability analysis

2B: Assess the costs of the measures

2C: Clarify relationships of responsibility

Stage 3: Prioritise and implement measures



3A–C

ANALYSIS QUESTIONS: What effects will the proposed measures have? What is their lifespan? Is it possible in legal terms to implement the measure? What will the measure cost and how much would it cost not to implement it? Damage may occur several times during the lifespan of a system and may have an indirect impact such as lost income, environmental impact and personal suffering. Are there conflicts of interest and goals? Possible synergies?

Prioritise among the measures based on safety levels, existing goals and strategies, legislation, previous decisions on land use, costs and time aspects. Benefits and synergies can be achieved if measures are coordinated or considered early on in the planning, e.g. when reviewing and upgrading plants, and when drafting and updating plans. Each function or administration etc. is responsible for detailed planning and implementation.

3A: Compare measures

3B: Prioritise measures and appoint persons responsible

3C: Implement measures

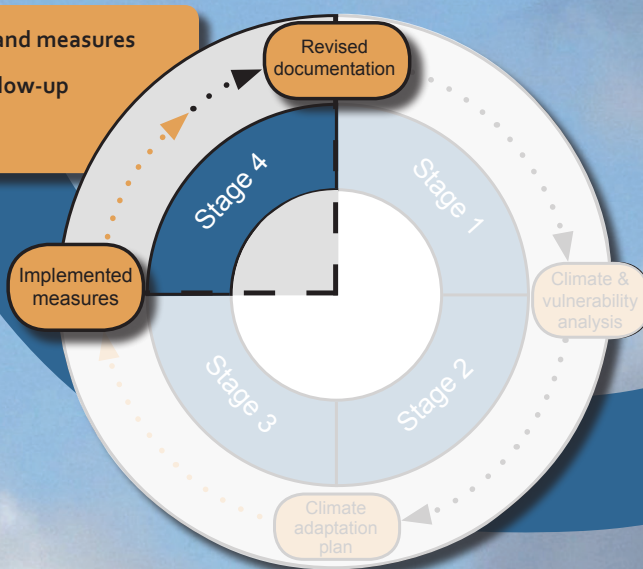
The nature of the problem area requires an iterative work method, as the conditions regarding climate and the various municipal values/systems change continuously. For example, each measure implemented means that impact and vulnerability are reduced. It is important that the work is transparent and that lessons are learned throughout the process. Clear, successive documentation is essential. The process cycle should be set before work is initiated and may vary depending on other municipal planning and vulnerability to various climate factors.

Stage 4: Follow up, evaluate and revise

4A: Follow up planning, projects and measures

4B: Evaluate the results of the follow-up

4C: Revise



4A–C

ANALYSIS QUESTIONS: Have the measures implemented given the desired results? Have conditions changed since the adaptation work was implemented? Has anything specific occurred in the municipality of relevance to the adaptation perspective? Has new knowledge emerged about changes in the climate and about measures, e.g. new technology? Has the impact decreased sufficiently or is there still unacceptable impact? Has undesirable impact arisen? How have the costs developed? Do measures need to be changed?

Update the climate and vulnerability analysis, climate adaptation plan and other strategic documents based on the follow-up and evaluation. Follow-up may take place, for example, on inspection and ahead of reviewing the municipality's comprehensive plan on each term of office. Through revision, documents are kept relevant and up to date.

Further reading:

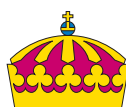


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