**Identifying adaptive capacity / adaptation measures for climatic changes (Exercise V)**

This exercise aims at identifying the factors and measures, which help adapt to the most significant climatic changes. The most critical climatic stressors and chances for Estonian TA are marked with red in the left most column.

| Climatic parameters and impacts | How significant the change of climate parameter or impact is for Estonian TA? | Likely direction of the change? How much / how often / for how long / where these stresses can occur? | Which activities and how the change of a climate parameter might influence? (approx. up to year 2050) | What might help adapt to changes and mitigate negative consequences? |
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| No of cold days and nights (below 0°) | Not significant? | Duration of cold periods has decreased, winters are warmer. Day and night minimum t° has increased more than maximum t°. According to the SMHI scenario no of days with minimum t° < 0° will decrease by up to 19 days per year until the end of century. Average annual t° is projected to change with around 5° towards the end of the century. The t° increase is unevenly spread over the seasons, winter temperatures are projected to change with around 7° and summer temperatures with around 3°. The increase in maximum t° is rather similar. Minimum t° increases the most in winter, with up to 8 C°, while the increase in summer is around 4°. | Decrease in heating expenses, winter sports. Negative impact on winter tourism. Risk of night frosts decreases. | |
| Heat waves (Days with t° > 30°. Criterion of hazard is t° > 33° and very high hazard when 33° remains for 5 days and longer). | Not significant | No significant heat waves in Estonia | | |
| Day and night temperature fluctuations around 0° | Significant impact? | In the SMHI climate scenario until the year 2100, the number of days with t° max > 0° and t° min < 0° will decrease by up to 10 days per year. | Increasing frequency in short-term can have negative impact on transport (frequent freeze and thaw degrade roads, glazed ice increases risk for traffic accidents), on agriculture (soil | Stricter requirements for road construction (make road building more expensive). Growing suitable crops which tolerate t° fluctuations around 0°. Increasing proportion of |

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| | | | structure deteriorates and nutrient loss increases), on health (spread of infectious agents) etc. | permanent grasslands? |
| Total precipitation/rainfall | Significant impact | Total precipitation has increased, especially in winter as rain and sleet. Rains much at a time.<br>In the SMHI scenario the average annual precipitation increases with around 20%. | Negative impact on roads, pipes, tourism, winter crops. | More attention to maintenance of storm water sewage systems and using water-permeable ground coverings, stricter regulations for road construction, developing conference tourism. |
| Periods with heavy precipitation | Significant impact if the periods last several days and frequency is increasing | According to the SMHI scenario wintertime precipitation is projected to increase with up to around 80%, while summer precipitation is projected to decrease with around 10%. Maximum wintertime precipitation is projected to increase with 100-160% in the end of the century and increase in variability. Spring and autumn maximum precipitation is projected to increase with around 40% while summer maximum precipitation remains almost unchanged. | Negative impact on roads, pipes. | |
| Storms (wind) | Significant impact | Models show that frequency is increasing. Warmer winters may cause stronger winds and more frequent strong winds.<br>In the SMHI scenario the changes in wind speed are projected to be small, less than 1m/s. | Power outages, forest breaks, negative impact on agriculture (decrease in productivity), on cycle paths.<br>Stronger winds more favourable for wind energy production. | Timely maintenance of power line corridors. Reducing energy consumption need (smaller power line corridors require less land and maintenance costs).<br>More attention to maintenance of storm water sewage systems in densely populated areas.<br>Using rainfall-filtering covers on houses (green roofs, gravel roofs) and on roads.<br>Growing mixed forests (spruce forests are vulnerable to storms due to shallow root system). |

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| | | | | Increasing usage of wood chips as energy source – after forest breaks Growing lodging resistance crop varieties. Planting trees/bushes at the cycle paths. |
| Cloudiness | Significant, but few data yet | According to SMHI scenarios up to year 2100, sunshine hours per day will slightly decrease (by about 40 minutes), mostly in spring. | If cloudiness increases, then negative impact on energy management, building of passive houses, psychological impact on health. | |
| Snow cover duration | Significant impact | No of days with snow cover is decreasing. Snow cover is projected to decrease in all seasons and the variability between years will decrease. From around year 2050 there will be years with no snow at all during spring or autumn. | Negative impact on agriculture – risk for droughts in spring. Extreme winter colds without snow cause deeper freezing of land – crop productivity decreases. Impact on transport (more cycling and private transport than in winters with heavy snow). Maintenance of roads and streets in winter is cheaper. Negative impact on winter sport centres. | Increasing proportion of growing summer crops. Developing and growing crops resistant to lack of snow cover and spring dryness. Environmentally friendly farming and land cultivation are important (in using fertilisers, pesticides, keeping buffer zones at field margins, etc.). |
| Ice cover extent | Significant impact in sea | Decreasing trend in ice cover on the Baltic Sea. | If ice cover is less, spring will be earlier and warmer – impact on agriculture. | |
| Beginning of spring events | Significant impact | Has shifted to an earlier time. Snow melts earlier. | Impact on transport, energy management – shorter heating periods | Review of business plans of thermal power stations (increase in heat energy should not be expected). Heat pumps can be effectively used longer. |
| Spring peak discharge | Not very significant impact | Has shifted to an earlier time, the amount of water has decreased due to few snow in recent winters. | If it is earlier or no high water at all – risk for spring droughts is higher – impact on agriculture. | |

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| | | | Positive impact of less spring discharge can be on transport – floods do not overwhelm culverts – the risk for it, however, is not big in Estonia. | |
| Modification of water regime (incl. warming of lakes and rivers) | Impacts due to climate change likely not significant | There are not many water bodies in the TA. | Impact on eutrophication is not big, on recreation – no evidence. | |
| Droughts | Significant impact in spring | More droughts in spring. Frequency of thunder has not changed. | Impact on agriculture – if duration of snow cover decreases, the risk for droughts increases. | |
| Floods | Significant impact locally, but not for TA as a whole | Locally years with heavy snow might have impact on spring flooding. Floods also caused by storms. | Risk in densely populated areas where most of the ground is impermeable. | |
| Length of vegetation period | Neutral impact? | Springs are earlier, autumns more late. In the SMHI scenario the vegetation period will grow by up to 100 days until the year 2100. | Impact on forestry and agriculture – more winter crops, southern crops can be grown. | |
| Crop productivity | Neutral impact | In warmer and more humid climate, productivity will grow. | Increased production of biomass from agriculture, forestry – impact on biomass energy production. | |
| Forest fires -> landscape fires (forest, bog, grass) | Significant impact | Risk is increasing due to more frequent droughts | Impact on forest management, etc. | Creating fire protection zones in forests.<br>Building capacity for preventing and fighting of fires.<br>Raising awareness on land use methods (prevention of grass fires in spring).<br>Improving fire monitoring.<br>Creating and maintaining of firewater supply places.<br>Supporting and training voluntary fire fighters, involving young people.<br>Identifying risk areas in |

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| | | | | municipality comprehensive plans.<br>Indirect measure – increasing excise duty on tobacco. |
| Shifts in distribution of animal, plant and pest species, changes in abundance of populations | Not enough evidence | Some plant pest species have shifted to north. | Impact can be on agriculture, forest management, hunting, fishing: e.g. plant pest species shift northward, more frequent forest fungus diseases and tick-borne infections of roe deers, shifts in life-cycles of migratory birds and species they feed on, shifts in dynamic balance of predators and prey species.<br>Increase in wild boar abundance – impact on agriculture, roads | |
| Changes in allergic pollen (distribution) | Not enough evidence | Distribution might be affected by atmospheric humidity. | Impact can be on agriculture, health. | |
| Vectors of infectious diseases (distribution) | No firm evidence | Distribution area of ticks is determined by the frequency of cold winters. | Infections of Lyme disease (tick borrelia) have increased.<br>Risk for mosquito-borne malaria if warm winters become more frequent. | |
| Ground instability – landslides | Not significant | More instable in SW Estonia | | |
| Coastal erosion | Not significant | Increases in coastal areas | | |
| Coastal flooding | Not significant | In certain areas | | |
| Loss of coastal wetlands | Not significant | | | |
| Sea level rise | Not significant | | | |