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Scenarios for Denmarks future land use

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Abstract

Denmark's scarce land area must accommodate cities and infrastructure, agriculture and forestry, nature, and all the other activities and interests associated with land use. At the same time, land use is critical for meeting Denmark's objectives for climate, water environment, and biodiversity, among others. These are objectives are either subject to national policies or following from EU-directives or global treaties. In this study the Danish Council on Climate Change examines how Denmark can most effectively meet objectives on climate, aquatic environment and biodiversity. The objectives are closely connected with land use in agriculture and forestry. We apply a spatial differentiated social planner model for investigating various scenarios comprising goals for climate, aquatic environment and biodiversity. The model selects from a range of different measures, such as establishment of catch crops, afforestation on agricultural land, set aside of carbon rich soils, and transforming production forest into untouched forest. Hereby various objectives can be met under the condition of cost minimization. The scenarios are described in table 1.

Table 1 Scenarios in the study

Scenario		Description
Climate scenario		Obtaining net zero GHG emissions from the areas
Climate and aquatic environment scenario		Net zero GHG emissions and fulfilment of the EU Water Framework Directive along with national goals for afforestation and untouched forest
Biodiversity and aquatic environment scenario		Biodiversity and aquatic environment objectives along with goals for afforestation and untouched forest

Note1: Afforestation and untouched forest are included in both the climate and aquatic environment scenario and the biodiversity and aquatic environment scenario as objectives.

Note 2: The objective of improving biodiversity is based on EU's biodiversity strategy regarding a 30 percent protection of the area. We rely on an outline from the Danish Biodiversity Council is used to address how the goal can be met on Danish land.

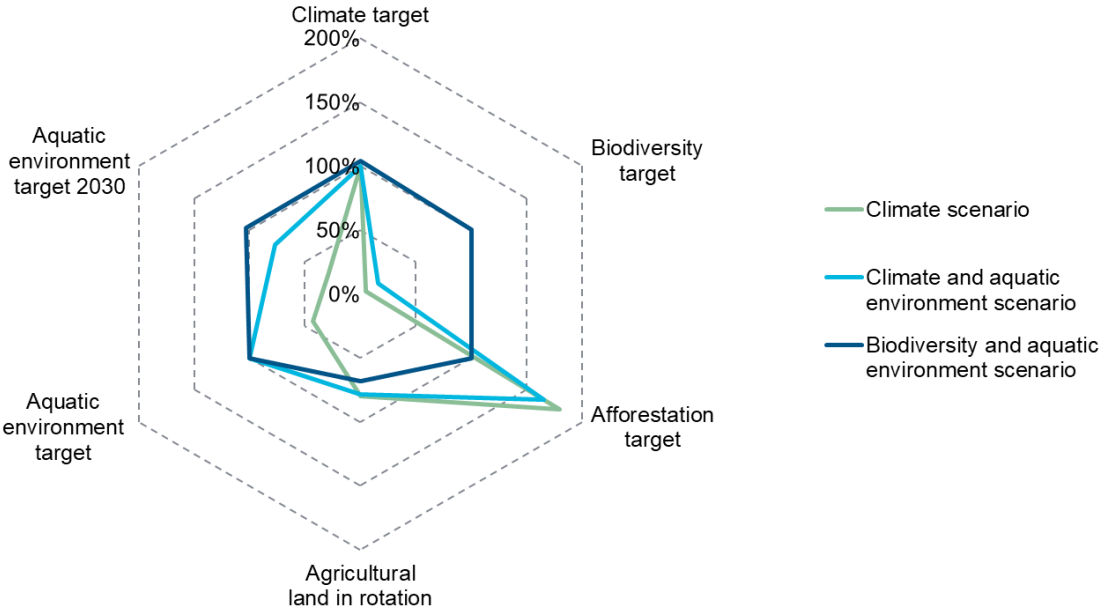
Source: The DCCC

The main findings show that policies targeted to improve the aquatic environment and increase areas designated for biodiversity will also result in significant reductions in GHG emissions. On the other hand, a dedicated focus on climate only, do not automatically deliver benefits for the aquatic environment and biodiversity. This is because of the site-specific dependency of the effect's on aquatic environment and biodiversity, whereas effects on GHG emissions of land use changes is less dependent on the location.

The costs of the scenario increase with the number of policy goals. Especially the biodiversity and aquatic environment scenario lead to higher costs than the other scenarios. Thus, the annual costs increase from 0.7 mill. DKK to 2.7 mill. DKK from the climate scenario to biodiversity and aquatic environment. This is mainly due to a reduction of the area used for agricultural production by approximately one-third, and designation of more untouched forests.

The scenarios are compares in figure 1, relative to their contribution to the different goals and the reallocation of agricultural land.

Figure 1: The three scenarios in the study compared across different objectives



Note 1: Agricultural land in rotation shows how much area can be used for production compared to today's land use.

The main conclusion from the study are, that if the objectives concerning the aquatic environment and biodiversity are to be met, geographically targeting of area measures are required. Such targeting should be based on the designation of areas where there are specific considerations for the aquatic environment, biodiversity, and similar geographically dependent concerns as drinking water protection. Meeting these targets will also lead to substantial GHG reductions. This require efficient and coordinated planning, involving appointment of arear designated for biodiversity purposes.