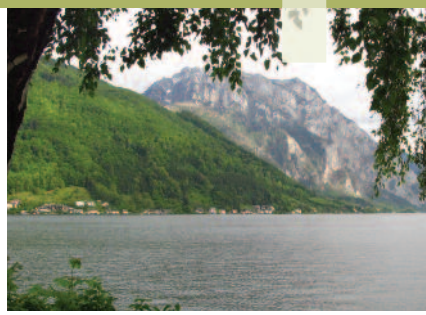
Pilot Study 1



Orientgate

Adapted forest management in Austria

SOUTH EAST EUROPE
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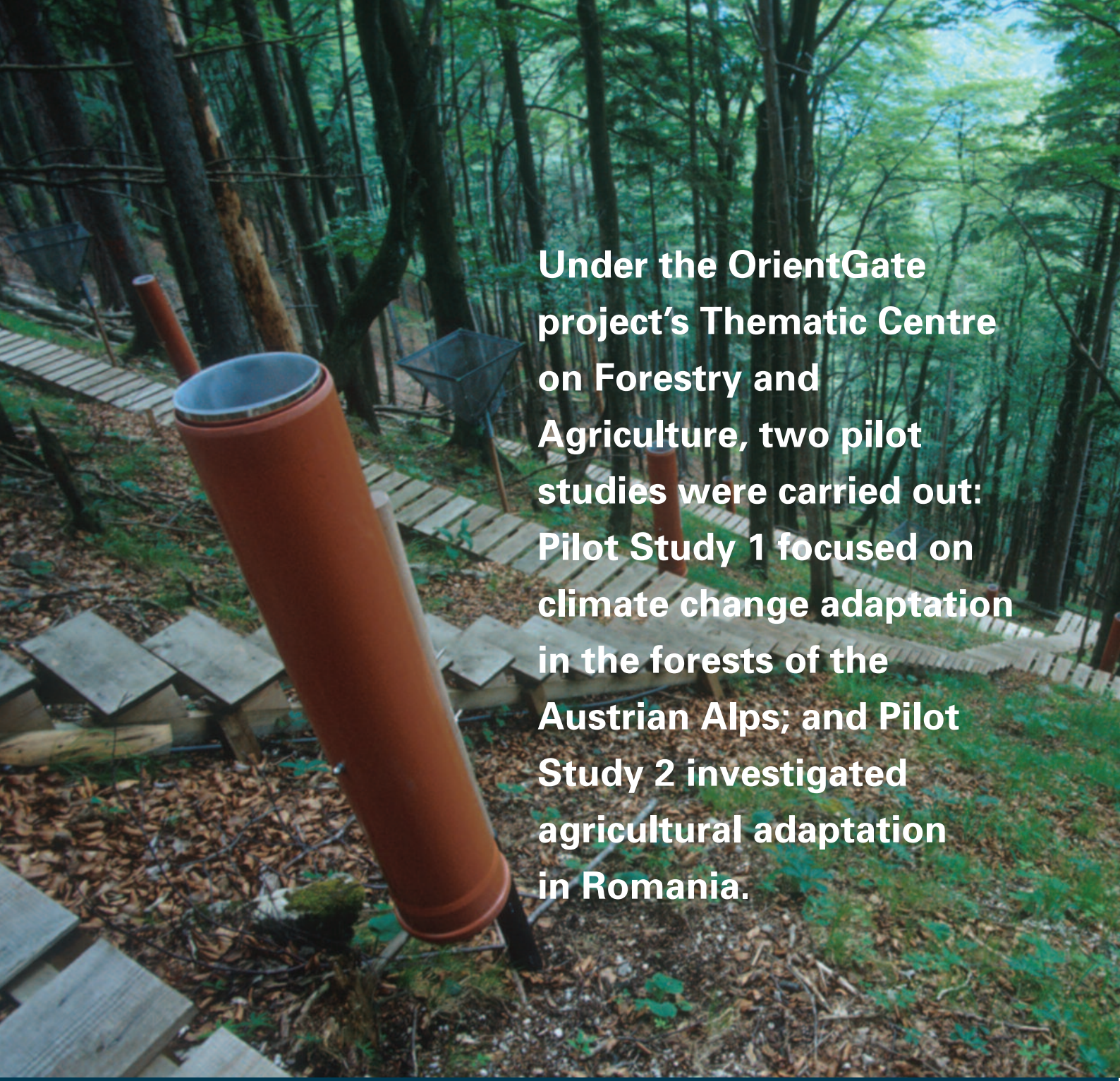


Under the OrientGate project's Thematic Centre on Forestry and Agriculture, two pilot studies were carried out: Pilot Study 1 focused on climate change adaptation in the forests of the Austrian Alps; and Pilot Study 2 investigated agricultural adaptation in Romania.

Modelling study

Peak nitrate concentrations in the leachate during clear-cutting and thinning increased under all scenarios. During understorey reinitiation in the clear-cutting and shelterwood systems, nitrate leaching was also greater compared to the current climate. This is due to retarded understorey development as a consequence of increased water stress in summer and nutrient deficiency. Nitrogen is taken up by trees less efficiently, transpiration is lower, and higher infiltration enhances the transportation of nitrates below the rooting zone and subsequently into the groundwater. At the altitude of the study area (950 metres above sea level), a warmer climate will be beneficial for the growth of Norway spruce. This enhanced growth under the climate scenarios may even outweigh the stem wood biomass accumulation under the current climate and, as a result, nitrate loads in the groundwater may be lower in mature forests.

Setting the scene

The Northern Limestone Alps are characterised by shallow soils that are vulnerable to nutrient loss and erosion once forest cover is damaged. Many settlements in the region are supplied with high-quality drinking water from forested headwaters, thus forest functions such as water retention and the filtering of pollutants must be maintained. The Federal Environment Agency runs LTER Zöbelboden, a long-term ecosystem research site in the Kalkalpen National Park. The site is representative of the major forest types of the Northern Limestone Alps, in particular mixed spruce-fir-beech forests. At the heart of pilot study 1 was the development of model-based scenarios of climate change impacts on the amount and quality of water runoff. Scenario results were discussed with local authorities, forest managers and policy makers, and optimal adaptation strategies for forest management were defined.

Joining forces

The Forest Service of Upper Austria is responsible for forest management in the province, while local foresters implement management plans at local level. Both parties were involved in model building, defining concrete forest management scenarios, and checking the plausibility of model results. Jointly prepared training courses in the pilot area offered forest practitioners an opportunity to discuss climate change adaptation options. As the focus was on forest–water relations, experts and local authorities involved in the water sector also participated in the discussions. Further outreach took place through an international workshop.

Facts and findings

Since the 19th century, temperatures in the European Alps have risen by almost 2°C. In the study area, a further increase of between 2 and 5°C is predicted by 2100, with the biggest rise in the summer. An

increase in winter precipitation of up to 20 percent is predicted, along with a similar decrease in summer precipitation (the latter subject to greater uncertainty).

Norway spruce is the most abundant tree species in Austria but is also the most vulnerable to rises in temperature. Many forest sites at lower to middle altitudes will become unsuitable for Norway spruce in the future. Even today, the homogeneous spruce plantations created at natural beech forest sites can be considered highly vulnerable and unstable. At higher altitudes, however, the growth of Norway spruce may even be stimulated. All spruce forests are at risk from an increase in bark beetle infestations: probably driven by climate warming, such infestations cause damage to forest ecosystem functions over large areas, and reduce the incomes of forest owners.

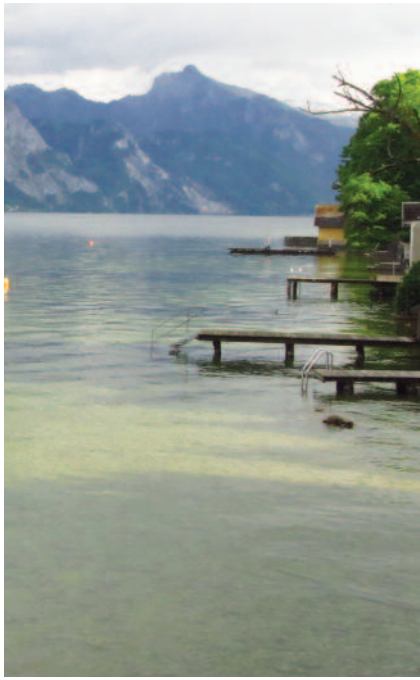
Managing impacts

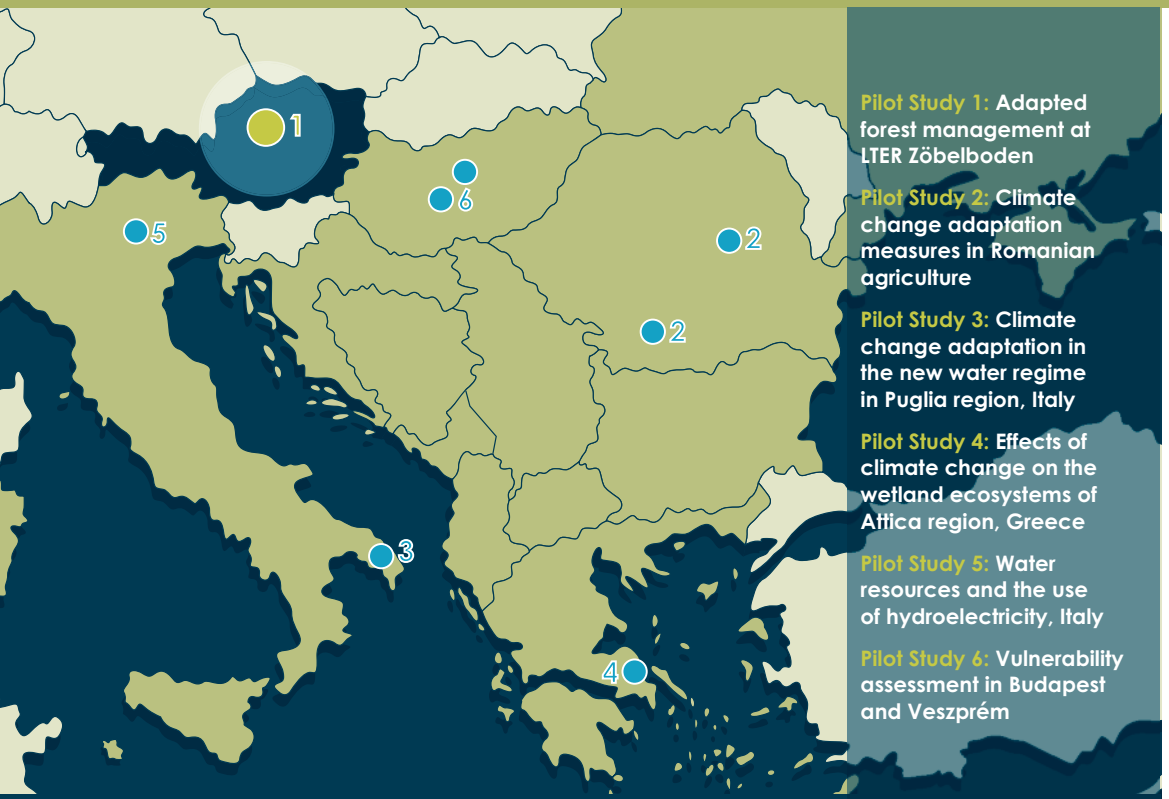
Forest management has various impacts on water quality. The prevalent approach to Norway spruce management has led to even-aged, homogeneous forests that are less resilient than mixed conifer-deciduous forests and therefore subject to greater and more frequent disturbance. Norway spruce forests are typically managed using clear-cuts or shelterwood cutting, which potentially causes the contamination of water sources. With respect to nitrates, and probably also turbidity, the expected impacts of climate change will enhance the negative effects of management interventions on water quality. An appropriate management option for optimising water protection, which is particularly important in protected areas, is therefore the creation of mixed forest stands that include a wider range of naturally occurring tree species, along with the establishment of a continuous cover forest management system. These two goals are part of the overall best practice catalogue for forest management in drinking water protected areas. Particularly in the light of the expected impacts of climate change on forests, the introduction of such a management system is recommended.

Putting results into practice

To protect and guarantee the provision of freshwater supply for future generations under climate change conditions, several improvements in forest management and relevant policies and strategies are necessary. These include:

- The elaboration of suitable forest management plans for each water protected area and conservation zone.
- The development and implementation of the new subsidy programme "Forests for Water", within the framework of the EU's Rural Development Policy 2014-2020, by the Federal Ministry of Agriculture, Forestry, Environment and Water Management to improve the impacts of forests on the water regime and to clean up ditches and riverside forests taking into account scientific findings and recommendations and various EU strategies and legislation.
- The promotion of further research programmes to obtain greater knowledge about the future impacts of climate change and the necessary adaptation measures for the sustainable protection of drinking water resources.
- The inclusion of specific binding legislation exclusively on drinking water protected areas within the Austrian Federal Forest Act.
- The evaluation of existing water protection zones and the elaboration of an action plan for improvements.
- Greater consideration of important drinking water bodies within spatial planning instruments.
- The continuous and punctual implementation of existing climate change adaptation and mitigation policies and strategies.
- The raising of awareness among relevant actors of the impacts of forest management on water quality and quantity.





Pilot Study 1: Adapted forest management at LTER Zöbelboden

Pilot Study 2: Climate change adaptation measures in Romanian agriculture

Pilot Study 3: Climate change adaptation in the new water regime in Puglia region, Italy

Pilot Study 4: Effects of climate change on the wetland ecosystems of Attica region, Greece

Pilot Study 5: Water resources and the use of hydroelectricity, Italy

Pilot Study 6: Vulnerability assessment in Budapest and Veszprém

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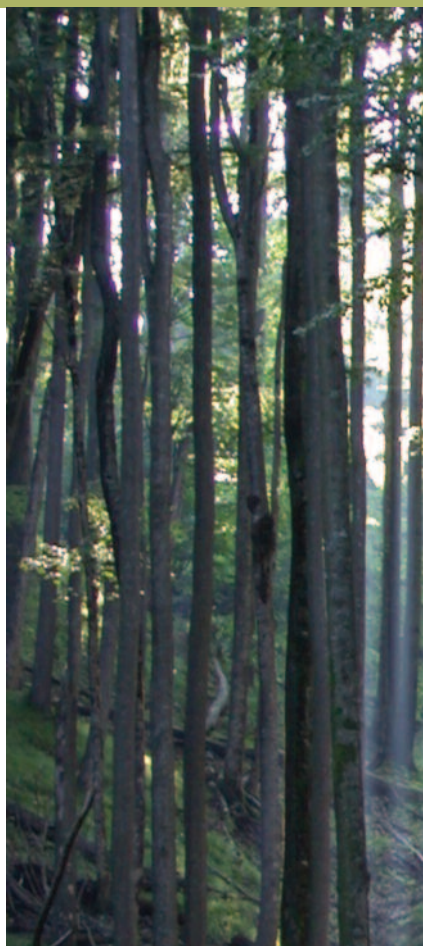

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