Holding the balance in the Alps:
Can we meet the bioenergy target while preserving ecosystems services?

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1. Scenarios
The trade-offs for renewable energy production with other ecosystems services are identified and assessed. In this case study, the focus is on one key ecosystems service: carbon sequestration. Two scenarios are created by variations in the rotation time and forest management.

<table>
<thead>
<tr>
<th>Carbon Sequestration (S1)</th>
<th>Biomass Production (S2)</th>
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<tbody>
<tr>
<td>Increased forest rotation period</td>
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<tr>
<td>A rotation period is selected that leads to maximum storage of carbon in forest. (Otherwise, damage through ageing trees gets too high).</td>
<td>A rotation period is selected that maximizes forest growth: high availability of biomass for energy generation.</td>
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2. Mapping Trade-Offs
Figure 1. Carbon stock that can be sequestered in the Alpine region for scenario S1 (left) and scenario S2 (right): double the amount of harvesting potential is available under S2 (23 MtC/a) compared to S1 (11 MtC/a), but the carbon stock under S1 is almost double compared to S2. For both scenarios, sustainable forest management practices and no forest degradation, deforestation and afforestation are assumed.

Figure 2. BeWhere model (optimizing bioenergy plant locations) results: for the same production of combined heat and power, scenario S1 (left) indicates that sequestration requires a much more “diffused” harvesting pattern at lower intensity rates and scenario S2 (right) will lead to intensification.

3. Conclusions
- Both scenarios indicate a high sustainable and economic potential of bioenergy production in the Alps.
- Similar energy demand can be met under both scenarios. However, sequestration maximization does not allow for lower-cost, high-intensity harvesting practices.
- The pros and cons of bioenergy production have to be weighed against each other in an integrated and systematic manner while considering trade-offs with ecosystem services such as carbon sequestration.

4. Work in Progress
- A ranking of ecosystem services will be developed based on interviews with experts.
- The bio-energy potential in the Alpine region will be analyzed for a series of scenarios progressively excluding these ranks of ecosystem services.
- Extension to other renewable energy resources (wind, hydro, solar).