UNIVERSITÀ DEGLI STUDI DI MILANO

REMAINS – Simulation of Landscape changes and Wildfire dynamics under different Land Use Scenarios

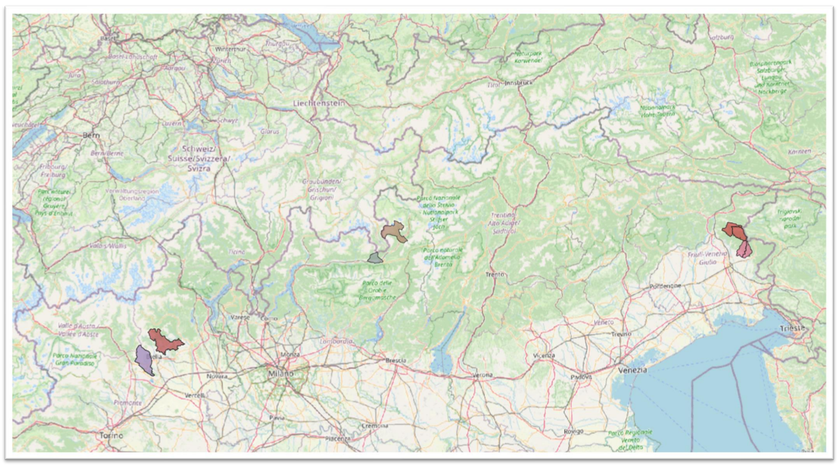
Sophia Djacenko, Giorgio Vacchiano

Achieving net-zero greenhouse gas emissions by 2050 requires effective carbon dioxide removal (CDR) strategies. In the Alpine region, **rewilding** through **natural reforestation** and **proforestation** is a promising approach to enhance carbon sinks. However, these strategies also increase wildfire risks, which could lead to carbon losses. The **REWILD-FIRE project uses the REMAINS model (Pais et, al. 2023) to assess the trade-offs between forest growth and wildfire risks under different land-use scenarios driven by policy and climate change**.

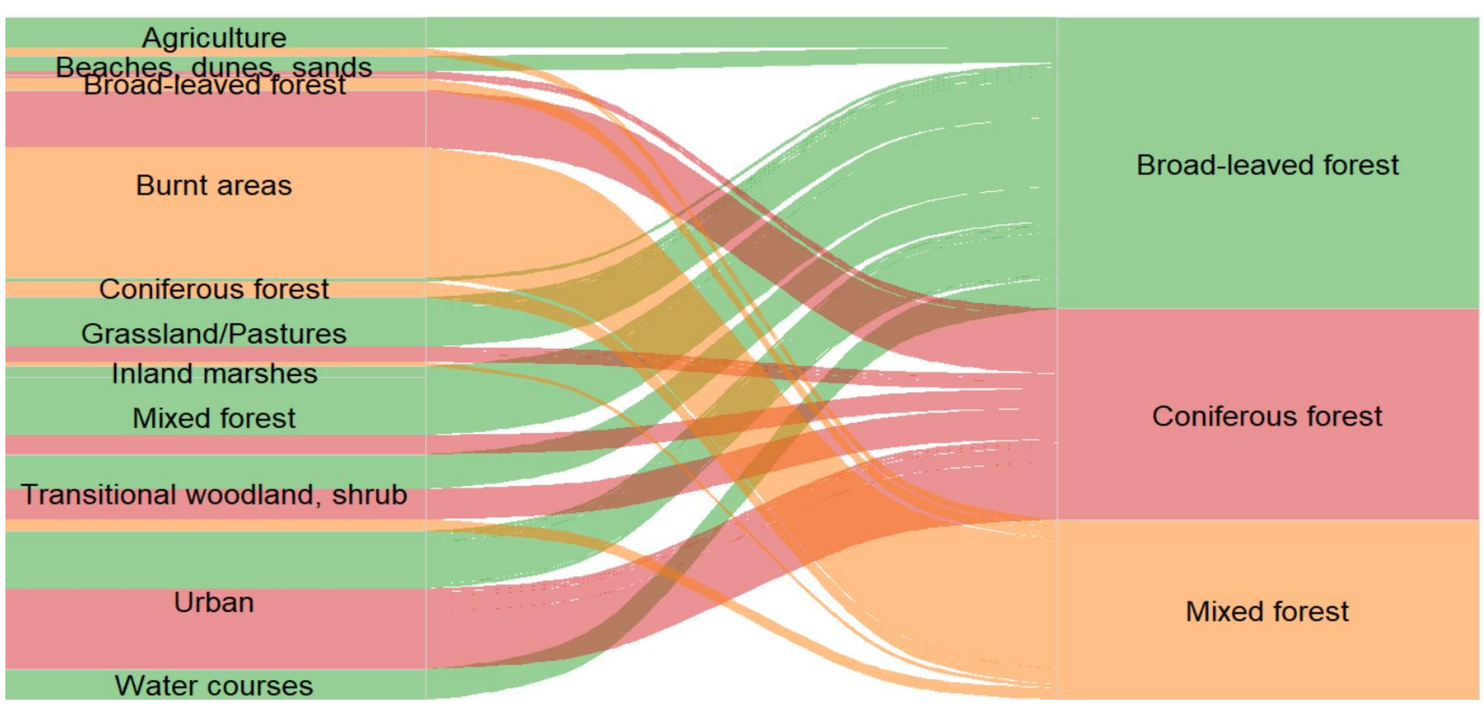
Research Questions

1. How will the landcover evolve under different scenarios
2. How do different scenarios and management options impact fire regimes
3. What are optimal policies for forest growth and carbon storage

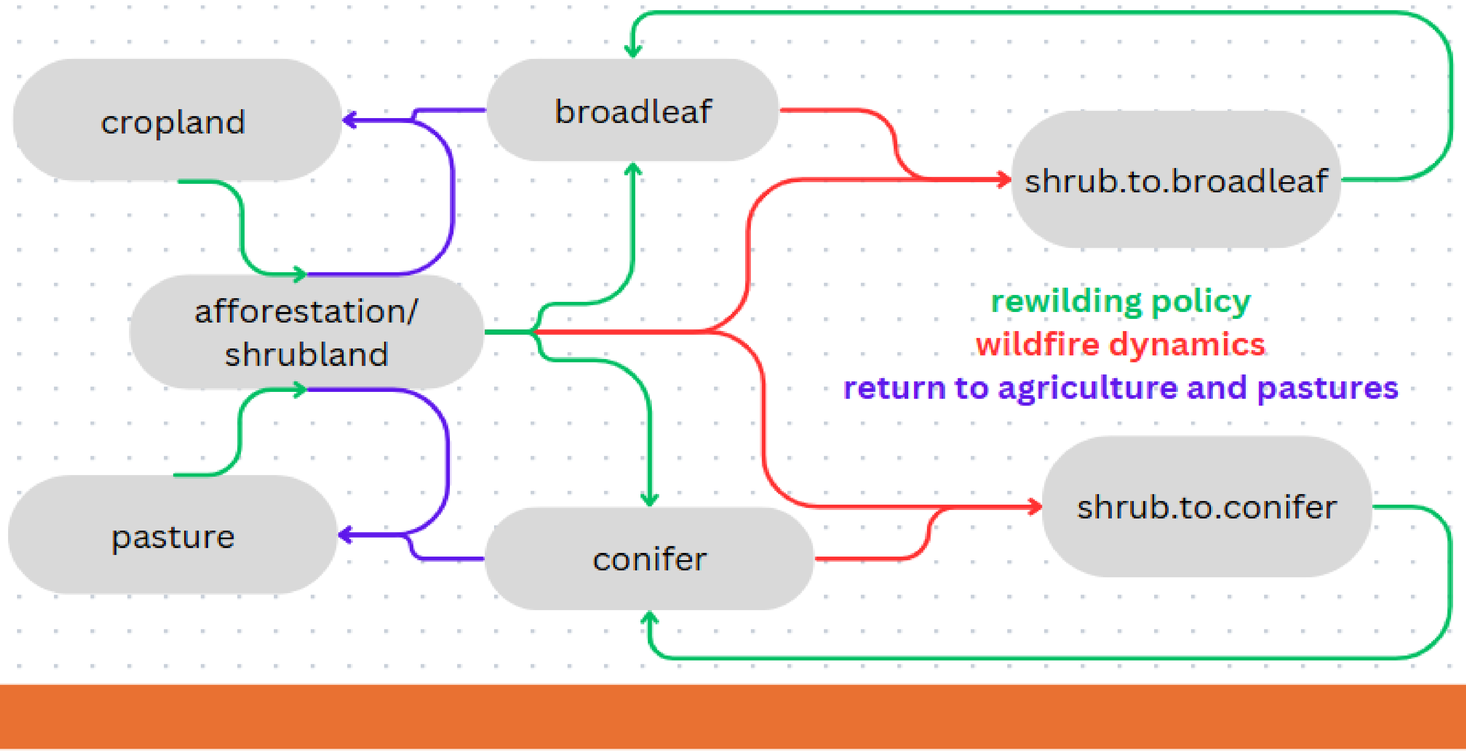
Landscapes: Biella, Valtellina, Faedis



Main landcover types which transitioned into Forest across the alps from 1990 -2018 using the Corine Land Cover types. Analysed to understand the past transitions to create baselines for future transition probabilities.



Land Cover Change scenarios for which demand will be given for different land cover types to transition per timestep of simulation



Modelling framework

REMAINS is a spatially explicit, semi stochastic, process-based model implemented as an R package. It integrates key processes, including fire ignition, spread, suppression, vegetation dynamics, and land-use changes.

Parametrization

- land cover types
- transition probabilities
- local wildfire extension and frequency per size class
- flammability of different land cover types
- forest recovery and post fire regeneration
- seed dispersal radius
- constraints for different land cover types based on topography

Input data

- Land Cover classes and time since last transition
- Topographic information → aspect, slope, elevation, road density, protected areas
- Wildfire information
- Land cover demand per time step for different scenarios

Time frame and spatial resolution

- Yearly timesteps for 30 years' time horizon
- Spatial resolution of 100 m2 grid cells , ca. 250,000 ha total area can be modelled

Land cover demand is projected by considering e.g. urbanization, agricultural expansion, and conservation efforts, allowing for predictions in response to different pressures.

Results

- Final landscape configuration
- Age distribution of forest types over time
- Burned and unburned forest type
- Shrub expansion, forest recovery, afforestation
- Forest age burned and forest age suppressed

Based on hectare and forest age allows to calculate carbon stored and emitted

FORESTE PER IL FUTURO
XIV Congresso Nazionale SISEF
Padova, 9-12 Settembre 2024

REWILD FIRE

Università degli Studi di Milano
Dip. Scienze Agrarie e Ambientali
Via Celoria 2, 20133 Milano
sophia.djacenko@unimi.it