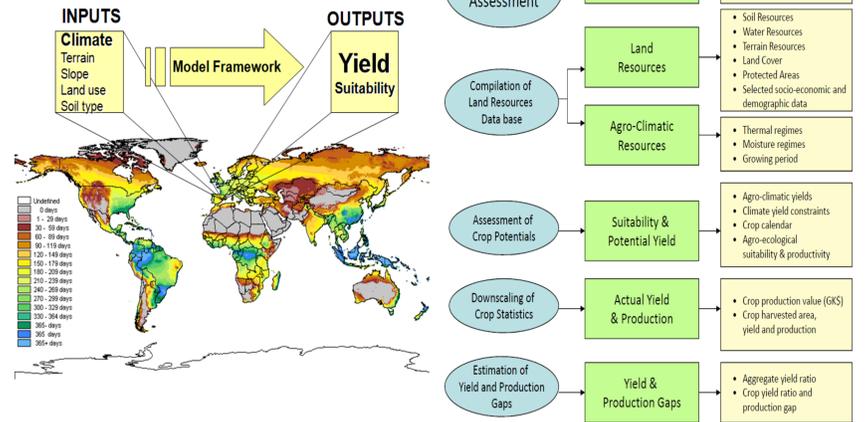


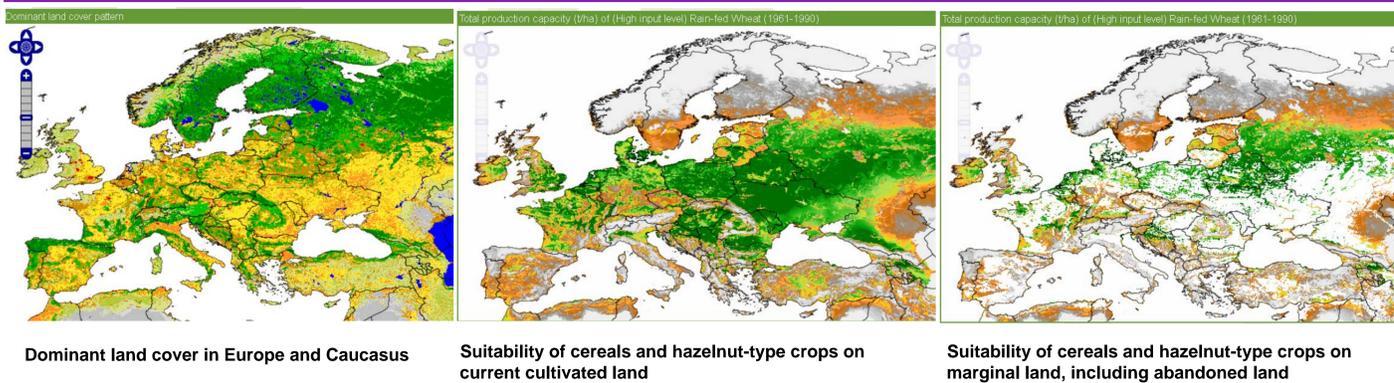
Climate change mitigation, adaptation, food production, scarcity of land

- The Food and Agriculture Organization predicts a **34% increase in the world's population** from 2010 to 2050 with a corresponding growth in consumption patterns, expected to result in a **60% increase in food demand**. While yield increases are important to satisfy this demand, preserving high-quality land and regaining abandoned land by the combination of forestry and agriculture provide further possibilities for sustainable resource management.
- IIASA's **GAEZ** framework can be applied to assess agricultural quality of abandoned agricultural lands. In collaboration with Ferrero and its pilot **Payment for Ecosystem Services hazelnut plantation** project we argue that production on such land can be economically viable and technologically sound, land degradation can be reversed, while preserving carbon pools, enhancing biodiversity and simultaneously **producing food, feed, fuel and fiber**.
- As demonstrated by our case study, linking forest plantations with increased production of food on human-induced degraded landscapes can effectively contribute to combating climate change while triggering significant **environmental and socio-economic co-benefits**.

The Global Agro-ecological Zones (GAEZ) methodology:

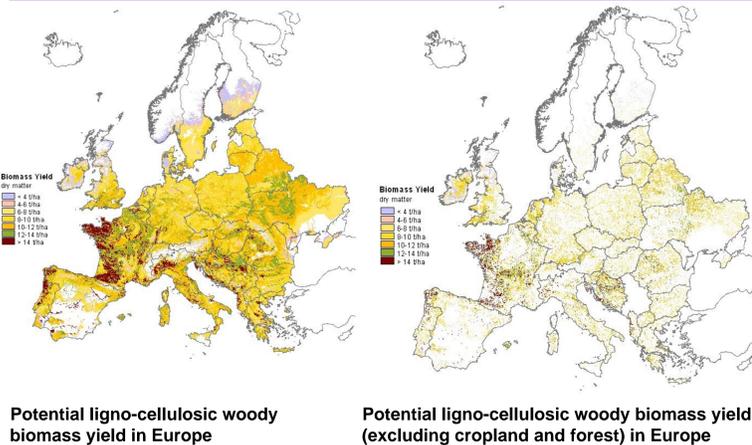


GAEZ results: abandoned and secondary land can be used for non-food biomass production



- Half of global cropland is used for food, one third for feed production, 8% for industrial uses and 7% of land are for seed production and statistical crop losses. (Source: IIASA Landflow analysis)
- Abandoned lands** are often low quality or degrading but **suitable for forest plantations** or the production of specific food and non-food low-input crops;
- Research shows that marginal and abandoned land would be suitable for fiber and **biofuel production** (IIASA-OFID Biofuel and Food security)

Forestry combined with agriculture on abandoned land can improve the resource base



- Forest plantations producing cash-crop create **permanent land cover** and replenish soil vegetative stocks.

- At the global level more than half of deforestation associated with agricultural products concerns the livestock sector dominated by pasture expansion for ruminant livestock production.
- Agroforestry and **inter-cropping** of trees and crops helps reduce the use of herbicides and fertilizers;
- Afforestation with **fruit and nut plantations** goes beyond inter-cropping and offers further **co-benefits** in sustainable land-use practices.
- Nut trees are suitable for **afforestation** and in general have low to moderate agro-ecological requirements but high tolerance to cold or heat stress;
- Hazelnuts are less sensitive to diseases and can be produced with **moderate use of fertilizers** on abandoned, low-fertility or degraded lands;

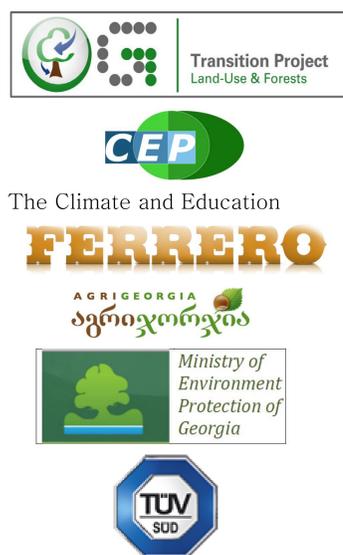


A range of crops are suitable for inter-cropping and agro-forestry

APPLIED SYSTEMS ANALYSIS IN BEST PRACTICE: forestry with agriculture projects

Permanent climate change mitigation can be achieved with co-production of food, feed, fiber and fuel for future generations

- Hazelnut plantations** are suited for **combined food-feed-fibre-fuel** production, ensuring that human and livestock requirements can be met without using any land with high biodiversity, protected and forested ecosystems.
- The case study demonstrated **NET positive environmental impacts** on soil, water, biodiversity and climate, halting and reversing degradation and indicate significant potential of hazelnut plantations.
- The application of **carbon financial mechanisms** on combined forestry with agriculture plantations proved to be suitable for establishment on abandoned but potentially highly productive lands.
- Measurable impact of training** on halting land degradation.
- Sustainable food production can be achieved on carbon plantations, with significant co-benefits on **livelihood improvement** and rural development.
- As a conclusion, afforestation can provide substantial additional land for agricultural commodities production to meet the food and fiber requirements of future generations.



The afforestation with hazelnut plantation projects represents a replicable model for the efficient use of abandoned by low-input food-fiber plantations

