Economic and climate change mitigation potential of forest fertilization in state forests in Latvia

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Aim of the study

- Forest fertilization is recognized as the **climate change mitigation measure** and solution for rapid **increase of roundwood supplies** from managed forests.
- Several types of forest fertilization are considered in Latvia:
  - **N application before final felling in forests on dry soils**;
  - **wood ash in coniferous forests** of different age on drained organic and mineral soils;
  - mixture of wood ash and N in forests of different age on dry and drained soils;
  - repeated application of N before and after forest thinning.
- Several types of application are not sufficiently evaluated, like N and ash application on wet soils.
- **Aim of the study is to characterize economic and climate change mitigation related aspects of forest fertilization**.

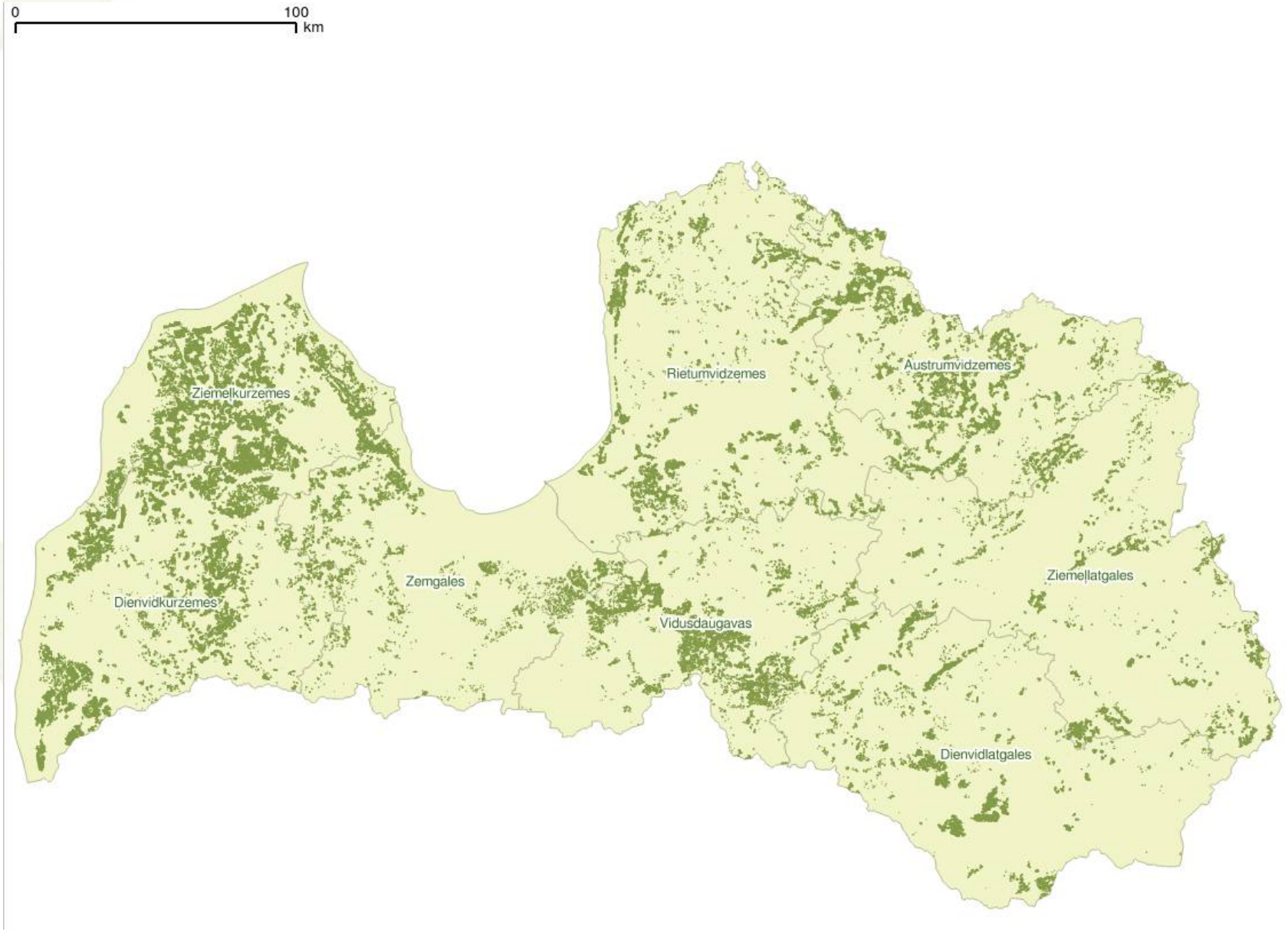
Evaluated aspects

- **Area** of state forests suitable for N and wood ash applications before final felling.
- **Cost** and amount of fertilizers, cost of application, additional harvesting cost.
- **Additional output** of roundwood, structure of assortments, potential income.
- **Cost – benefit** analysis of fertilizer’s application.
- **Climate change mitigation effect** and potential impact on national targets.
- Impact of **nature conservation restrictions** related impact.

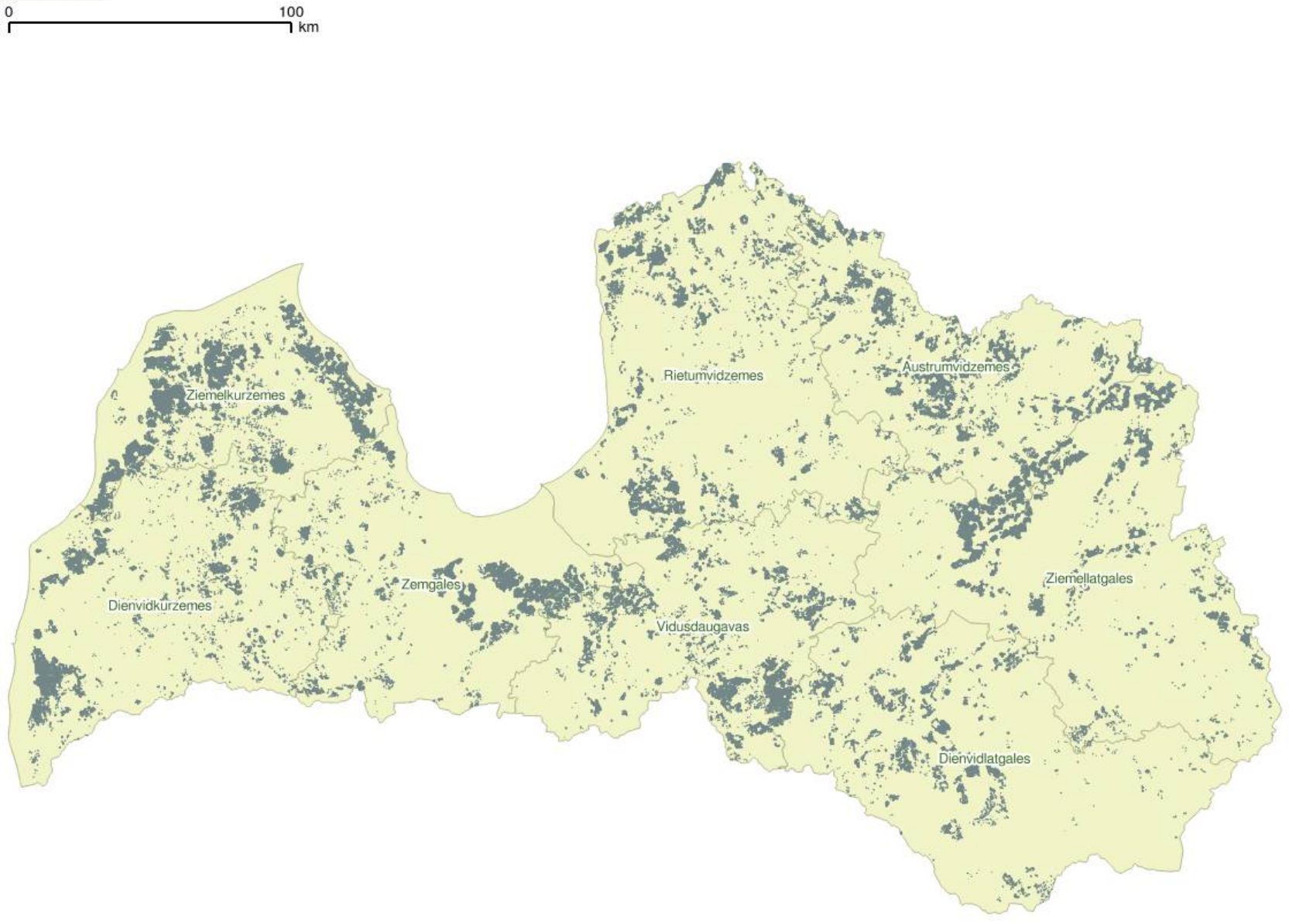
Areas suitable for fertilizers' application

- Forest areas suitable for **N application**:
  - according to **National forest inventory (NFI)** data:
    - total area – **430 kha**, including 295 kha pine, 89 kha spruce and 45 kha birch stands;
    - average annual application – **4.7 kha** *(2.9 kha pine stands, 1.1 kha spruce and 0.6 kha birch stands);*
  - according to **stand wise inventory data**:
    - total area – **217 kha**, mostly pine stands;
    - average annual application – **2.4 kha** *(1.5 kha pine stands, 0.6 kha spruce and 0.3 kha birch stands).*
- Forest areas suitable for **wood ash application**:
  - according to **NFI** data:
    - total area – **883 kha**, including 300 kha pine, 305 kha spruce and 278 kha birch stands;
    - average annual application – **10.7 kha** *(3.0 kha pine stands, 3.8 kha spruce and 3.9 kha birch stands);*
  - according to **stand wise inventory** data:
    - total area – **239 kha**, mostly drained peatlands;
    - average annual application – **2.9 kha** *(0.9 kha pine stands, 0.8 kha spruce and 1.2 kha birch stands).*

Areas suitable for application of mineral fertilizers



Areas suitable for application of wood ash



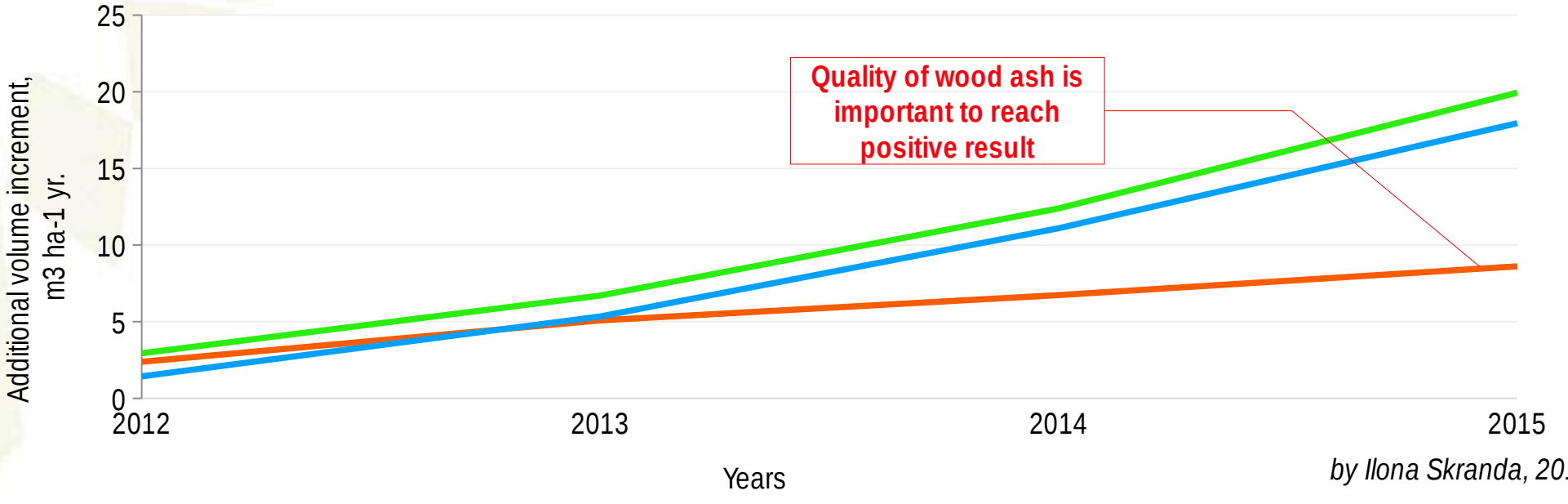
Amount of fertilizers

- Assumptions:
  - N application – 150 kg N ha^{-1} *(439 kg ha^{-1} of mineral fertilizer)*.
  - wood ash application – 5 tonnes ha^{-1} *(depending from moisture content forest gets at least 2 tonnes of dry wood ash)*.
- Application:
  - annual consumption of nitrogen fertilizer **1 ktonne** of ammonia nitrate *(0.4% of the amount used in agriculture)*.
  - annual consumption of wood ash **14 ktonnes** *(about 30% of wood ash produced in centralized systems, up to 100% if NFI data are used)*.

Time study data was used in cost calculations

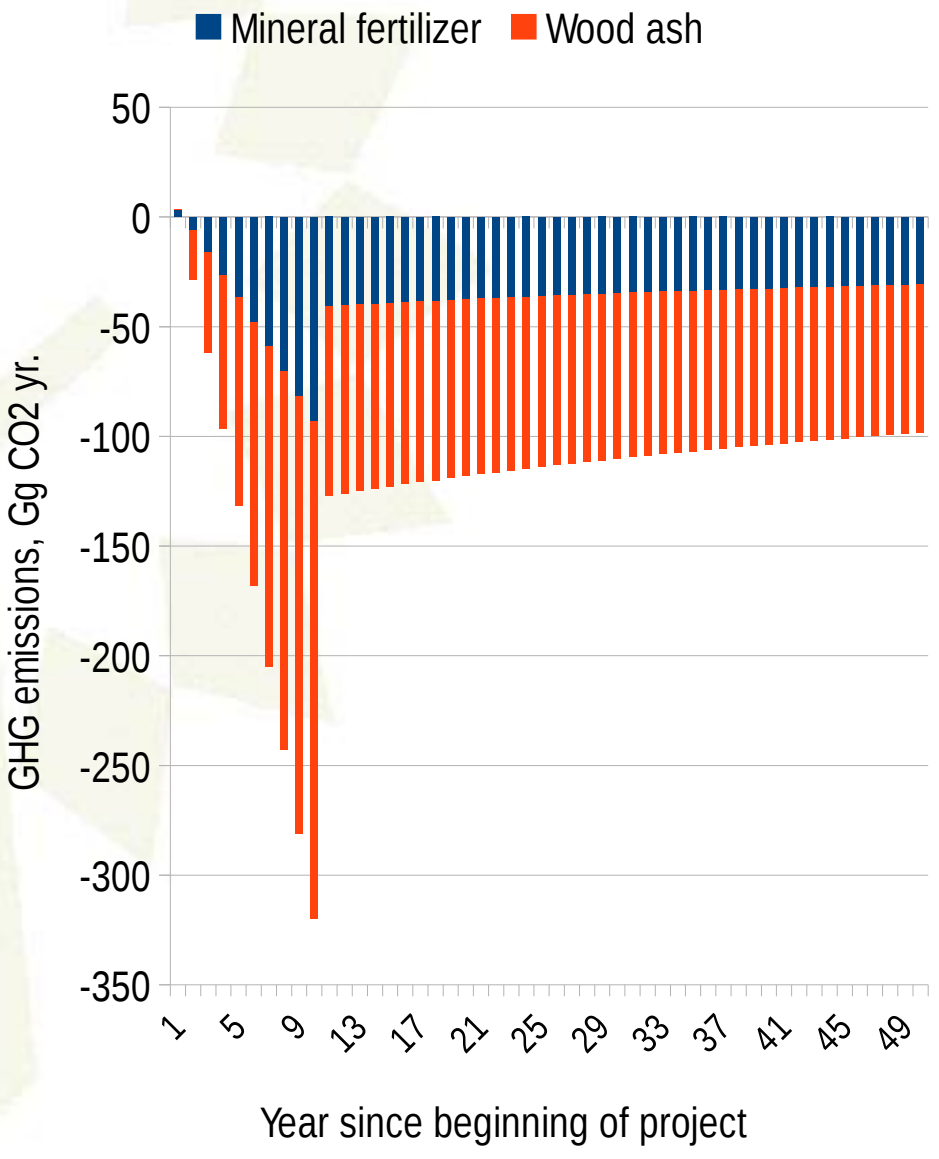
Summary of increments

- Application of N in **2.0 kha** area:
  - annual additional increment in 10th year – at least 28 thousands m^3;
  - cumulative additional increment in 10th year is 142 thousand m^3.
- Application of wood ash in **4.3 kha** area:
  - annual additional increment in 10th year – at least 58 thousands m^3;
  - cumulative additional increment in 10th year is 298 thousand m^3.



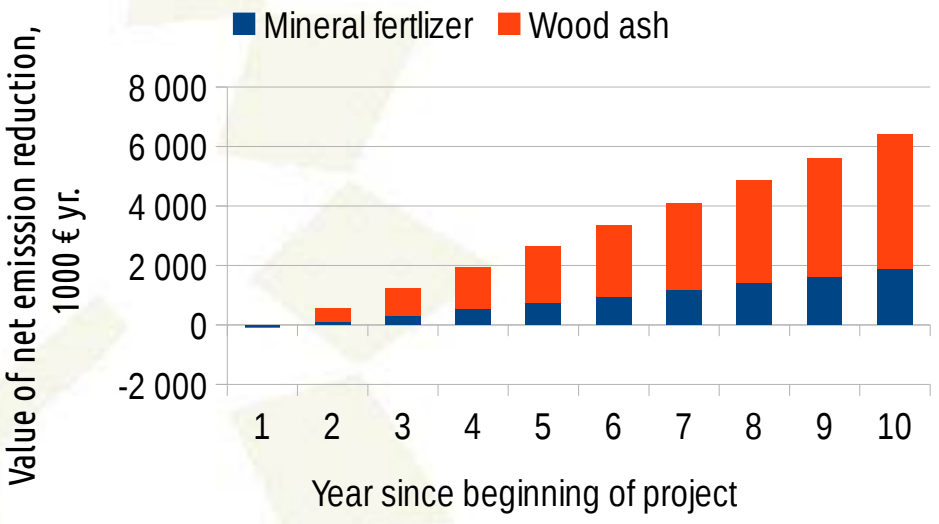
by Ilona Skranda, 2016

Climate change mitigation effect of forest fertilization

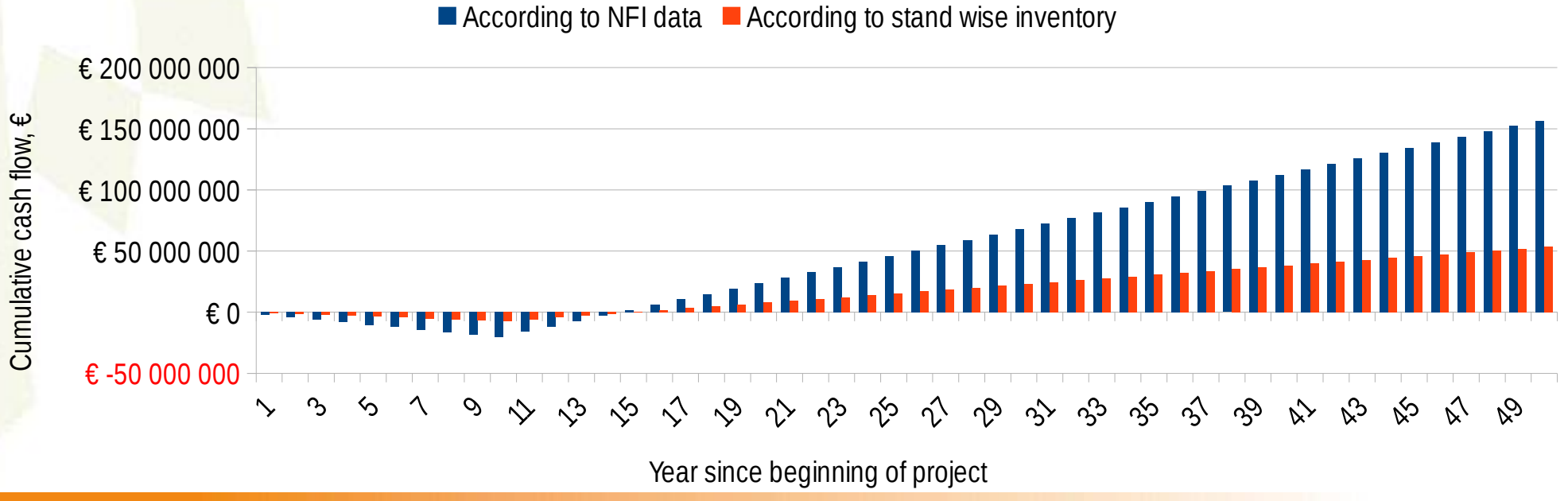


- Net GHG emissions from forest land in Latvia in 2015 – -2230 Gg CO_2 eq.
- Cumulative reduction of GHG emissions due to forest fertilization in 10 years – 635 Gg CO_2 eq. *(soil and dead wood is not considered)*.
- "Monetary value" of the forest fertilization equals to 12.7 mill. € in 10 years.
- The value of additional CO_2 removal is equal to **156 € ha^{-1}**.

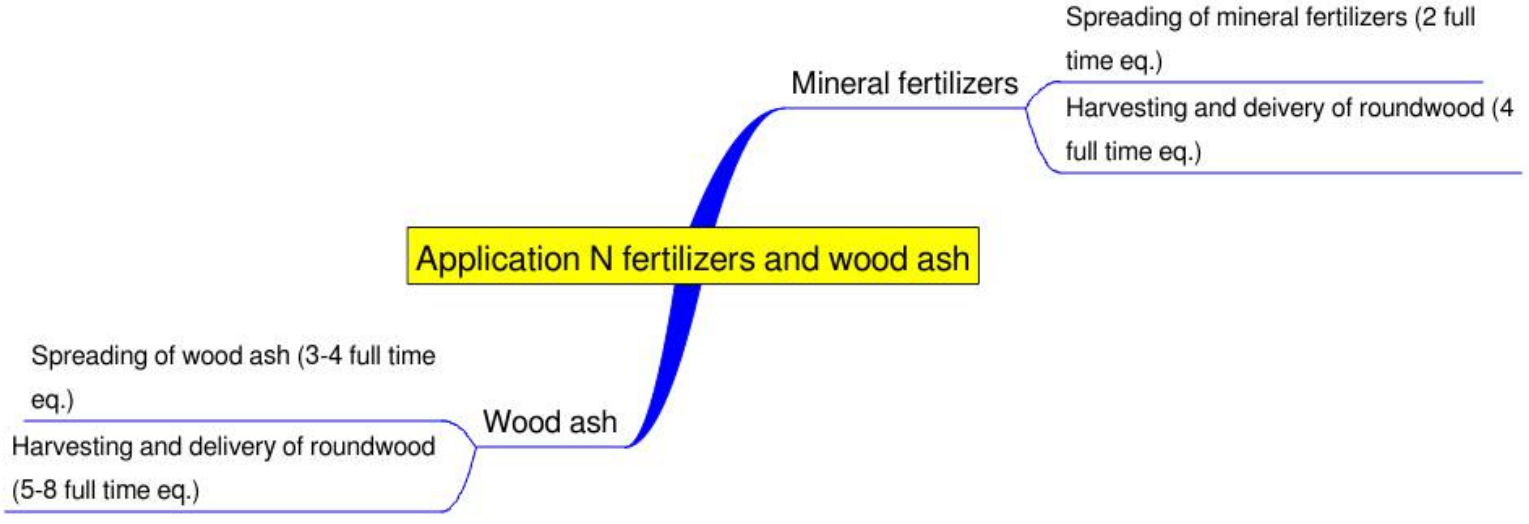
Economic effect of fertilization



- IRR for N application in 20 years reach 11%, but for ash application – 13%.
- Project influence on GDP reaches maximum *(3.2 million € per year)* 11 years after starting the project.



Impact on employment



- Cost of application of N fertilizer including fertilizer 166 € ha^{-1}.
- Cost of application of wood ash 119 € ha^{-1} *(no cost is considered for wood ash and transport of material)*.

Quality of wood ash requires more research and development