



NORWEGIAN UNIVERSITY OF LIFE SCIENCES
MDCCCLIX

Changing the forest sector modeling tools in Norway: From static to dynamic optimization

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MODELS

Norwegian Trade Model II (NTM II)

Static optimization model of Norwegian forest industry



NTM with dynamic optimization



Norwegian forest sector model

Dynamic model of forest industry and silviculture

Gaya

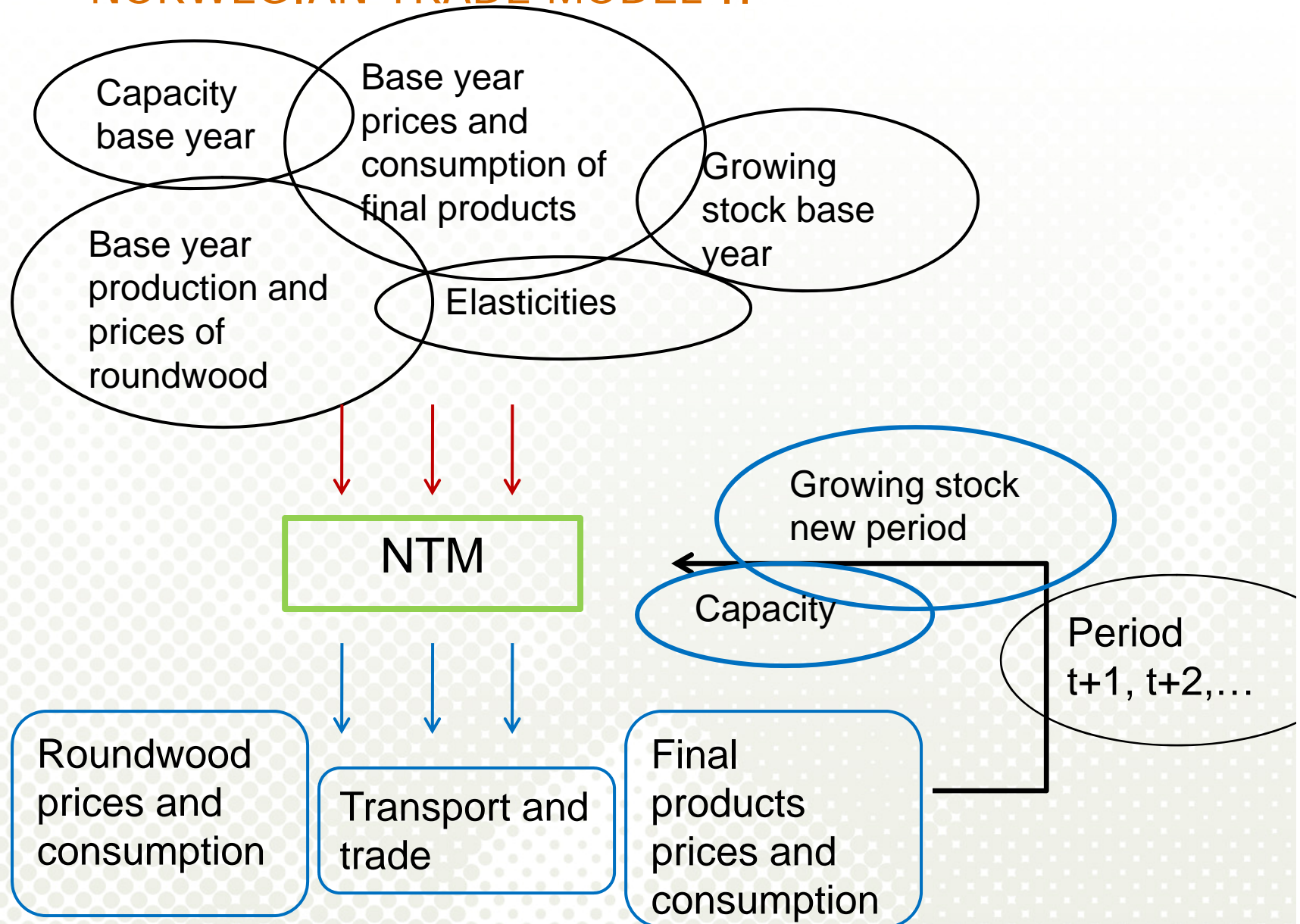
Simulation model of forest management in Norway



NORWEGIAN TRADE MODEL II (NTM II)

- **Partial, spatial** and **static** equilibrium model of the Norwegian forest sector (including bioenergy) (Trømborg & Solberg 1995, Bolkesjø 2004)
- Purpose of the model: Analyse **consequences** for the Norwegian forest sector of **shifts in economic conditions**
- Describes **production, consumption, trade** and **transport**
- Similar in structure to the Global Trade Model (GTM) developed at IIASA in the beginning of the 1980s and further developed in Finland (Kallio *et al.* 1987)
- Objective function: **Maximise the welfare** under the assumption of perfect competition
- **Equilibrium price** and **quantity** for each good is determined from the optimal solution

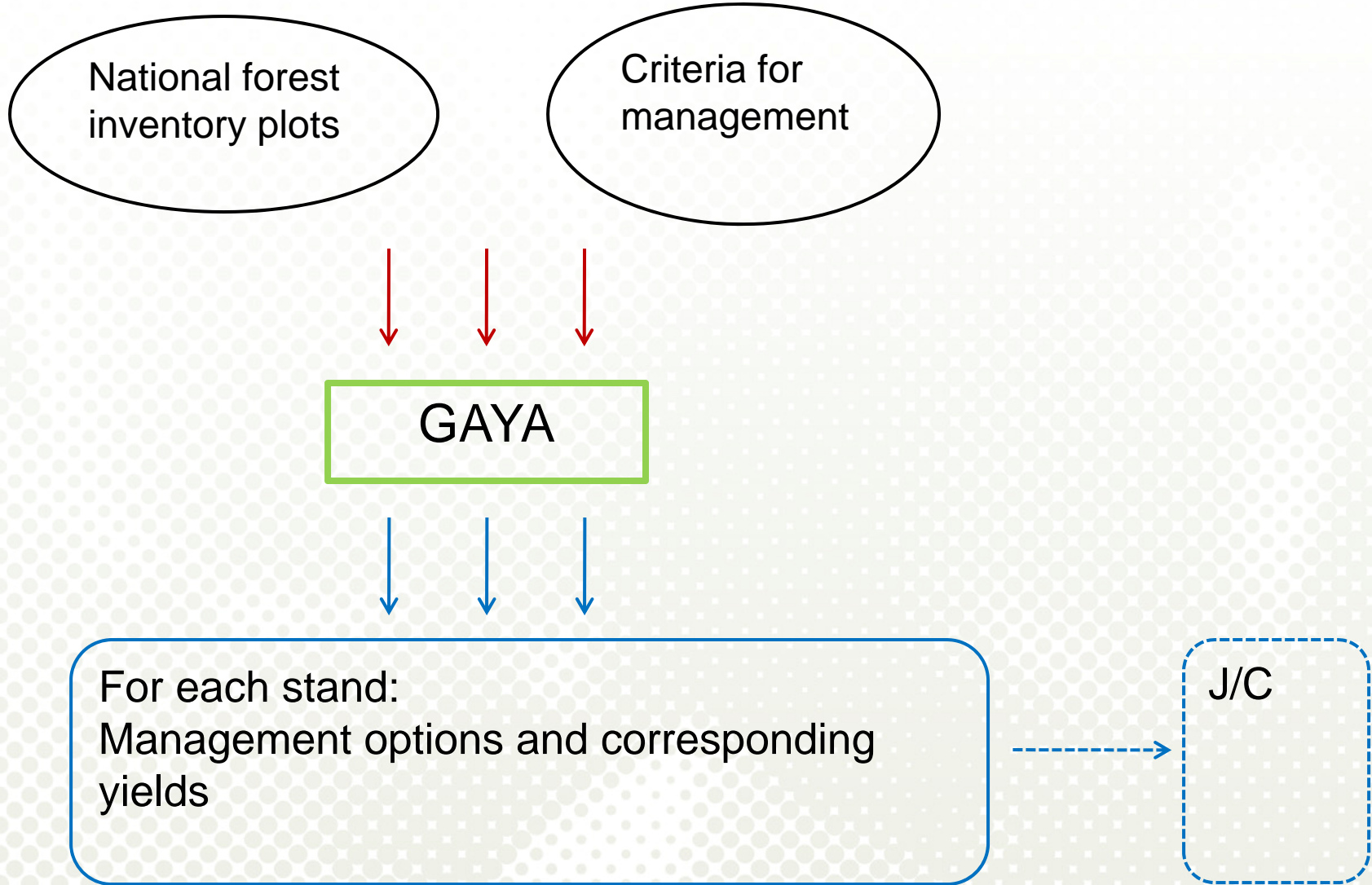
NORWEGIAN TRADE MODEL II



THE STAND SIMULATOR GAYA

- Simulates yield for a range of **management options** based on the **condition of the forest plot** at each point of time and **criteria** (Hoen 1990, Hoen & Solberg 1994)
- For example, thinning can take place if the stand is within the range of (t, t+n) years, has minimum x m³ per hectare and is a Spruce stand
- Yields of **timber** and **carbon** and corresponding **cash flows** are simulated
- **Prices** and **costs** are **exogenously** fixed
- The results from Gaya are usually put into a **optimization** model, J/C, which optimize the managements in order to **maximize the net present monetary value or net present carbon value**

GAYA



What modeling tools do we have now?

NTM

- Supply function endogenous and demand function exogenous: Deciding price and quantity at the given line
- Static: myopic model which only optimize for one year at the time
- No investments and silviculture in forestry included, growing stock $_{t} = \text{growing stock}_{t-1} + \text{increment}_{t-1} - \text{harvest}_{t-1}$
- Capacity in industry endogenous
- Two market levels

Gaya

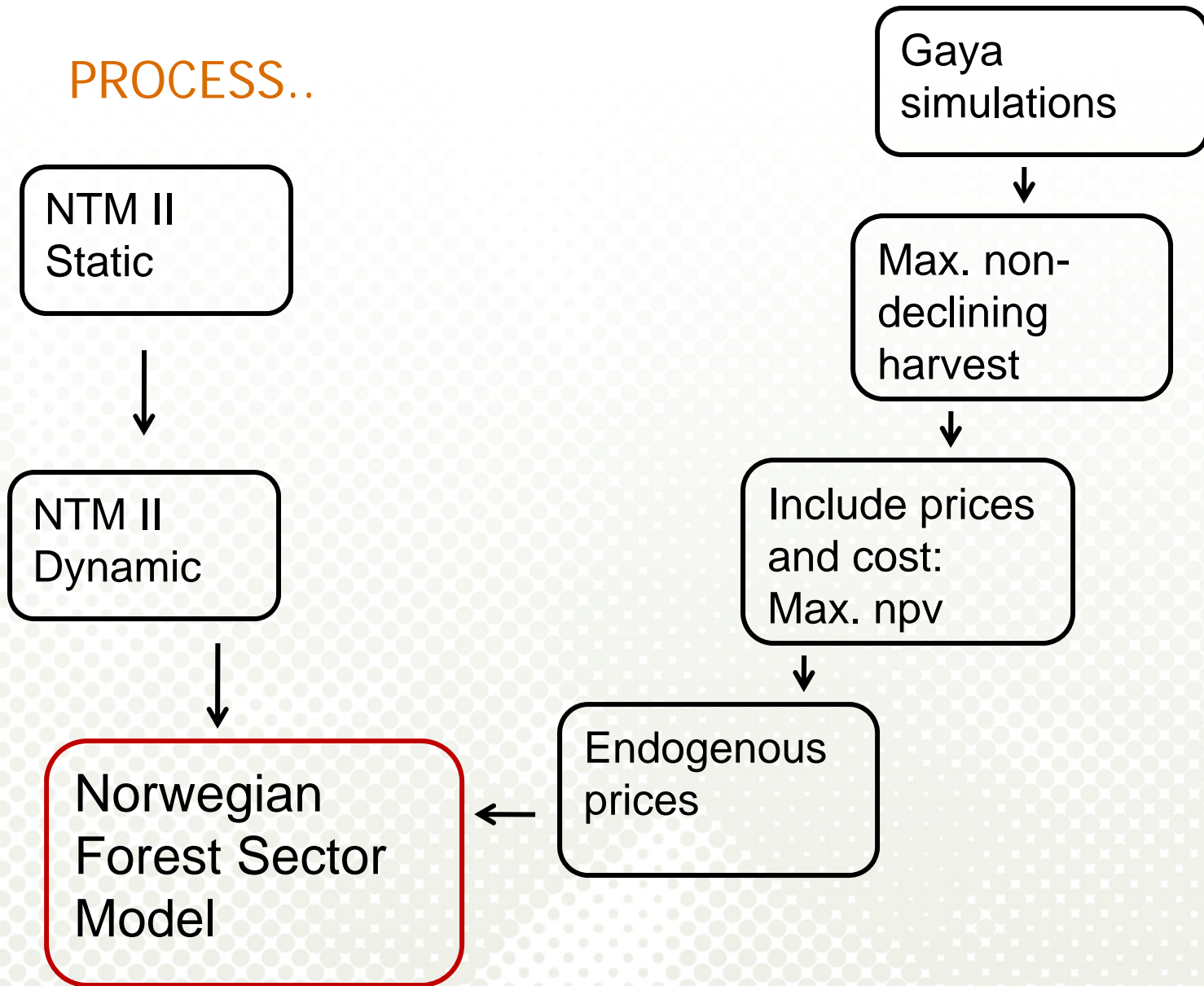
- Detailed modelling of management and effects on yield
- Prices and costs exogenous
- Breakdown into sawlogs and pulpwood exogenous
- Carbon accounting in forest and wood products, incl. storage in wood and substitution effects (but products exogenous)
- No inclusion of the industry other than the fixed prices

What modelling tools do we want?

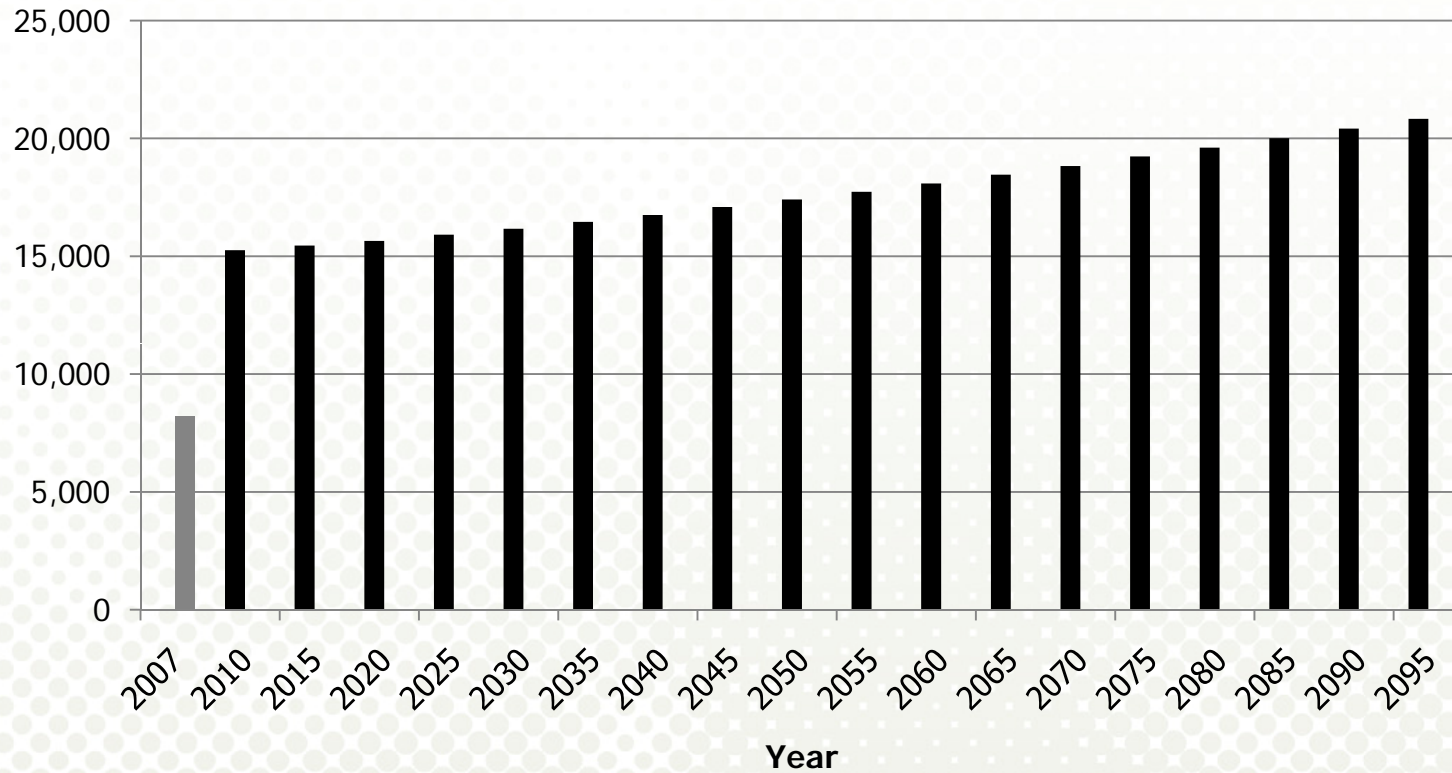
Partial equilibrium optimization model of the Norwegian forest sector:

- Dynamic: With perfect foresight
- Investments and management in forestry endogenous
- Carbon accounting
- Prices and quantity of wood supply / consumption endogenous
- Capacity in the industry endogenous

PROCESS..

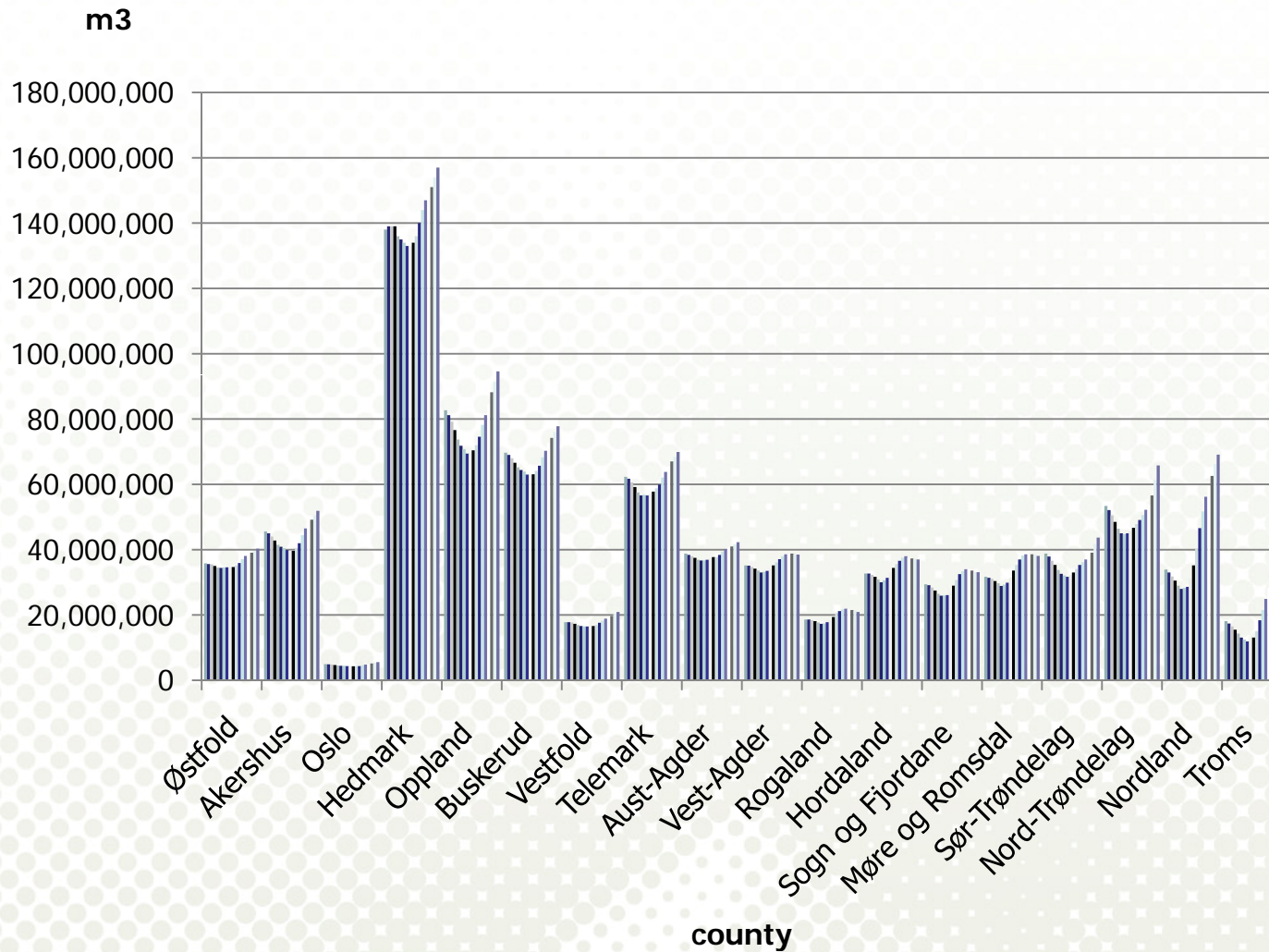


1000 m³ Harvest level from model vs. actual harvest level

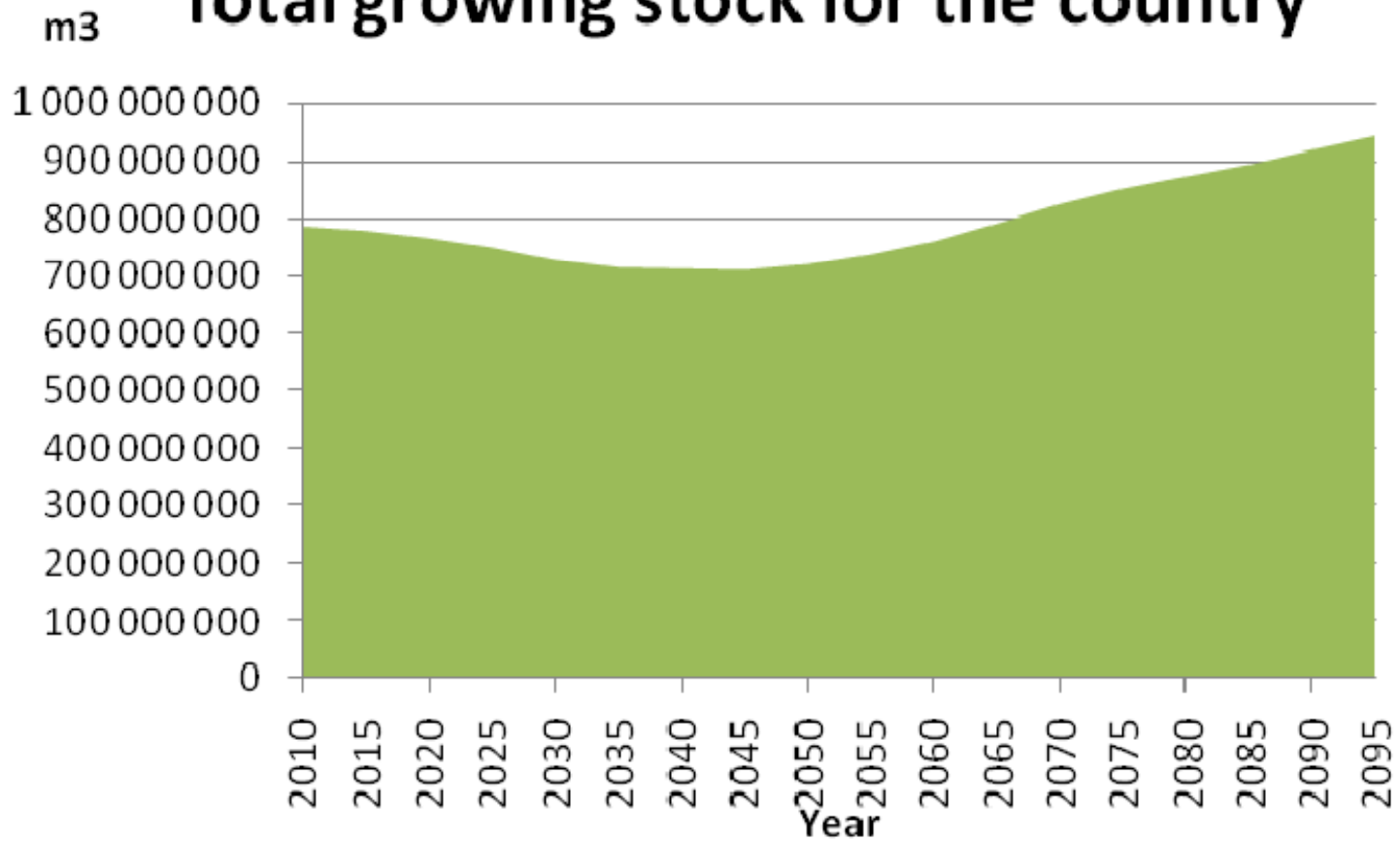


■ Harvest acc. to model ■ Actual harvest 2007

Growing stock for each county over next 90 years



Total growing stock for the country



Thank you for your attention!