



Norwegian Centre for Soil and
Environmental Research





MONITORING AND ASSESSMENT OF NON-POINT SOURCE POLLUTION IN NORWAY

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Outline of presentation

- Background and organisation of Agricultural Environmental Monitoring Programme in Norway (JOVA)
- Monitoring activities
- Dissemination of results



Background of JOVA

- **Severe situation concerning nutrient and soil losses both national, international, beginning of 80's.**
- **International obligation to reduce nutrient losses to the North Sea**
- **JOVA role in the EU/Water Framework Directive?**



Organisation

- JOVA is a joint effort between
 - the Norwegian Centre for Soil and Environmental Research (Jordforsk)
 - Norwegian Crop Research Institute (Planteforsk),
 - Rogaland Research,
 - Norwegian Institute for Water Research (NIVA)
 - County Department of Environmental and Agricultural Affairs.
- The programme is funded by the Norwegian Agricultural Authority.



Some facts about Norway

- Capital Oslo
- 4.5 mill inhabitants
- 386 958 km²
- Minimum temp. – 5 °C, January.
- Maximum temp. 17 °C , July.
- 3 % agricultural area
 - main products: grain (barley, wheat, oat), potatoes, beef, milk
 - 20 per cent of the agricultural area have a gradient exceeding 1:5
 - Grain area: 31 % of the total agricultural area
 - Growing season: 100 – 190 days
 - Average grain yield: 4 000 kg/ha
 - Artificial drainage

Norwegian mountain areas

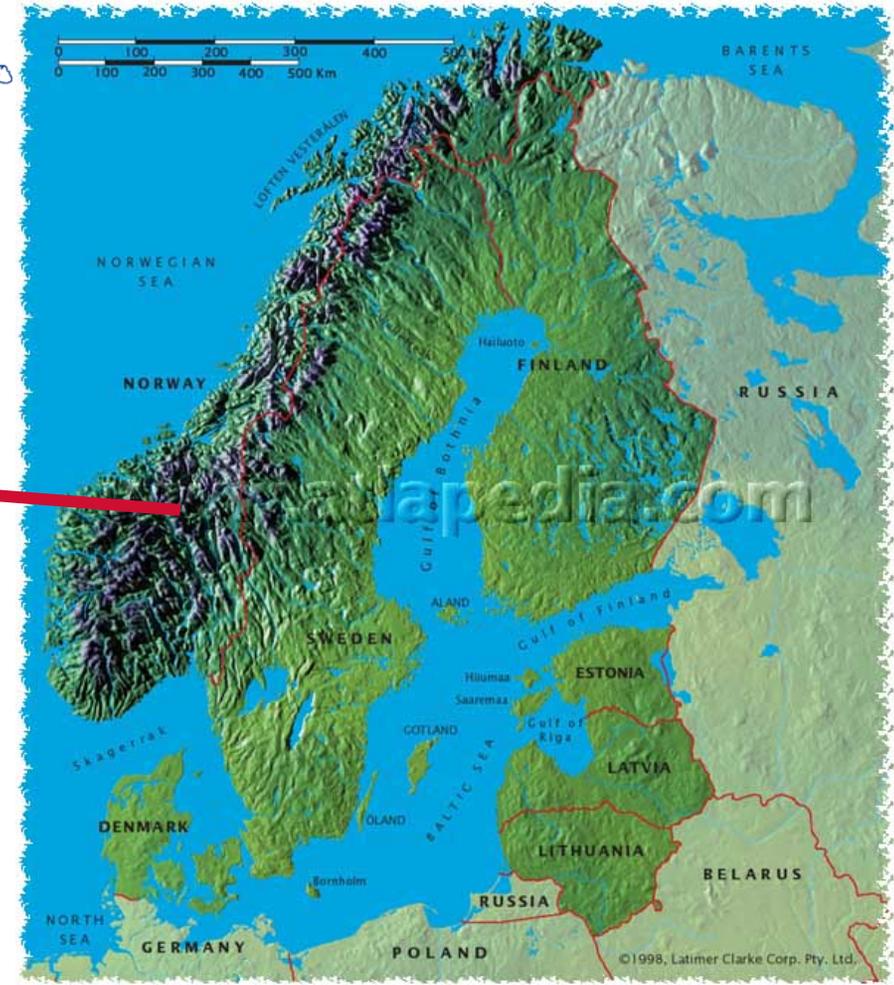
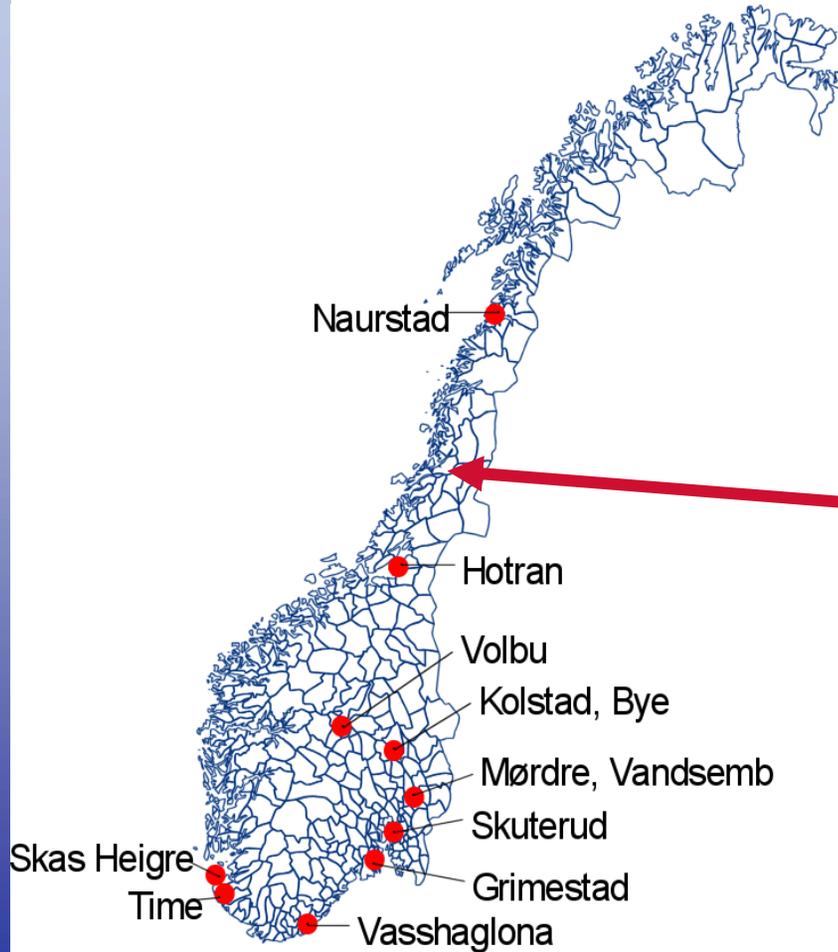




JOVA description

- *The programme has been in operation since 1992*
- *10 agricultural catchments varying in size from 1- 20 km².*
- *catchments represent*
 - *different geo-hydrological settings,*
 - *agricultural practices and*
 - *climatological conditions*

Geographical location of monitoring stations



Catchment description

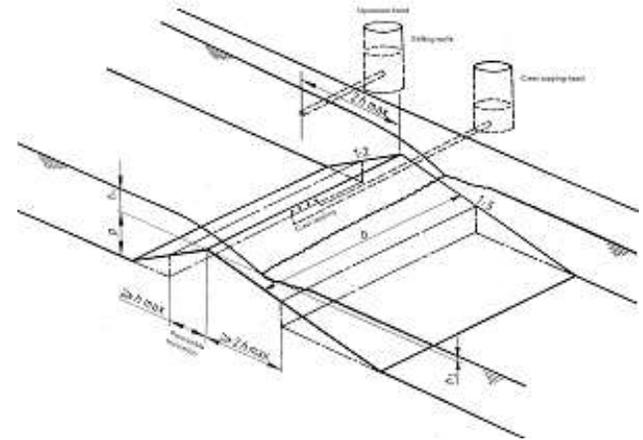
Catchment	Area (ha)	Temp (°C)	Prec (mm)	Soil type	Major crop
Skuterud	449	5.5	785	Silty loam	Cereals
Mørdre	680	4.3	665	Silt and clay	Cereals
Kolstad	308	4.2	585	Humic loam	Cereals
Hotran	1940	5.3	892	Silty l./clay	Cereals, grass
Naurstad	146	4.5	1020	Bog/fine sand	Grass
Skas-Heigre	2930	7.7	1180	Clay/sand/	Grass, cereals
Volbu	168	1.6	575	Silty sand	Grass
Vasshaglona	65	6.9	1230	Sand	Veg., pot., cereals
Time	1140	7.2	1189	Silty sand	Grass
Grimestad	177	7.3	1080	Silty sand	Cereals, grass



Monitoring elements

- Collect information concerning
 - agricultural practices
 - nutrient, soil, pesticide losses losses at catchment scale
 - climatological data
 - soil types
- Give information to
 - authorities (Agr., Env.)
 - farmers
 - others

Catchment monitoring calculation of load



Discharge measurement
using Crump weir, V-
notch



runoff(mm)

N,P,SS loss (kg.ha⁻¹)

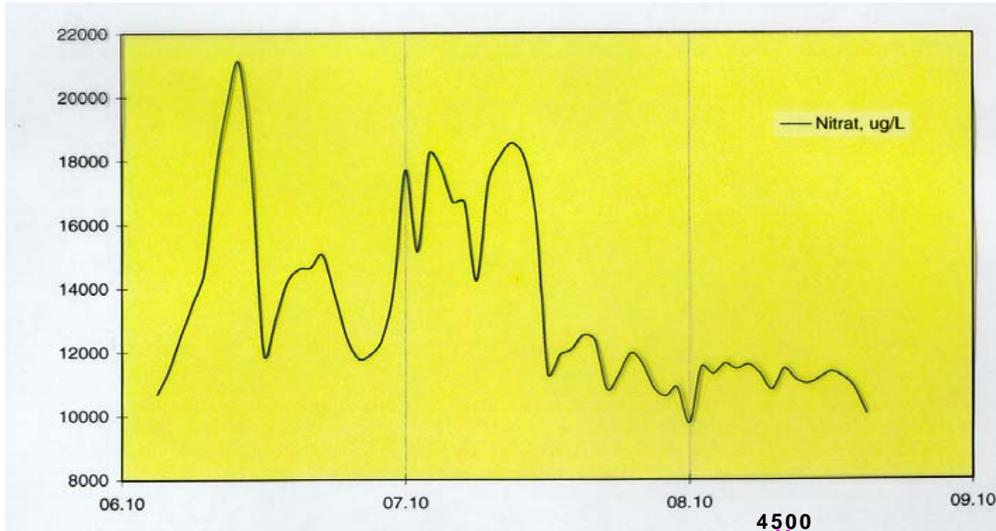
Water sampling and
analysis(TDS, N_{tot}, P_{tot})

Different sampling routines

Grab sampling



Short-term variability concentrations

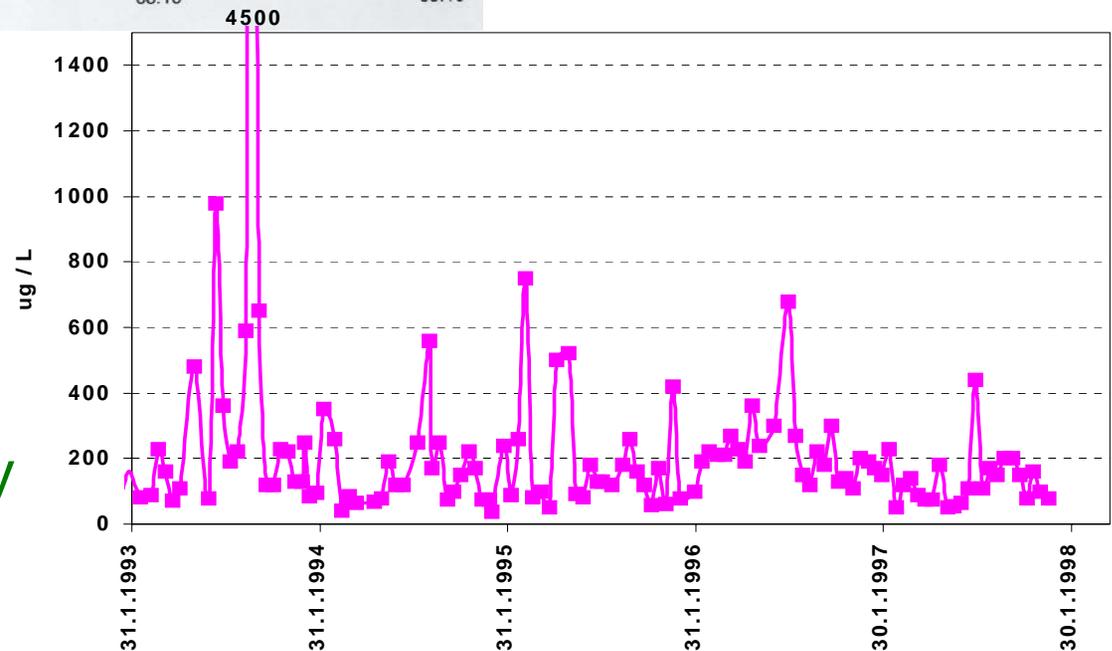


Nitrate concentrations
Arable land, grain,
South-eastern Norway

Phosphorus
dynamics

Pastures

South-west Norway



(Vagstad, Deelstra and Eggestad)

Winter episode (Øygarden, 2000)

January 30

Runoff: 25 mm

Soil loss: 2 kg ha⁻¹



January 31

Runoff: 77 mm

Soil loss: 3 050 kg ha⁻¹



Relative difference in suspended load based different grab sampling methods and volume prop. sampling

Susp. matter	Grabsampling period		
	1 week % deviation	2 weeks % deviation	4 weeks % deviation
Strategy 1	- 93 <> - 25	- 99 <> + 3	- 100 <> + 100
Strategy 2	- 93 <> - 49	- 99 <> - 4	- 100 <> + 97

strategy 1; runoff at sampling time

strategy 2; continuous discharge measurements



Relative difference in nitrogen load based different grab sampling methods and volume prop. sampling

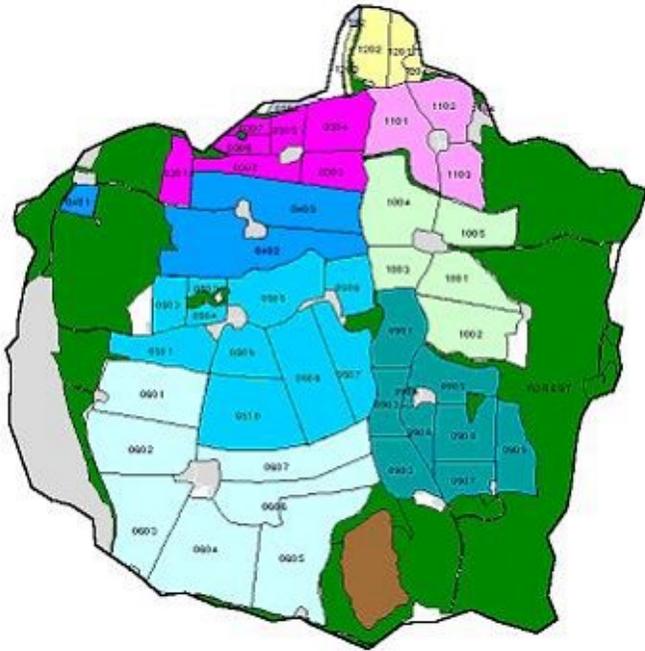
Total nitrogen	Grab sampling period		
	1 week % deviation	2 weeks % deviation	4 weeks % deviation
Strategy 1	- 39 <> - 14	- 51 <> + 2	- 73 <> + 33
Strategy 2	- 24 <> - 8	- 27 <> - 9	- 46 <> - 1

Strategy 1; runoff at sampling time

Strategy 2; continuous discharge measurements

In JOVA
volume proportional composite water sampling

Catchment monitoring



Collect information about

- farming practices
- soil types
- climatological data

Quality control - transfer of data

Sensors

Meteorological

Water quality

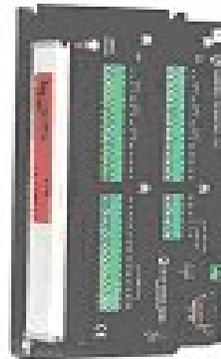
Water level/ flow



Monitoring System

Datalogger

Campbell
CR10X



GSM
Modem



Calculations
Max., min., avg.,
Waterflow
Start/stop sampler
Signalconditioning

Sampler



Power supply

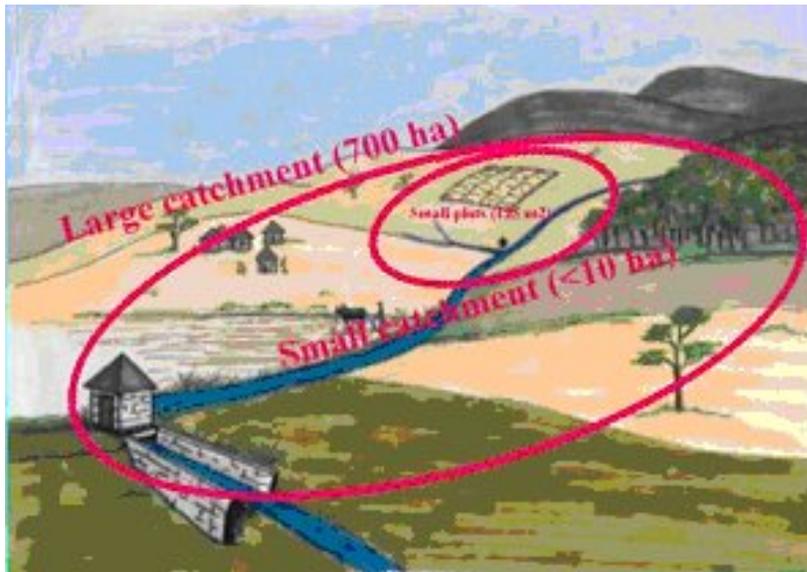


Data management, control and reporting

- All the monitoring stations are connected by telephone to the main office, automatic daily data collection
- Control routines are carried out on the collected data before being inserted them into a Sybase-database.
 - In case of problems, error messages are generated automatically
 - The data control and verification process can be carried out in two ways (inside/outside main office)
 - The data control programme is supported by a field programme
 - Water samples analyses results are send by email to the mainframe computer and subjected to control routines and inserted into database
- Farming practices are entered in database
- Reporting routines produce standard tables, graphs for yearly reporting to the agricultural and environmental authorities.
- Routines are available for more specialised data analysis.

Scale issues in monitoring

- Within a monitoring programme
 - research and measurements at different scales
 - to obtain information about the processes leading to soil and nutrient losses
 - collect information about load contribution from different land use types (agriculture, forest, housing)
- Vandsemb/Mørdre, Bye/Kolstad, Skuterud

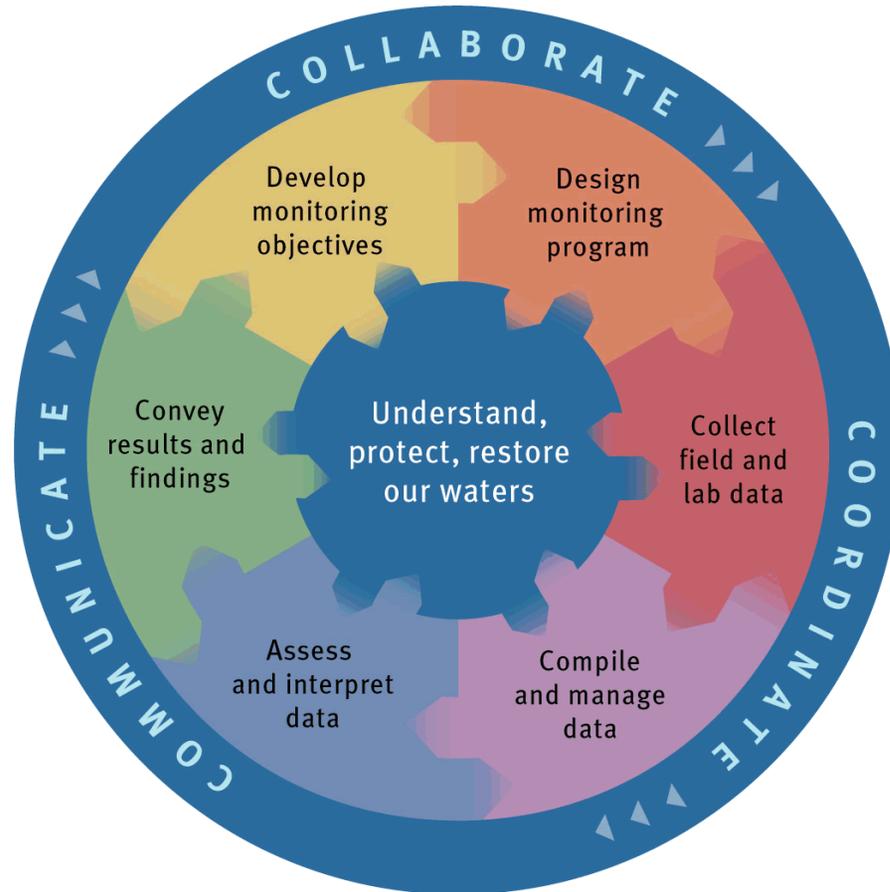




Results showing the variability in losses between catchment

	Runoff mm	Total Nit. kg/ha	Total Phos. kg/ha	Susp. Solids kg/ha
Skuterud	523	44	2.5	1550
Mørdre	287	20	1.5	1100
Kolstad	322	50	0.5	163
Hotran	769	54	3.8	2660
Naurstad	1151	30	4.0	751
Skas-Heigre	656	40	1.2	
Volbu	286	20	0.4	63
Vasshaglona	1277	100	6.9	1540

Data collection, information dissemination



Framework for Monitoring



Framework for JOVA monitoring programme

Develop monitoring objectives

Advisory board, ministries
Challenge will be implementation EU/WFD,

Design monitoring system, program

Background; national, international

Convey results, findings

Reporting, local meetings, conferences, internet, newspaper

Improve water quality through increased environmental awareness

Collect field, lab data

Through existing program

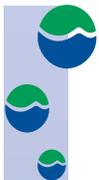
Assess and interpret data

Part of reporting, modelling

Compile and manage data

Routines for collection, reporting

Data collected used for research purposes



THE END

