Exposure assessment for surface water and groundwater

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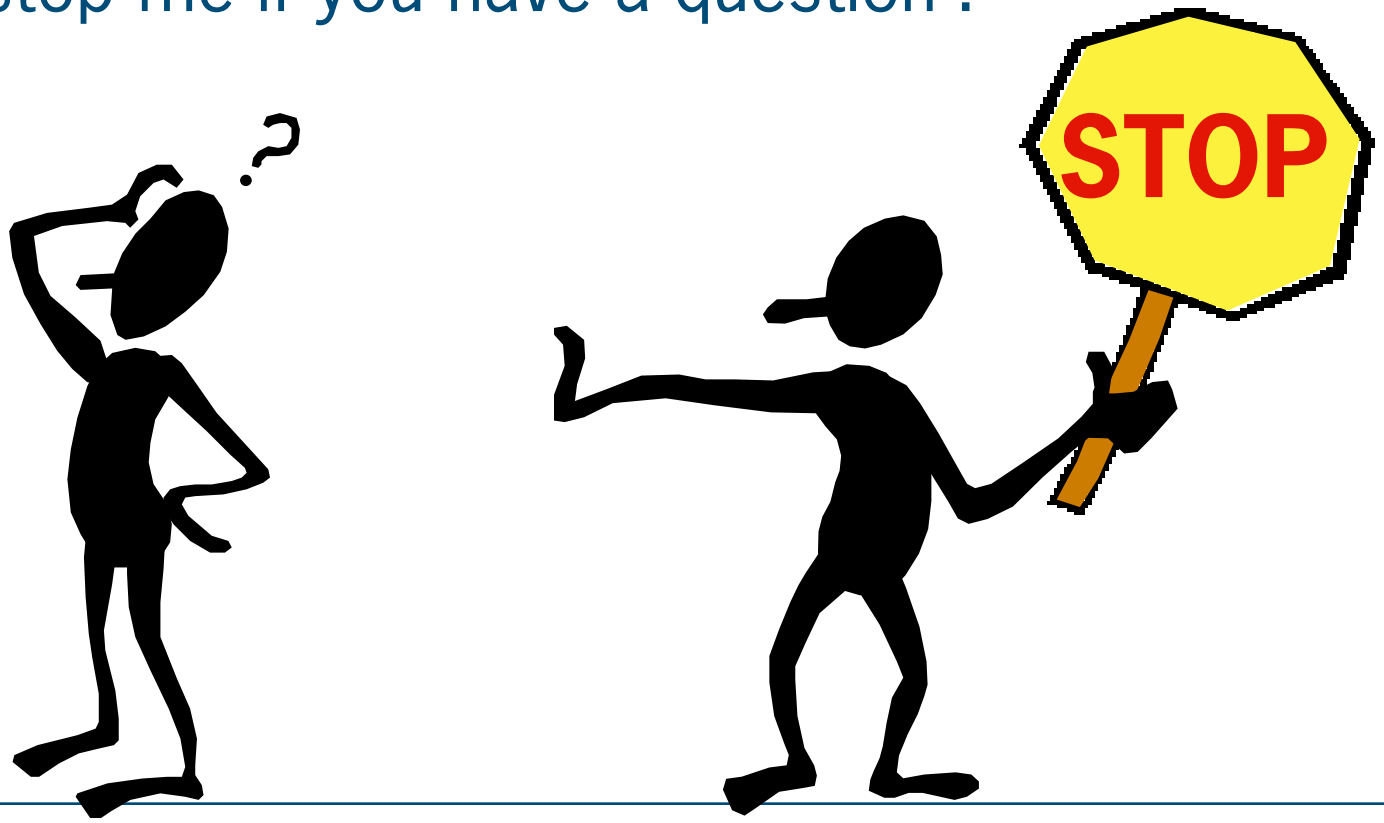
Outline

- protection goals
- principles of tiered flow charts
- example of a tiered flow chart for groundwater
- options for where to protect groundwater
- options for where to protect surface water
- how to develop scenarios ?
- regional differentiation in registration acceptable ?
- representativeness of scenarios

- Please stop me if you have a question !

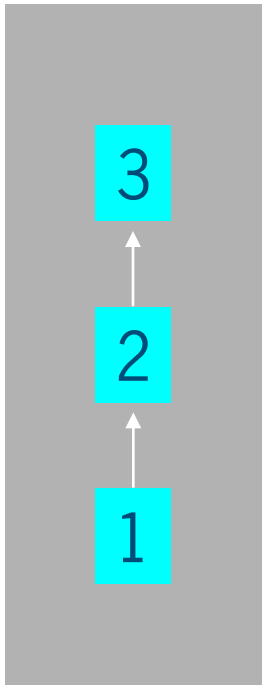


Protection goals

- Basis of any risk assessment is protection goal:
  - what has to be protected ?
  - where ?
- Protection goal is political decision: risk management
- Also needed: criteria (Monday: Peter and workshop 2012)
- Scientists develop appropriate risk assessment schemes for selected protection goal and criteria
- Risk assessment based on tiered flow charts

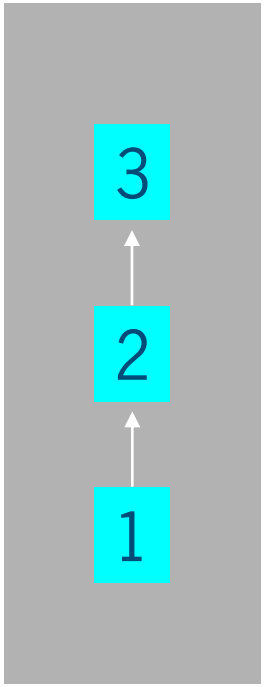
Principles of tiered flow charts

- tiered approach because cheapest both for industry and authorities
- concept: do not more than necessary
- same protection goal in all steps
- lower steps more conservative than higher steps
- higher steps more realistic than lower steps



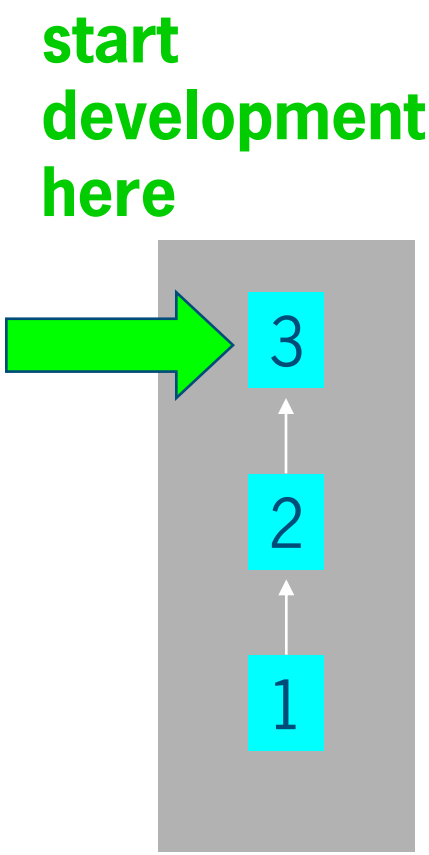
Principles of tiered flow charts

- lower steps require less efforts than higher steps
- jumping to higher steps acceptable
- balance between efforts and filtering capacity
  - industry will not use an expensive step that leads for 95% of pesticides to ‘unacceptable risk’



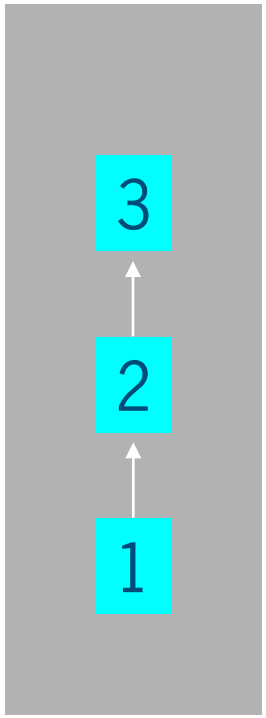
Principles of tiered flow charts

- in time frame of a project for development of a tiered flow chart: start always with developing the highest step
  - lower steps have to be consistent with highest step
  - highest step = the boss
  - lower steps can be best developed at the end
- principles are simple but difficult to apply also for experienced risk assessment scientists
  - exposure assessment is complex issue



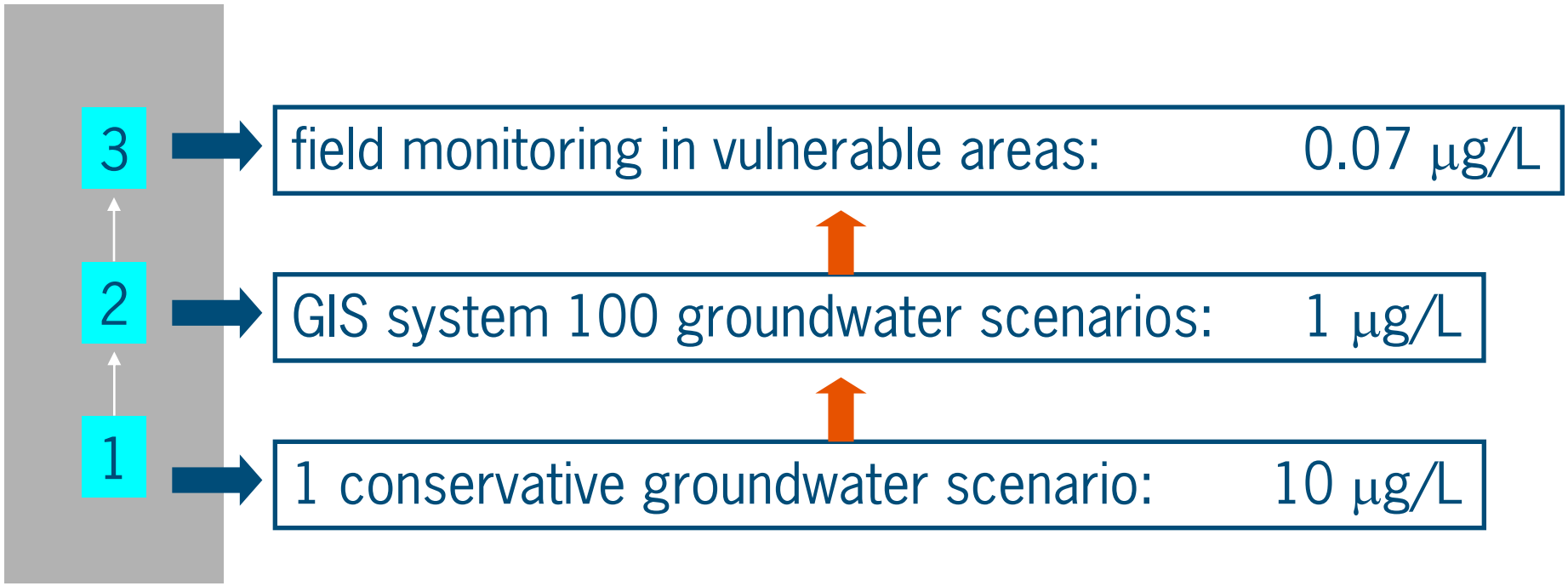
Principles of tiered flow charts

- procedure for developing a tiered flow chart:
  - group of experts develop a flow chart (dry swimming)
  - then apply flow chart to five pesticides (can you really swim in a swimming pool, does it work ?)
  - adjust flow chart based on experiences



Example of a tiered flow chart

Assume: concentration in groundwater of 0.1 μg/L is acceptable for this pesticide



Options for where to protect groundwater

- 1: groundwater at 1 m depth below soil surface
  - for all agricultural areas (so including e.g. groundwater below rice paddies and brackish groundwater close to the sea), or for
  - groundwater at 1 m depth below soil surface for all agricultural areas where it is used as a source of drinking water
- 2: groundwater at 10 m depth below soil surface only for agricultural areas where groundwater is used as drinking water

Side remark on protection goal groundwater

- criterion is important (workshop 2012)
- assessment of leaching much easier if human toxicological criterion is choosen than if EU drinking water criterion is choosen:
  - EU drinking water: 0.1 μg/L corresponds with 0.01% leaching of dose of 1 kg/ha
  - toxicological criterion: considerably higher concentrations so also higher %

Options for where to protect surface water

- 1: each agricultural ditch or stream in Ethiopia (including non-permanent streams that fall dry each summer)
- 2: all agricultural ditches or streams that fall dry only in 50% of the years
- 3: only permanent agricultural ditches and streams (fall never dry)

Options for where to protect surface water

- 4: only streams and ditches that are at least 4 m wide and have a minimum water flow of 10 m^3 per day
- 5: only a number of larger rivers (e.g. Blue Nile)
- 6: only the mouth into the neighbouring countries of a number of larger rivers

How to develop appropriate scenarios ?

(theoretical best approach)

- 0: define your protection goal: what to protect and where ?
- 1: select a suitable model
- 2: develop some 100-1000 scenario's covering all relevant cases
- 3: run all scenario's for each pesticide application
- Example: GeoPEARL in Netherlands in 2005: >1000 different scenarios

disadvantages: - laborious

- much data needed

How to develop appropriate scenarios ?

(pragmatic approach)

- 0: define your protection goal: what to protect and where ?
- 1: start with examining e.g. three example sites/areas that fit to your location definition
  - use all available information (GIS information, weather)
  - field trips organised by local experts
- 2: identify the main two or three drivers for your exposure concentration: i.e. properties of system that have largest effect
  - e.g. organic matter content of soil for groundwater
  - e.g. percent of area treated for surface water
  - based on knowledge of processes and of modelling; experts needed

How to develop appropriate scenarios ?

(pragmatic approach)

- 3: divide the desired vulnerability between the main drivers
  - e.g. take an 90th percentile soil and combine with an average weather situation for groundwater
  - many possibilities: pragmatic choices needed

  - very complicated issue also for FOCUS workgroups:

  e.g. FOCUS groundwater scenarios:

  take 80th percentile soil profile plus 80th percentile weather to get 90th percentile situation:

  80+80 = 90

Background: political level is usually not satisfied with average case

How to develop appropriate scenarios ?

(pragmatic approach)

- 4: select an exposure model and collect data
- 5: build the scenario

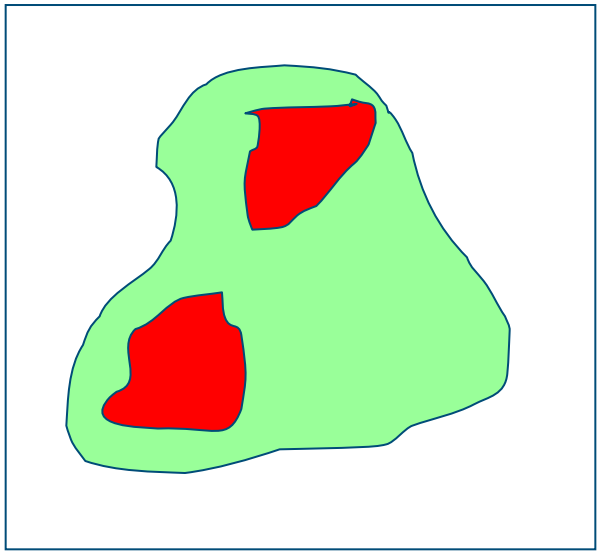
Regional differentation in pesticide registration acceptable ?

- regional differentiation: e.g. a pesticide can be registered for the Rift Valley but not for northern Ethiopia ?
- Ethiopia may be more diverse than European Union ?
  - Considerable climatic differences
- If yes, then develop different scenarios for different regions or states

Development of the scenarios: example FOCUS GW

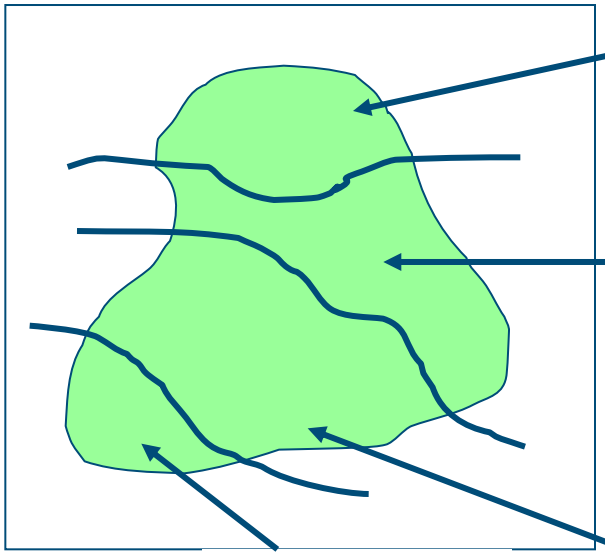
spatial overlays to identify areas of occurrence

Major agricultural areas



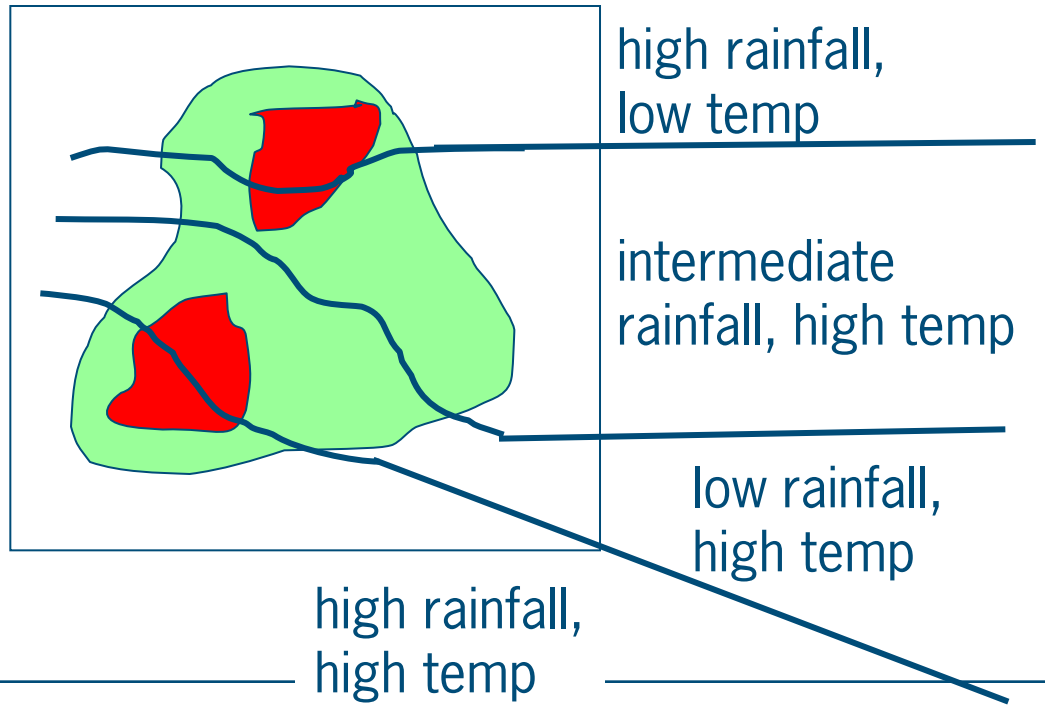
major agricultural activities

Climatic region (rainfall + temp)

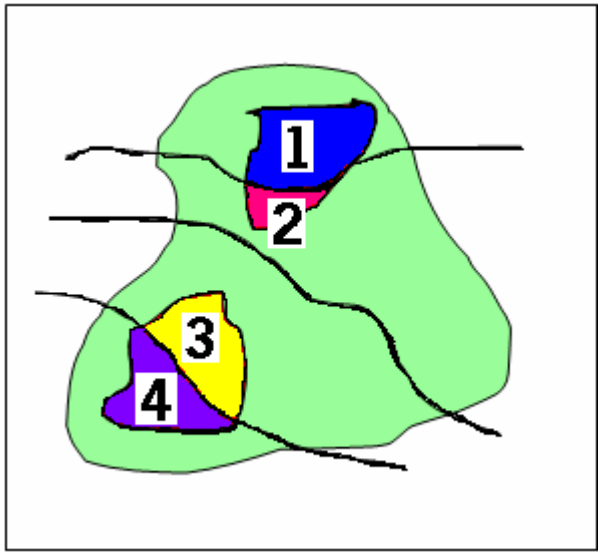


Development of the scenarios: example FOCUS GW

Identify per climate zone areas where agriculture exists

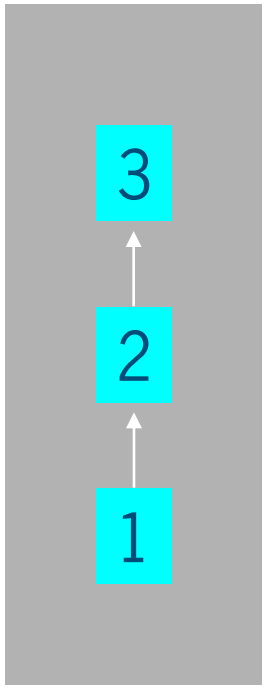


Identify in each area location with realistic worst case vulnerable soil to leaching (80th percentile)



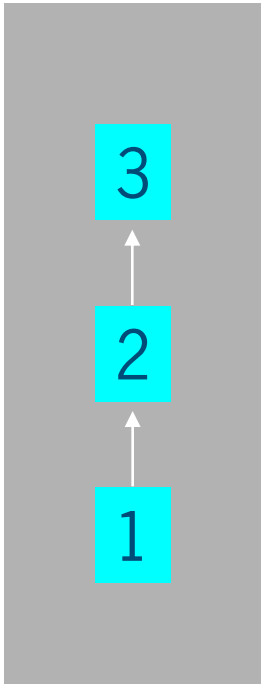
Representativeness of scenarios

- In EU exposure assessment: realistic worst case
- So scenarios have to be “representative for realistic worst case ”
  - NEVER in general representative
  - Unless political level is satisfied with “average situation”
- lower steps: conservative estimates for realistic worst case situations
- higher steps: less conservative estimates for realistic worst case situations
- scenarios do not need to be representative: more important is that they are conservative or protective enough



Representativeness of scenarios

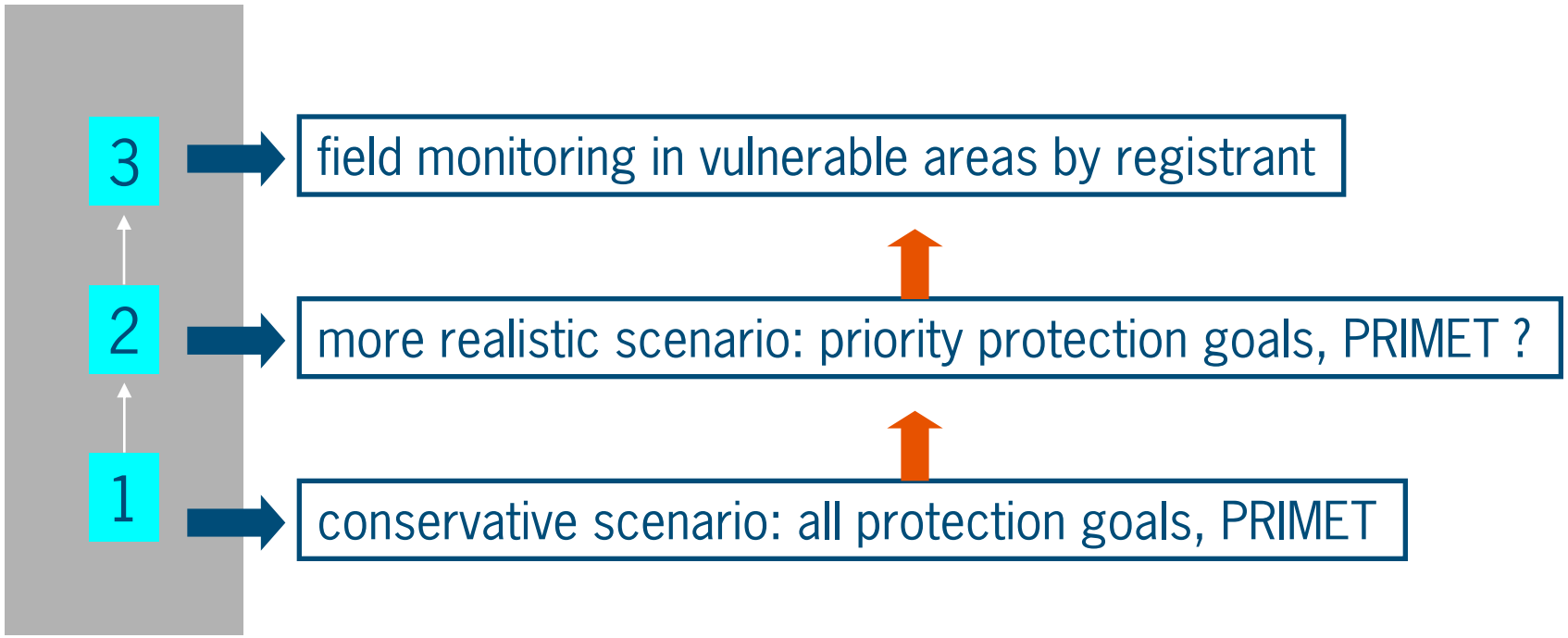
- Example: first tier of Dutch leaching flow chart:
  - scenario from Austria (other country)
  - not representative, but protective enough



leaching scenario for Netherlands

Proposed pragmatic approach for Ethiopia

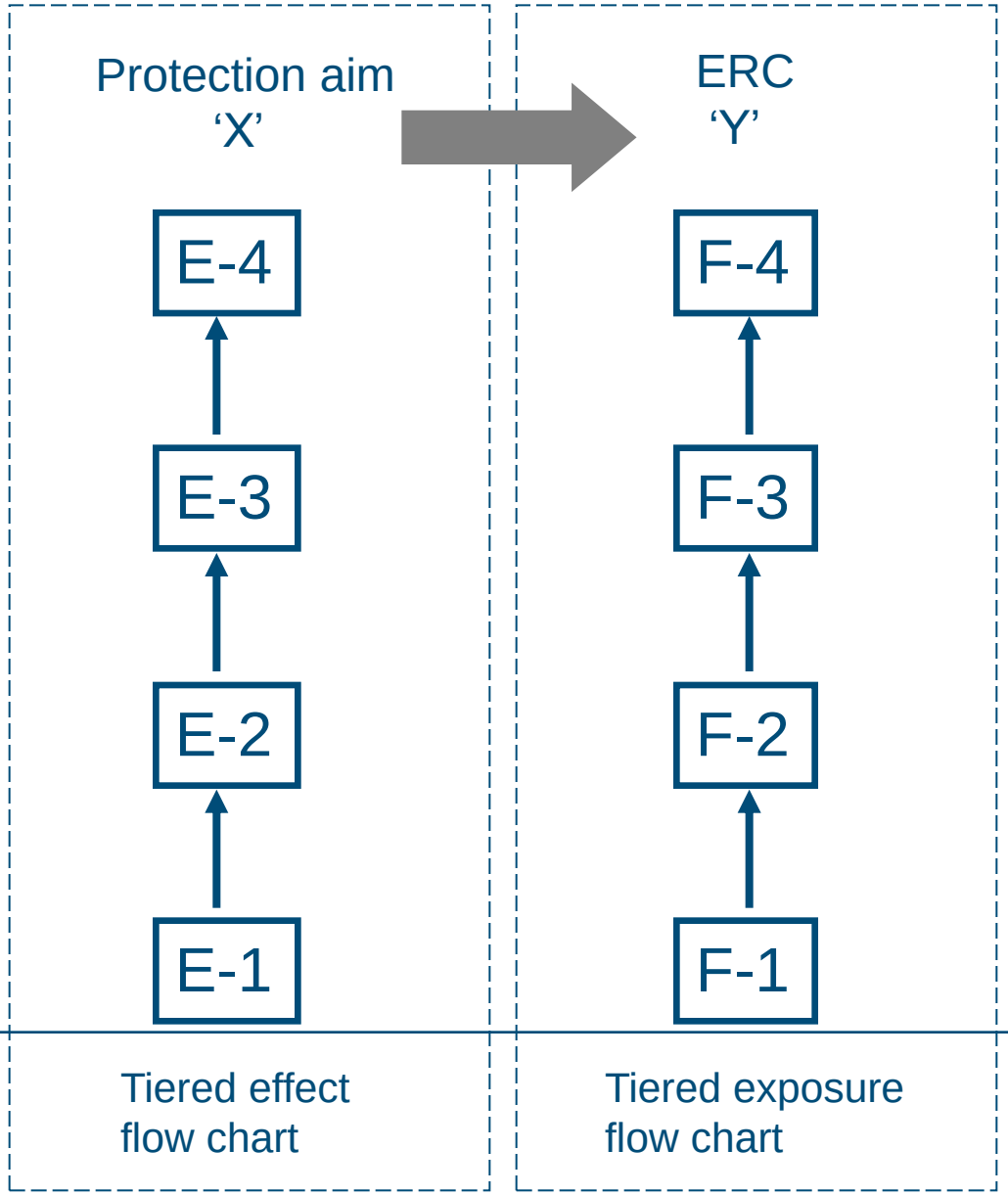
Start with 1st tier for all protection goals, 2nd tier for priorities and always offer option for monitoring in the field



End

Interface between fate and effects

- Risk assessment starts with desired protection goal
- Effect flow chart has to be linked to exposure flow chart
- Effect and exposure flow charts need to be based on same type of concentration: i.e. the **Ecotoxicologically Relevant Concentration (ERC)**



Interface between fate and effects

- Effect flow chart provides the relevant **Regulatory Acceptable Concentration (RAC)** level
- Exposure flow chart provides the relevant **Field Exposure Concentration (FEC)** level
- In the risk assessment different tiers of the effect and exposure flow charts can be linked