The Schäfertal Catchment

Ute Wollschläger, Frido Reinstorf, Hermann John & the UFZ-TERENO Team

TERENO AB-Meeting, 26/27 September 2011

WESS Water Earth System Science Competence Cluster

h2 Hochschule Magdeburg • Stendal

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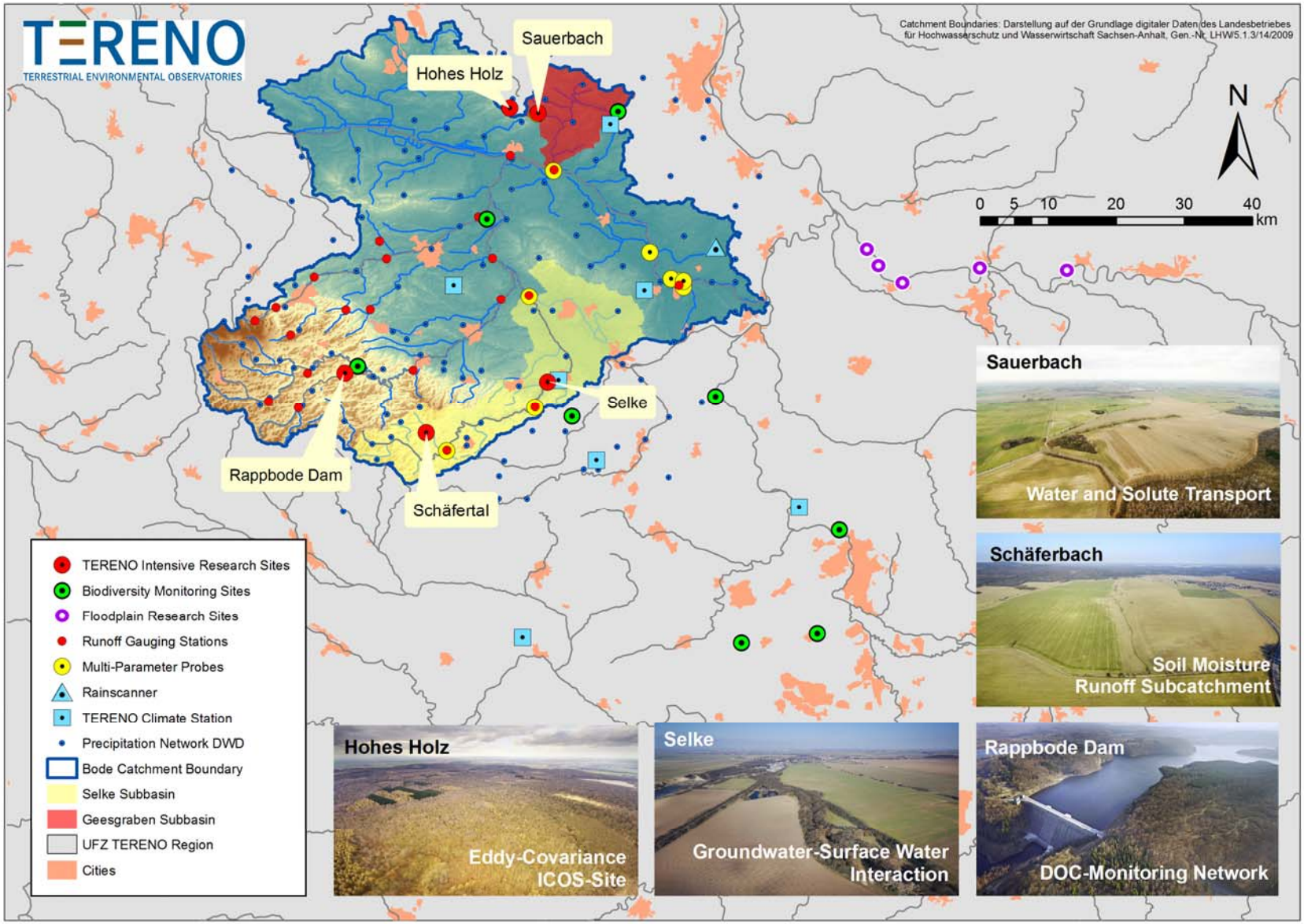
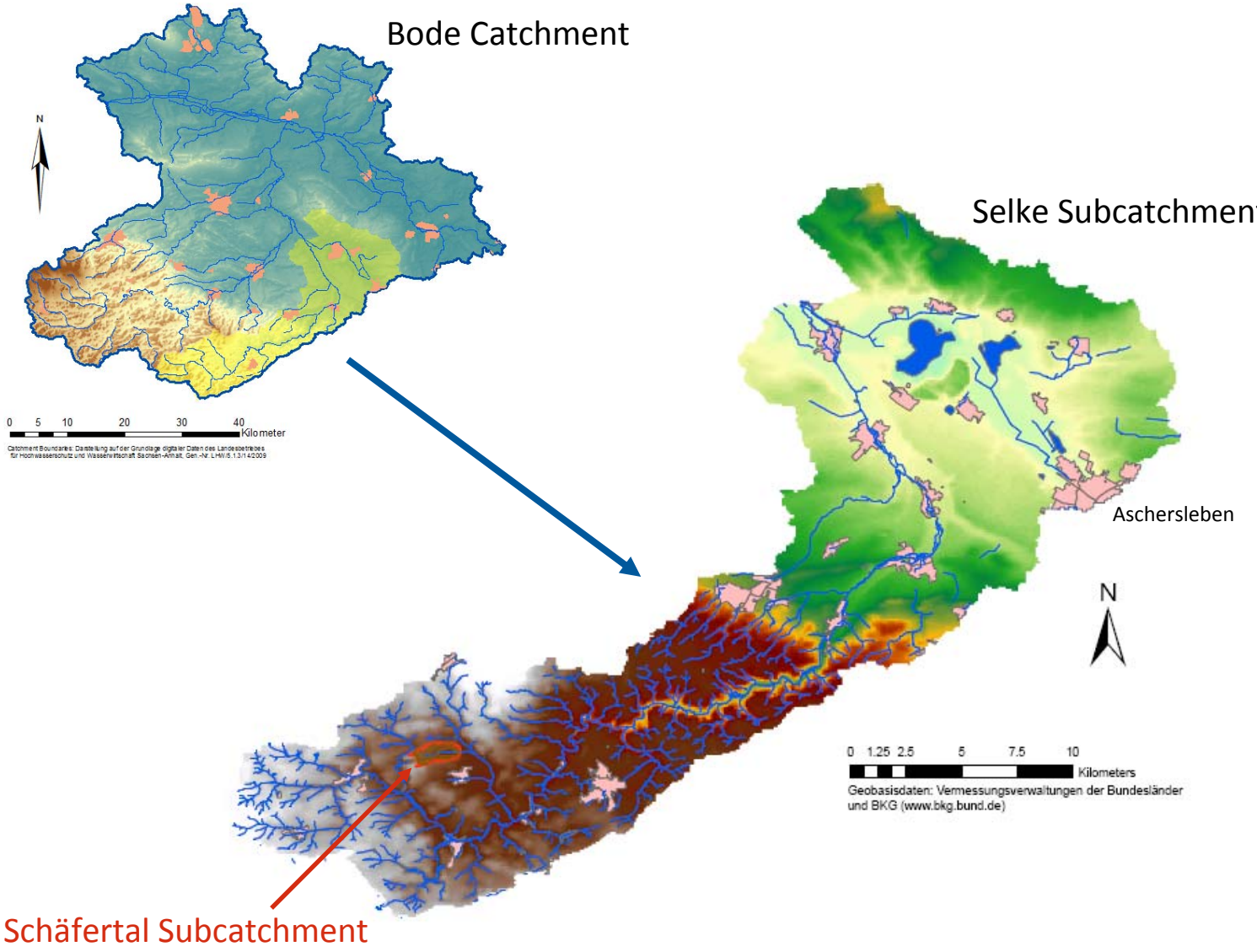
The Bode Catchment – Intensive Research Sites



The Schäfertal Catchment



The Schäfertal Catchment

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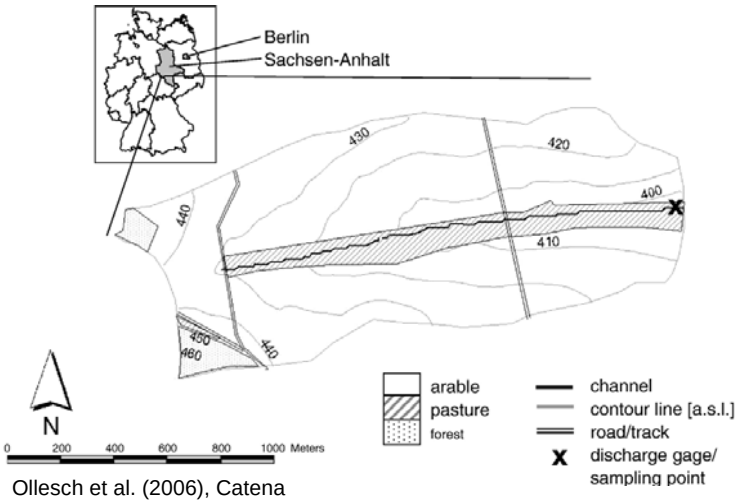
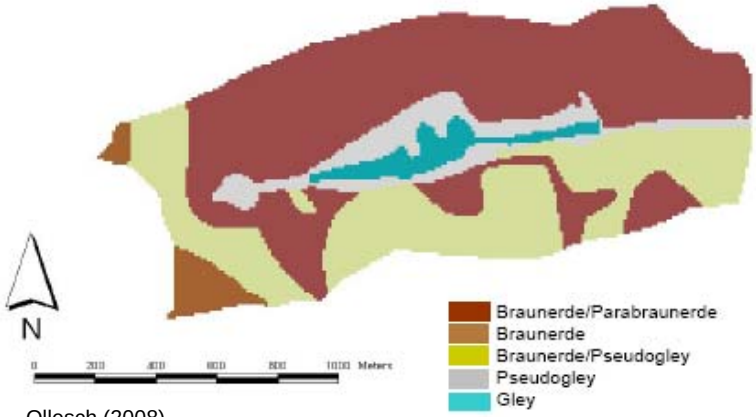
The Schäfertal Catchment



Ollesch et al. (2006), Catena



Ollesch (2008)

catchment details:

catchment area: 1.44 km^2

elevation range 392 … 474 m a.s.l.

mean precipitation: 680 mm a^{-1} (1968…2006)

mean annual air temperature: 6.9°C

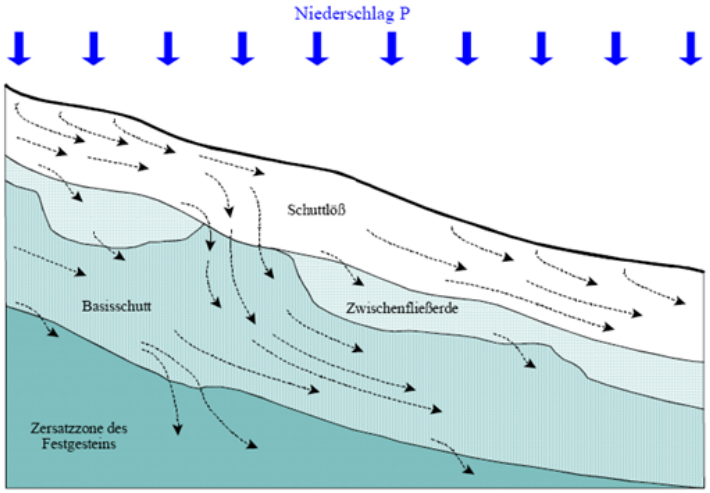
basin type: low mountain

landuse: 83% arable, 12% pasture, 3% forest

soils: cambisol, luvisol, gleyic luvisol

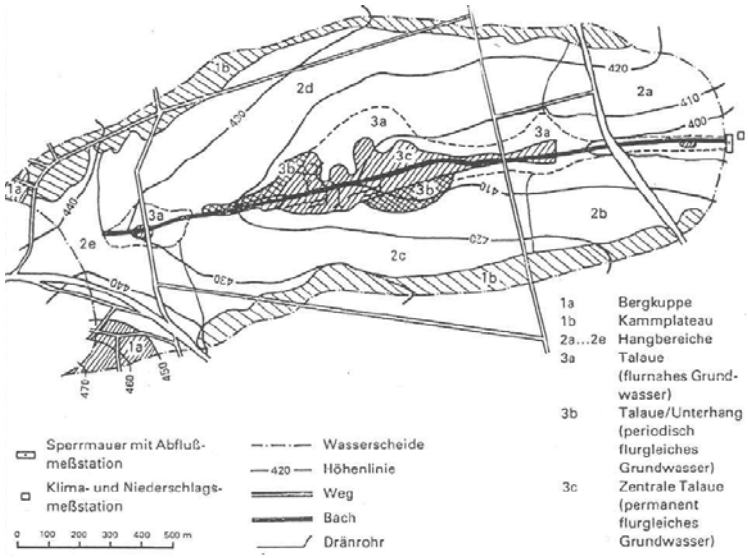
geology: paleozoic greywacke, argillaceous shale

The Schäfertal Catchment: Hydrology



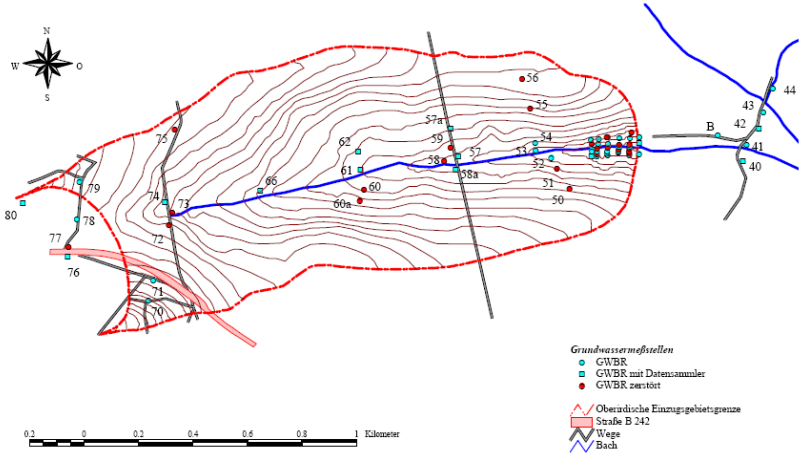
Wenk (2004)

- past times: lowering of groundwater levels due to mining activities; today: almost back on natural level
- interflow along hillslopes
- high importance of snowmelt



Borchardt (1982), PGM

The Schäfertal Catchment: Available Data



Wenk (2004)

Cooperation with University of Applied Sciences Magdeburg-Stendal:

- long-term continuous climate data since 1968
- soil moisture sensors, TDR, tensiometers
- 78 groundwater monitoring wells
- runoff gauging station with subsurface barrier (since 1968)
- surveys on snow height, snow water equivalent
- sediment yield, phosphorous, nitrogen, DOC / LC-DOC, T, EC in runoff at gauging station
- precipitation distrometer (Parsivel)

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Research Challenge –
Understanding the Functioning of the Terrestrial System Using Novel Observation and Modelling Techniques

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Understanding the Functioning of the Terrestrial System Using Novel Observation and Modelling Techniques – An Interdisciplinary Approach

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- Monitoring & modelling of water fluxes at the small catchment scale
- Biodiversity monitoring
- Soil-landscape modelling

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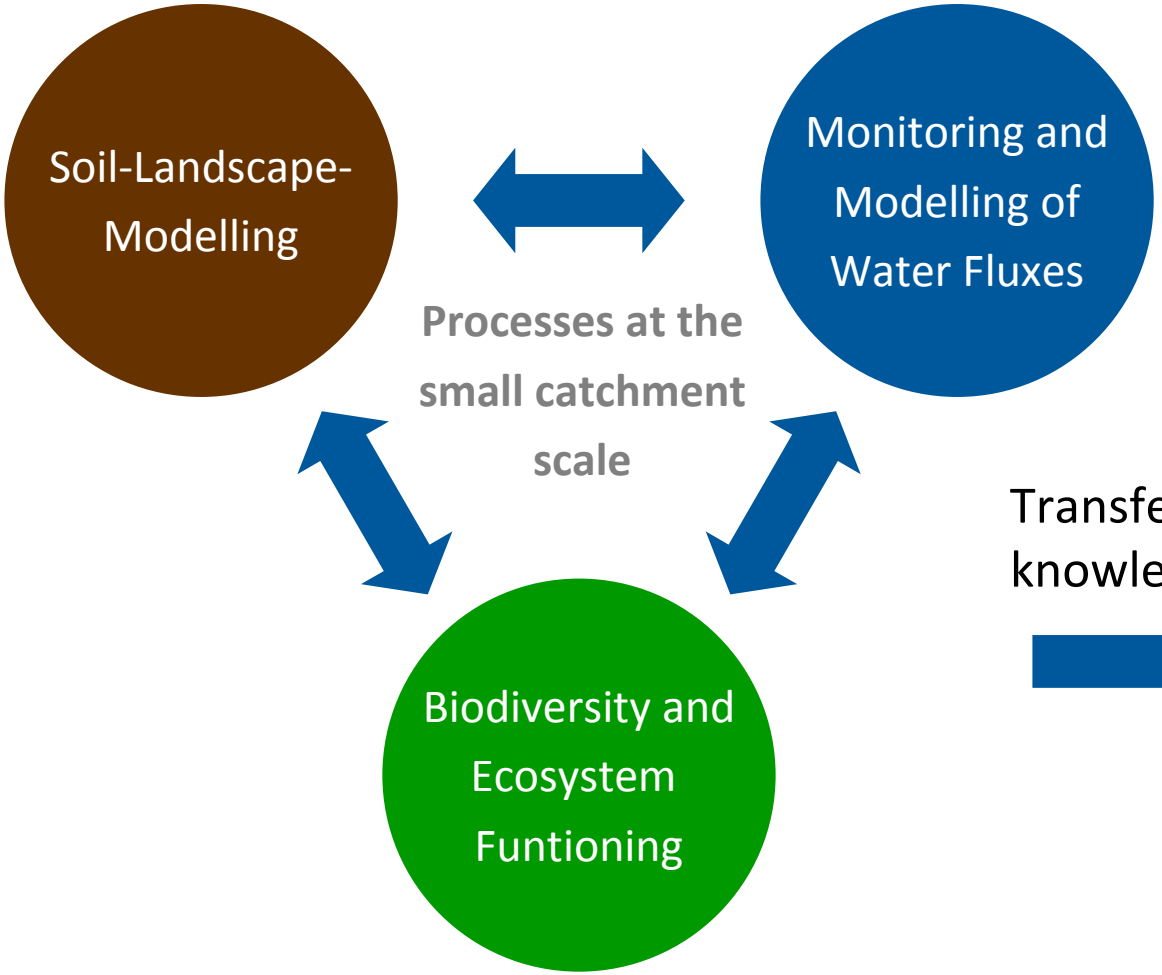
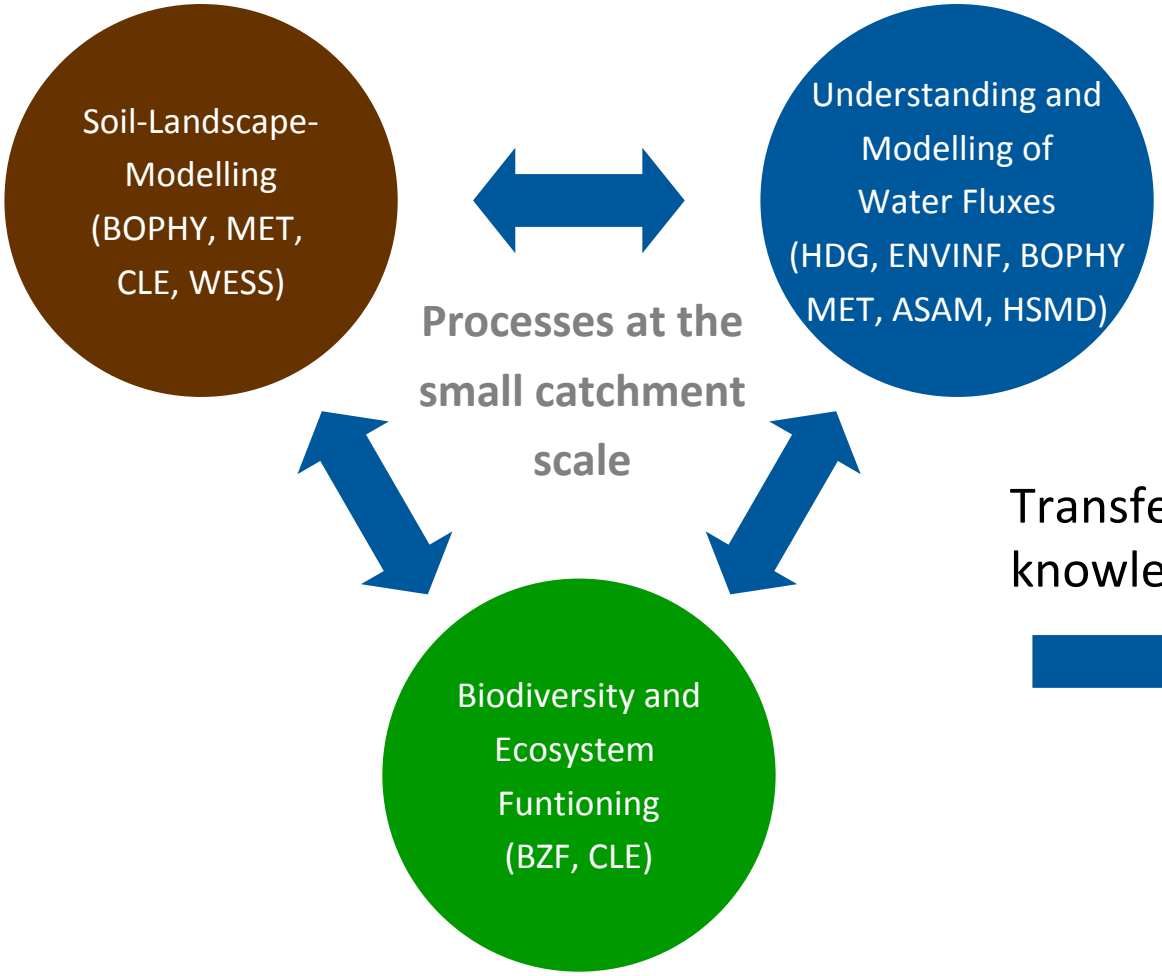
The Schäfertal-Approach



Transfer of knowledge

Bode-Catchment
TERENO-Network
Scientific Community

The Schäfertal-Approach



Transfer of knowledge

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Monitoring & Interpretation of Water Fluxes at the Small Catchment Scale

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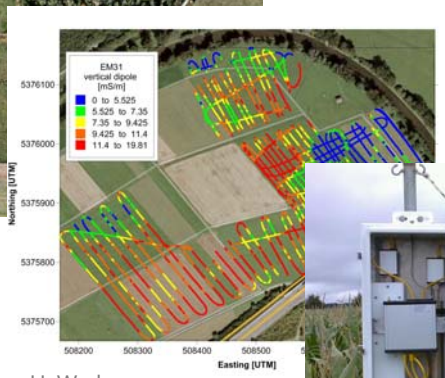
Multi-scale approach for monitoring soil water content (& snow)

→ lysimeters (SOILCan & VAMOS, running)

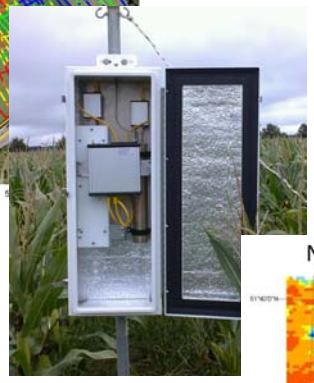
→ wireless soil moisture monitoring network (spring 2012)

→ geophysical monitoring campaigns



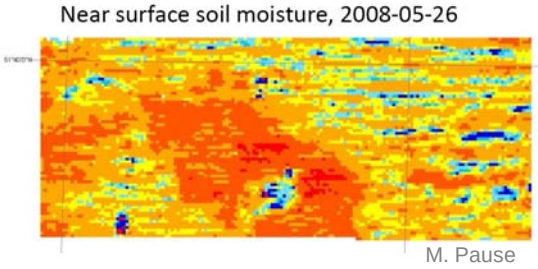
U. Werban

→ cosmic ray probes (installed in May 2011)



S. Oswald

→ airborne & spaceborne remote sensing (e.g. F-SAR & hyper-spectral RS campaigns)



M. Pause

point scale

small catchment scale

Biodiversity and ecosystem function research

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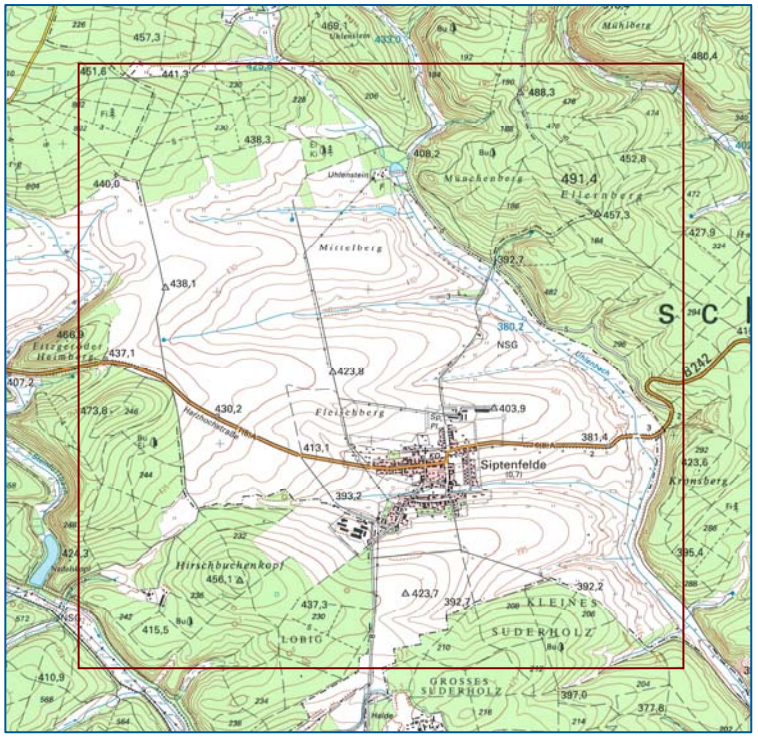
Assessment targets

- Land use and landscape structure (based on GIS)
- Soil (type, depth, quality, water retention)
- Vegetation analyses (145 permanent plots - composition, productivity, functional types)
- Organism groups (protocols of EU projects BIOASSESS and GREENVEINS)
  - Vascular plants
  - Bees, Hoverflies
  - Butterflies
  - Birds
- Genetic variation of selected species (microevolution; sensitive to landscape structure and land use intensity)



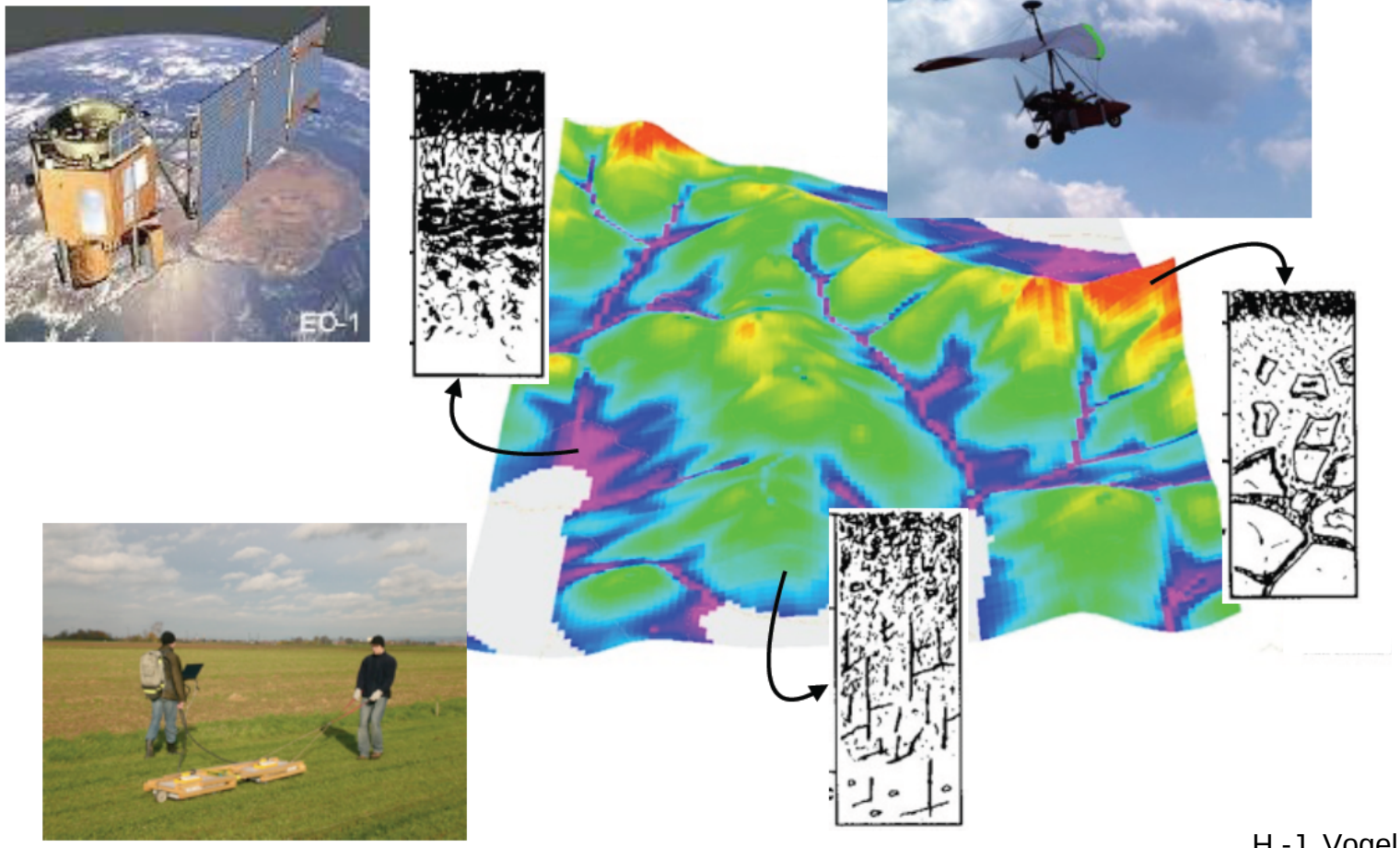
Cornelia Baessler, Mark Frenzel, Stefan Klotz – Dep. Community Ecology

Soil-Landscape Modelling

soil properties → spatially heterogeneous, but:

spatial distribution of soil types is not random (Jenny, 1942)

f(parent material, climate, relief, vegetation, age, …)

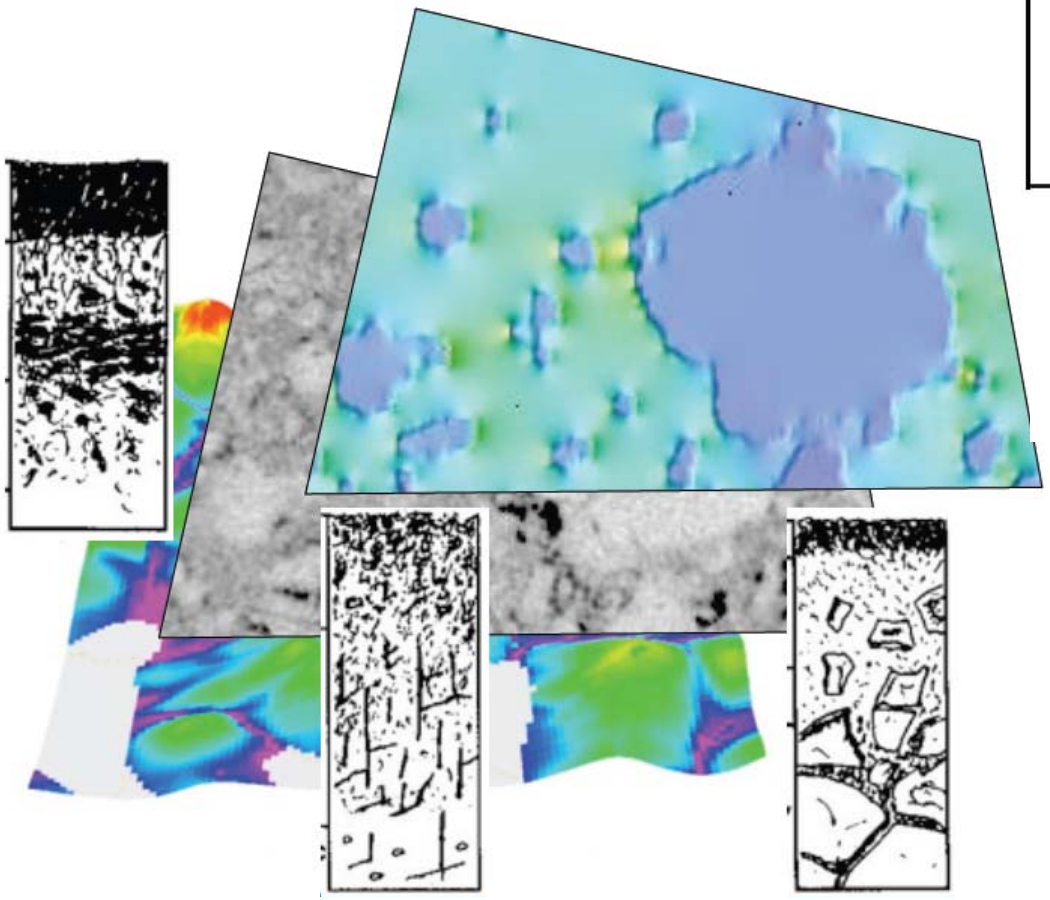


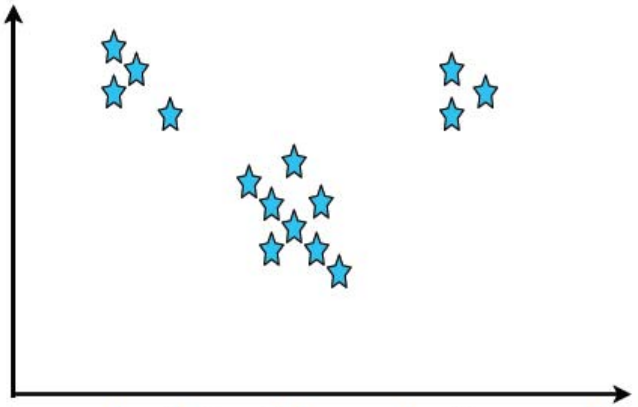
H.-J. Vogel

Soil-Landscape Modelling

different sensors

repeated surveys





purely data driven cluster analysis

combined with pedogenesis

and pedotransfer functions

H.-J. Vogel

Soil-Landscape Modelling

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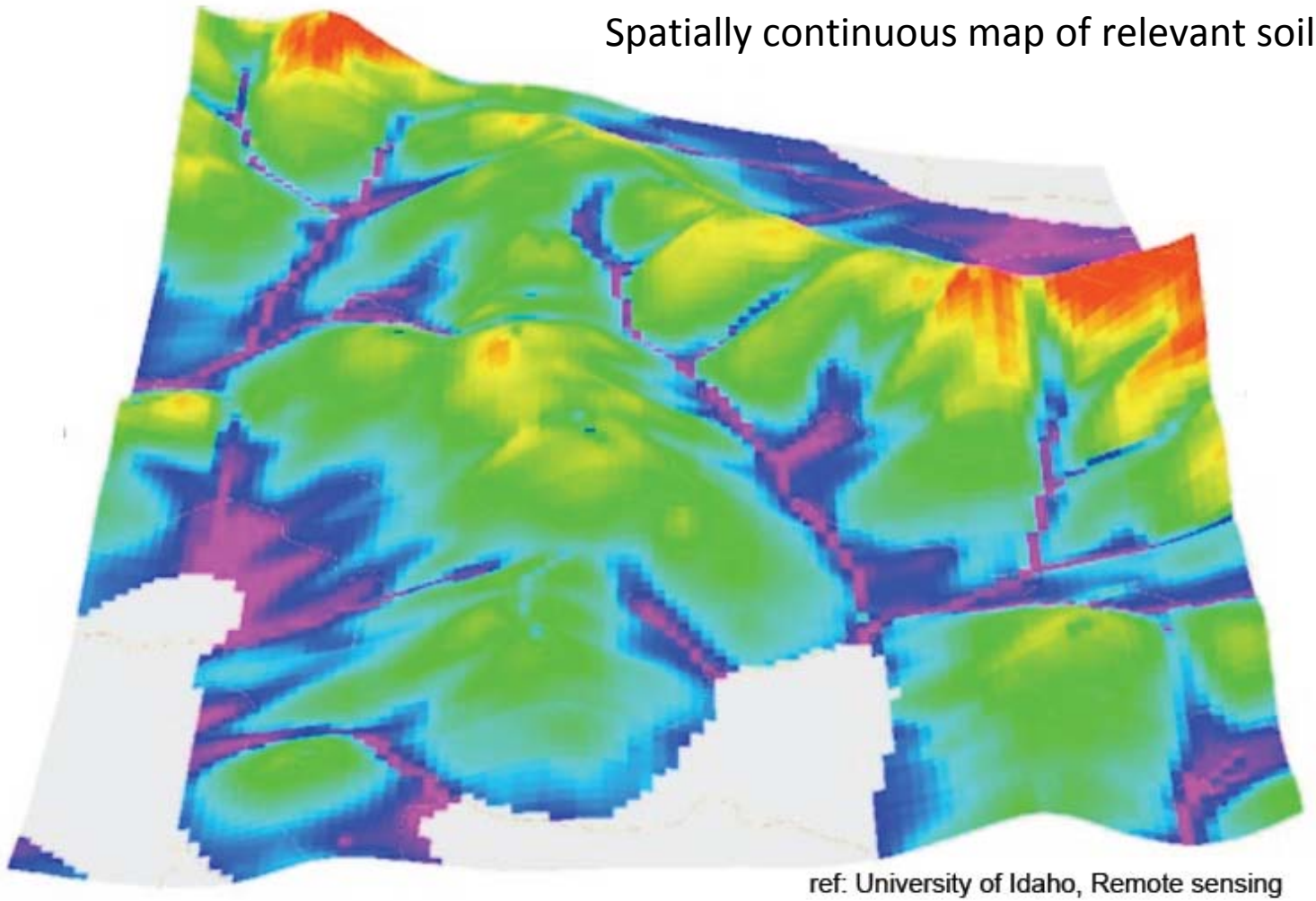
Spatially continuous map of relevant soil properties



ref: University of Idaho, Remote sensing

H.-J. Vogel

The Schäfertal-Approach – Work Packages

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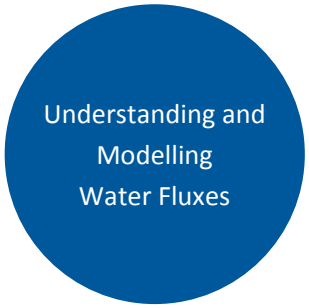
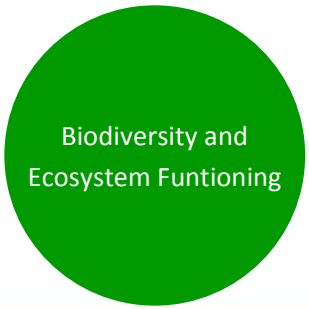


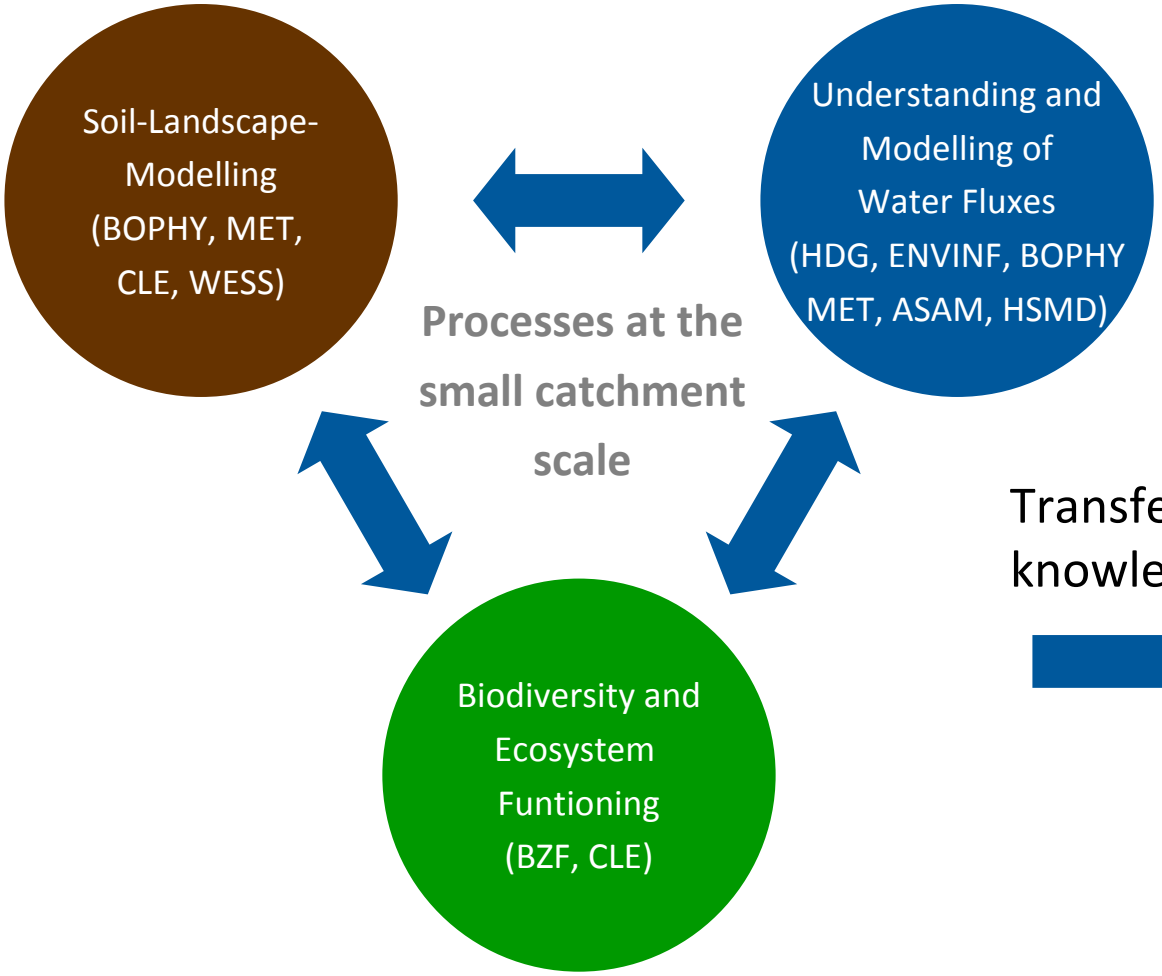
- Soil moisture dynamics at the hillslope scale
- Soil-atmosphere coupling
- Climate change effects on water balance using lysimeters
- Snowmelt-runoff-modelling
- Modelling solute transport and water quality
- Hydrological modelling

- Create spatially continuous map of relevant soil properties using a soil-landscape-model
- Catchment-wide characterization of the subsurface using geophysical measurement techniques
- Estimation of near-surface soil properties using remote sensing



- Analysis of changes in biodiversity and ecosystem functions in space and time
- Measurement of biochemical-physical vegetation parameters using remote sensing

The Schäfertal-Approach



Transfer of knowledge

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The Schäfertal – a research platform

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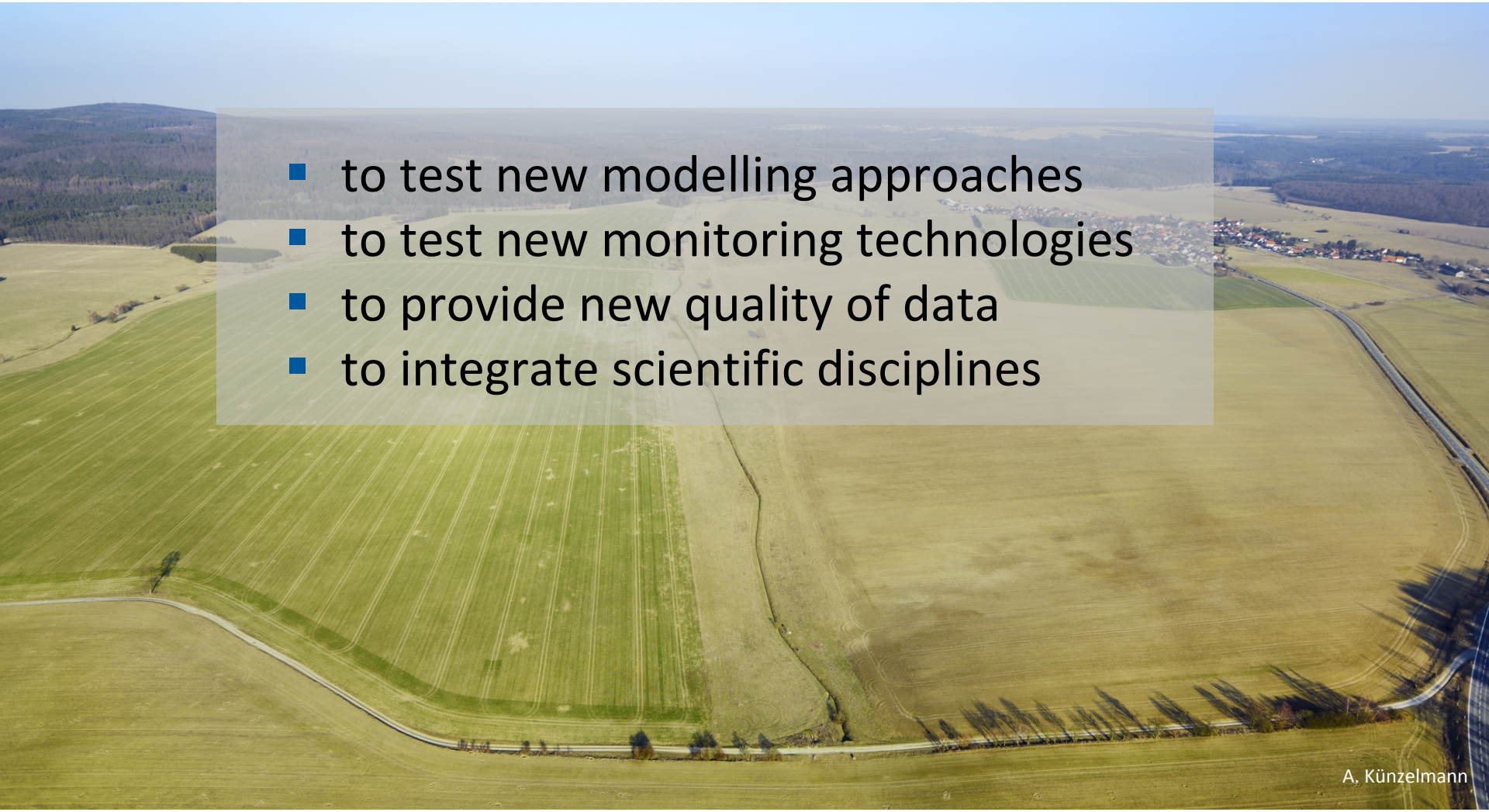

- to test new modelling approaches
- to test new monitoring technologies
- to provide new quality of data
- to integrate scientific disciplines