Model SWAT as an integrated management tool in water catchment Švihov

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Content

- Project introduction
- Water catchment
- Sources of nutrients
- Measured profiles
- Governmental data
- Data for SWAT
- Integrated management
- Discussion
Project introduction

- Supported by Technology Agency of the Czech Republic (TACR)
- „A comprehensive approach to reducing water pollution by reactive forms of phosphorus and nitrogen within a hydrologically defined part of the Švihov water reservoir catchment area“
- Project time: 6/2014 – 6/2017
Water catchment of Švihov water reservoir

- Area 1178 km$^2$
- Drinking water supply for 1.5 mil. people
- Pipeline system:
  - Tunnel length: 51 km
  - Diameter: 2.6 m

Source: www.vmap.cz
Point sources

- Waste water treatment plants (WWTP)
- Constructed wetlands
- Villages without WWTP
- Agricultural farms

Source: www.vces.cz
POINT SOURCES

Legend
- Agricultural companies
- WWTP
- Streams, water courses
- Water reservoirs, ponds
- Water catchment Trnávka

Source: ArcMap
Non-point sources

- Land Parcel Identification System (LPIS)
- Complex system of agricultural land
- Source of information about agricultural land in the Czech Republic
- Fertilizer calculation from dominant crop
- Under management of Ministry of Agriculture
- Data available for free download
Measured profiles – hydrological part

- 21 measured profiles (by hydrometer)
- Measurement of important water courses
- Acquired data:
  - Input data for water balance
  - Part of calculation of water pollution

Source: www.cksvv.vuv.cz
Measured profiles – chemical part

- Nutrient measurement in streams
- Historical (247) x Measured (125) profiles
- Profiles named according to the hydrological number of measured stream
- Chemistry monitoring: $P_{PO4^{3-}}$, $P_{total}$, $N_{NO3^{-}}$, $N_{ammonia}$, COD
- All data from field research
- Determination of endangered watersheds by high nutrient loads
- Subwatersheds divided by combination of outflow and chemistry
Profile Evidence

- Each profile has its own list of properties
- Catalogue of evidence cards
- Measurements will continue in chosen profiles (according to level of pollution)
### Odběrné místo:

**Odběrné místo – popis:**

**Přítok od Radějova**

**Odběrné místo – fotodokumentace:**

- Průtok: $[m^3.s^{-1}]$
- Průměrný roční průtok: $[m^3.s^{-1}]$

### Průměrný roční průtok

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<th>Rok</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
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<td>Průměrný roční průtok $[m^3.s^{-1}]$</td>
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### Chemismus vody:

<table>
<thead>
<tr>
<th>Měření číslo</th>
<th>Datum měření</th>
<th>$P-PO4^-$ [mg/l]</th>
<th>$P_c$ [mg/l]</th>
<th>$N-NO_3^-$ [mg/l]</th>
<th>$N_{nit}$ [mg/l]</th>
<th>CHSK [mg/l]</th>
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### Počasí při odběru

<table>
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<tr>
<th>Datum odběru</th>
<th>Počasí</th>
<th>Teplota</th>
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<td>Zataženo a přeháňkami</td>
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Data for SWAT

• Public
  – Available for download (Corine, HEIS VUV, LPIS, ...)

• Non-public
  • (weather data, soil map, management, outflow, chemistry, ...)
    – For free (for research purpose)
      • Available upon request (PVL)
  – Paid
    • Available upon request and payment (CUZK)
DEM

- Data from Czech Cadastre
- The model is based on the data acquired by altimetry airborne laser scanning of the Czech Republic territory between years 2009 and 2013
- total standard error is 0.18 m of height in the bare terrain and 0.3 m in forested terrain
  
Data for calibration

- Povodí Vltavy state enterprise
  - (http://www.pvl.cz/en)
    - Data in monthly step for 14 years
    - Chemical properties in 6 monitored profiles (water quality)
    - Water flow in 1 monitored profile
Management

• Corn, Rape, Potatoes
• High rate of erosion
• High surface runoff
• Calibrated model + different management = optimal combination
• Fast growing wood, grassland, etc...
Directive Water Management Plan

• „The aim of water management planning is the improvement or maintaining of the so called good status of surface and subterranean water and aquatic ecosystems“

• WWTP, point sources, etc... - in detail

• Agricultural management – in general

• SWAT = Agricultural management in detail

should make directives more efficient
The Nitrates Directive

- Defines limits for fertilizing for different crops
- Protection of waters against pollution caused by nitrates from agricultural sources
- Obligatory for this area – catchment of drinking water reservoir
- Changes at least every four years

Source: www.zahradni-hnojiva.cz
Discussion

• Is SWAT acceptable as an integrated management tool?
  • Improve management (efficient for farmers)
  • Data quality (not precise)

Source: www.fotocesko.cz
Thank you for your attention.

Source: www.fotocesko.cz