

<b>20.STONE</b>	
<b>FAIRWAY partner: Koos Verloop (Wageningen University and Research, NL)</b>	
<b>Brief description</b>	
A nutrient emission modelling system (STONE) designed for evaluation at the national and regional scale of the effects of changes in the agricultural sector (e.g. changes in fertilizer recommendations and cropping patterns) and in policy measures (e.g. EU nitrate directive for ground water) for the leaching of nitrogen (N) and phosphorus (P) from agricultural land areas to ground water and surface waters.	
<b>Contaminants covered (e.g. nitrate, pesticides etc.)</b>	N, P
<b>Intended end users (e.g. farmer, water quality manager, policy maker)</b>	Used by researchers to advise policy makers
<b>Level of expertise and/or training required</b>	Expert users only
<b>Geographical resolution (e.g. field, catchment, national)</b>	National and regional scale
<b>Temporal resolution (e.g. daily, annual, long-term).</b>	Long-term
<b>Real-time component (e.g. live weather data, soil moisture data feeds etc.)</b>	None
<b>Number and type of mitigation measures included</b>	Various policy measures to reduce nutrient emissions to ground water and surface waters (e.g. MINAS system), may be specified, which can be translated into data on the number of various farm animals and their manure excretion.
<b>Platform (e.g. paper-based tool, phone app, bespoke software).</b>	Software tool used by researchers
<b>Frequency of updates</b>	
<b>Cost/availability</b>	
<b>Number of users or number of copies distributed/downloaded/purchased</b>	
<b>Links to demo material and other relevant information (e.g. user guides).</b>	
<b>Additional comments</b>	

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<b>Input data required to run the DST</b>	Extensive input information is required by each model component (see Wolf <i>et al</i> , 2003)
<b>Outputs (including links to water quality and economic or financial aspects)</b>	The main outputs are: (1) main soil N and soil P processes; (2) immobilization of N and P in soils; (3) lateral fluxes of water, N and P to drainage systems and surface waters; (4) vertical fluxes of water, N and P to deeper soil layers and ground water; (5) N and P concentrations in shallow ground water. The output is given as a yearly average and its change over the 15-year period, and is specified for the 6405 STONE plots and for the 31 regions, covering the Netherlands as a whole.
<b>Age/provenance of supporting data used to develop the DST</b>	Details given in Wolf <i>et al</i> (2003)
<b>Country-specific calibration or data requirements (including restrictions on use)</b>	Nationally differentiated for soil type and geohydrology
<b>Details of validation and testing</b>	Details given in Wolf <i>et al</i> (2003)
<b>Date developed/released (or planned release date)</b>	1998
<b>Author/developer names and affiliations</b>	J. Wolf, A.H.W. Beusen, P. Groenendijk, T. Kroon, R. Rötter, H. van Zeijts (ALTErrA and RIVM)
<b>Member state(s) where developed</b>	NL
<b>Member State(s) where currently used</b>	NL
<b>Key publication references</b>	Beusen, A.H.W., Boogaard, H.L., Finke, P.A., Gehrels, B., Groenendijk, P., Van Jaarsveld, J.A., Knol, O.M., 1998. User's guide STONE 1.0 (in Dutch). RIVM report. RIVM, Bilthoven, the Netherlands. Wolf <i>et al.</i> (2003). The integrated modeling system STONE for calculating nutrient emissions from agriculture in the Netherlands. <i>Environmental Modelling &amp; Software</i> , 18, 597-617 <a href="https://www.sciencedirect.com/science/article/pii/S1364815203000367?via%3Dihub">https://www.sciencedirect.com/science/article/pii/S1364815203000367?via%3Dihub</a>

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Any other useful information (e.g. screenshots of DST input/outputs)

Overview of input data, modeled processes in different components, and output of the STONE modeling system.

