Hennen, W. van Leeuwen, T.

Abstract number–48 Assessing nitrogen surplus for individual farms based on comparable farms: A genetic algorithms approach

WIL HENNEN & TON VAN LEEUWEN
Wageningen Economic Research, P.O. Box 29703, 2502 LS The Hague, the Netherland

The European and Dutch policy and legislation aim amongst others to reduce the concentration of nitrogen and phosphate in water bodies. This can be achieved by the reduction of surpluses of these minerals in the soil. In the project LMM, the national measurement network of the effects of the manure policy, data concerning in- and output of nutrients are collected on farms from the Dutch Farm Accountancy Data Network (FADN). These data are used in research where questions related to nutrient surpluses in relation to water quality are investigated.
FADN is a sample of a total population of farms (Agricultural Census). In the latter dataset, information on nutrient use and nutrient surpluses is not available. These missing data can be assessed from FADN on the assumption that conforming farm characteristics are similar.
The objective of this paper is to describe a model based on genetic algorithms that has to find a group of 5 dairy farms on sandy soil from FADN that matches a farm from the Agricultural Census. Not only individual similarity of each of the 5 farms is required, but also the group averages of the chosen characteristics have to be as similar as possible. In order to find this “best” group, the genetic algorithm of the model mimics an evolutionary process based on biological principles like cross-over, mutation and natural selection. The calculated averages for the relevant indicators are then used as proxy for the Agriculture Census farm.
In this paper the results of an application on dairy farms on sandy soil in the Netherlands concerning the surpluses of nitrogen per hectare will be presented. For all dairy farms on sandy soil in the Agricultural Census the surpluses of nitrogen per hectare will be assessed. Next a geographic map is constructed to show the levels of nitrogen surplus of all locations these farms. This map together with additional geographical information like water quality and farm characteristics can then be used as input for (spatial) analysis to better understand the relation between farm type, nitrogen surpluses and water quality and contribute to finding ways to reduce surpluses by adapting farm management.

Thornton, C.M.Elledge, A.E.Shrestha, K.Wallace, S.Bosomworth, B.

Abstract number–49 The Brigalow Catchment Study: The impacts of developing Acacia harpophylla woodland for cropping or grazing on hydrology, soil fertility and water quality in the Brigalow Belt bioregion of Australia

C.M. Thornton, A.E. Elledge, K. Shrestha, S. Wallace, B. Bosomworth.
Department of Natural Resources and Mines, PO Box 1762, Rockhampton Q 4700, Australia.
e-mail: Craig.Thornton@DNRM.qld.gov.au

The 36.7 Mha Brigalow Belt bioregion of northeastern Australia is characterised by brigalow (Acacia harpophylla) vegetation on clay soils. Over half of the bioregion has been cleared, predominantly for agriculture. To quantify the effects of this land development on water and soil resources, the Brigalow Catchment Study (BCS) commenced in 1965. The BCS is a paired, calibrated catchment study consisting of three catchments of between 11.7 ha and 16.8 ha. The

catchments were monitored in their virgin state for 17 years prior to two catchments being cleared and developed for cropping (C2) and grazing (C3). A virgin catchment was retained as a control (C1). Post-development monitoring commenced in 1984 and has continued for 33 years.
Pre-clearing, average annual runoff from the catchments was 5% of annual rainfall. Peak runoff rates averaged 3.4 mm/hr. Deep drainage was <0.34 mm/yr. Post-clearing, runoff increased to 11% and 9% of annual rainfall from C2 and C3 respectively. Peak runoff rates increased by 96% from C2 and by 47% from C3. During development, deep drainage increased to 59 mm/yr from C2 and 32 mm/yr from C3. Once the land uses were established, deep drainage from C2 remained above pre-clearing levels at 19.8 mm/yr; however, deep drainage from C3 was similar to pre-clearing at 0.16 mm/yr.
No change in soil organic carbon (OC), acid or bicarbonate extractable phosphorus (BSES P and Colwell P respectively) occurred in C1; however, total nitrogen (TN) increased between 2008 and 2014 in response to record rainfall. TN declined by 61% over 26 years post-development in C2; however, record rainfall and legume ley pastures grown from 2010 to 2014 restored this to 75% of virgin levels. TN declined by 37% over 32 years post-development in C3. In the same period OC declined by 46% in C2 and 8% in C3. Development increased BSES and Colwell P by 2.2 and 2.5 times virgin levels, respectively. BSES P has since declined by 59% in C2 and 66% in C3. Colwell P has declined by 54% in C2 and 64% in C3.
Runoff from C1 contained an average of 81 kg/ha/yr of total suspended solids (TSS), 2.61 kg/ha/yr of TN and 0.08 kg/ha/yr of total phosphorus (TP). Post-development, C2 loads of TSS increased by 645%, TN by 42% and TP by 253%. In C3 loads of TSS increased by 146% and TP by 721%; however, TN load was only 43% of C1.
The BCS has clearly shown the changes in hydrology, soil fertility and water quality resulting from developing brigalow lands for agriculture. In addition to meeting the aims of the study at its inception, multi-disciplinary research has enabled the study to answer other questions. It functions as an “outdoor laboratory” providing data and whole-of-system understanding for model development, validation and calibration. The 50 plus year record of this long-term study can be considered a model in its own right and a sentinel site for management and climate impacts within the Brigalow Belt. It will continue to answer questions that we have yet to ask.

Bleeker, A. van Grinsven, H.

Abstract number–51 Evaluating the Dutch fertilizer and manure policies: How successful were they in reaching the targets of the Nitrate Directive and Water Framework Directive?

A. BLEEKER & H. VAN GRINSVEN
Sector Water, Agriculture & Food, PBL Netherlands Environmental Assessment Agency, PO Box 30314, 2500GH, The Hague, The Netherlands
e-mail: albert.bleeker@pbl.nl

The agricultural sector in the Netherlands belongs to the most productive and efficient in the world. The export value of agricultural and horticultural products is the second largest (behind USA) exporting country in the world. However, it is also one of the most intensive sectors with high inputs of fertilizer and feed.

The downside of implementing such an intensive system in the Netherlands, is that problems related to nitrate and phosphorus in ground- and surface waters became apparent over the years.