SOIL ACIDITY UPDATE 2022-2023

Summary Report
June 2023

PHOTO: *Lime trial,* Strathbogie SoilCare Group.

Goulburn Broken catchment

Australian Government | National Landcare Program

GOULBURN BROKEN CATCHMENT MANAGEMENT AUTHORITY

from the ground up

This project is supported through funding from the Australian Government's National Landcare Program

Introduction

This report provides an update on the state of soil acidity in the Goulburn Broken catchment, and farmer actions towards its management. It combines soil test data collected in 2022-2023 and farmer survey data collected from 2019 to 2023, to assess the impact of soil acidity extension activities undertaken through the From the Ground Up project and provide a snapshot in time of soil pH levels across the catchment.

Why are we interested in soil pH?

Soil acidity influences chemical and biological conditions in soil. It influences the availability and toxicity of nutrients, impacting plant growth.

Soil acidity also influences microbial activity reducing biological processes such as organic matter turnover and nitrogen fixation (Botta, 2015), which can also impact plant growth.

Soil acidity varies across the Goulburn Broken Catchment according to factors such as soil parent material, rainfall, and age of the soil. We start to see aluminium toxicity (when aluminium is above 5%) when pH is 4.8 or less in calcium chloride.

For optimum pasture production in our catchment for this reason, topsoil ideally has a pH above 4.8 (CaCl2) (Botta, 2015).

While low soil acidity is a natural occurrence in many areas, agriculture has sped up the rate of soil acidification. This can occur due to historic and current practices such as the use of legumes, fertiliser selection, transition from perennial to annual pastures, and export of alkaline material which leaves the farm in all products e.g. meat, fodder, grain, milk, wool (Upjohn et al, 2005).

Goulburn Broken Regional Catchment Strategy (2021) soil pH target: pH above 4.8 (CaCl2), or at a level where available aluminium is below 5%

PHOTO: *Validating and managing grazing effects on nutrients on farm.* South West Goulburn Landcare Network.

From the Ground Up project 2018-2023

For the last five years, From the Ground Up was our primary investment opportunity to meet the Regional Catchment Strategy soil pH target. The project worked with farmers, industry, and community groups to improve soil health, native vegetation and biodiversity on farm to boost the region's agricultural productivity and profitability.

In the From the Ground Up project, the soil pH baseline was 4.8 (CaCl2). This baseline was derived from the median soil pH from 1,398 soil samples taken between 2011-17 from across the Catchment (Costin, 2019), and also informed the RCS target.

From the Ground Up project goal: 341 farmers across 4,569 hectares have adopted practices that maintain soil pH at or above the baseline level of 4.8 in CaCl2.

Soil sample collection and analysis

In 2022, Goulburn Broken CMA released an EOI for farmers to access 1-3 free soil chemical tests to a total of 200 tests. Farmers with up to 40ha were eligible for 1 test, 41-80ha - 2 tests, 81ha and above - 3 tests.

Soil samples were mostly collected from participating farms by Goulburn Broken CMA staff using Victorian DPI Property Snapshot 9 (2009) methodology whereby 25-30 10cm cores were taken from the sample area, bulked and sub-sampled. Soil samples were sent by post to Nutrient Advantage laboratory. Further comparable pH soil sample results collected through the project were also included.

241 samples were analysed for this report. Soil pH is reported in calcium chloride (CaCl2).

Results

Soil samples were collected across all Socio Ecological Systems (SES) (Figure 1) except for the Southern Forests SES, where no EOIs were submitted.

The median and mean pH from 241 samples was 5.0 (CaCl2) in 2022-2023, with a median and range variation across Social Ecological Systems. The results for each SES region are listed in Table 1.

In the higher rainfall region of the Upland Slopes SES, pH levels were mostly moderately to highly acidic (orange bars Figure 2). The acidic nature of the soils in this SES is well known due to rainfall and soil type, with many farmers raising it as a primary issue. 57% of soil samples (n 107) were below 4.8 (CaCl2). 42% of soil samples had aluminium levels over 5%, representing a significant constraint to plant production.

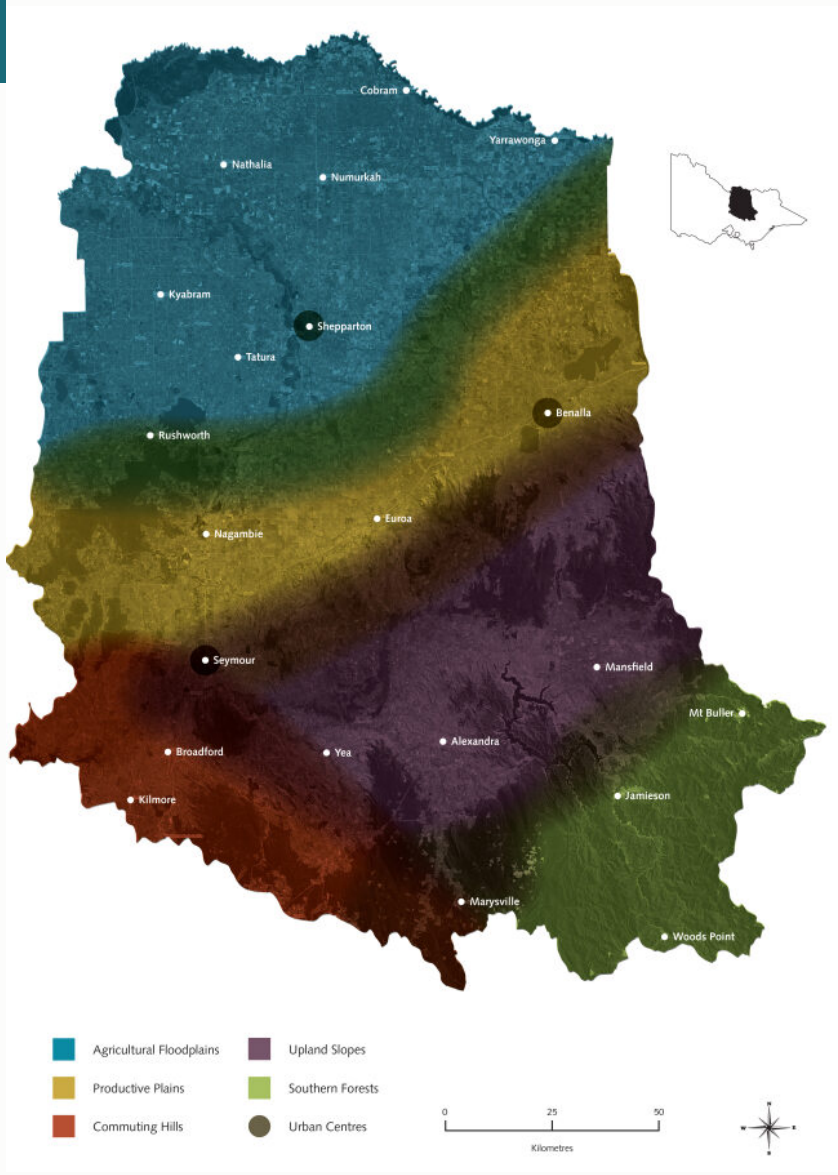

Figure 1. Socio Ecological Systems in the Goulburn Broken catchment.

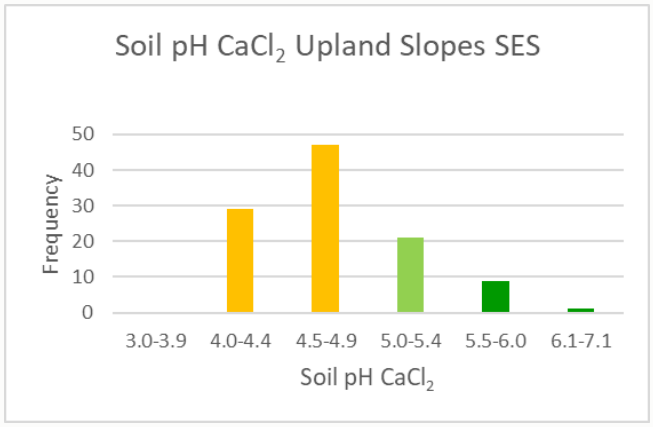

Figure 2. Soil acidity in the Upland Slopes SES.

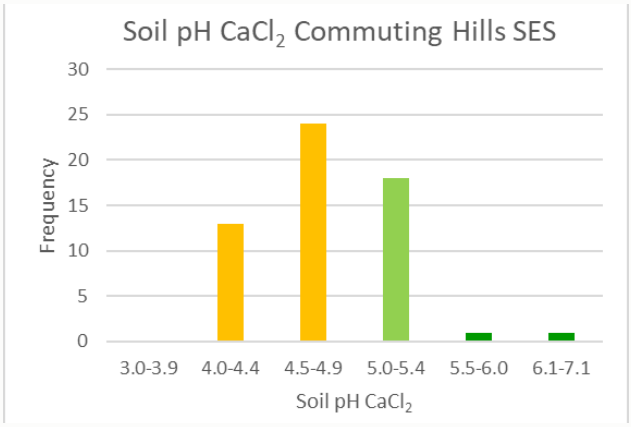

Figure 3. Soil acidity in the Commuting Hills SES.

Table 1. Soil acidity figures from each Social Ecological System.

SES	No. samples (n)	Average pH (CaCl2)	Median pH (CaCl2)	Range pH (CaCl2)
Agricultural Floodplains	29	5.7	5.6	4.9-7.1
Productive Plains	48	5.1	4.9	4.4-6.8
Upland Slopes	107	4.7	4.6	4.1-6.7
Commuting Hills	57	4.8	4.9	4.2-6.2
Southern Forests	*Not tested*	-	-	-
Total	**241**	**5.0**	**5.0**	**4.1-7.1**

Similar to the Upland Slopes SES, the Commuting Hills SES had soils in the range of 4.0-4.9 (CaCl2) with 34% of soil samples with pH below 4.8 (CaCl2) (n 57) (Figure 3). 27% of soil samples had aluminium levels above 5%. Soil acidity in this SES is also well recognised.

All soil tests in the Agricultural Floodplains SES were above the target level of 4.8 (CaCl2) (n 29), with a range 4.9-7.1 (CaCl2), and median pH 5.6 (CaCl2) (Table 1). This was not unexpected given historic sampling reported in earlier projects which highlighted that soil acidity is not a strong issue in Agricultural Floodplains SES. This may be due to the relatively lower annual rainfall and therefore reduced leaching of nutrients, soil type and management practices such as liming, however, no analysis of management practices or history were collected for this project. Aluminium was not an issue at any of the 29 sites/samples in this SES.

Soils sampled in the Productive Plains SES had pH ranging from 4.4-6.8 (CaCl2) with a median pH of 4.9 (CaCl2) (n 48). 70% of soils sampled were at or above the target pH of 4.8 (CaCl2), with 30% of soils strongly acidic with a pH below 4.8 (CaCl2). This corresponds with 20% of soil samples having aluminium levels above the 5% threshold, representing a risk to plant production.

Across the whole catchment, samples with high aluminium (5% or above) had pH of 4.8 (CaCl2) or less (Figure 4).

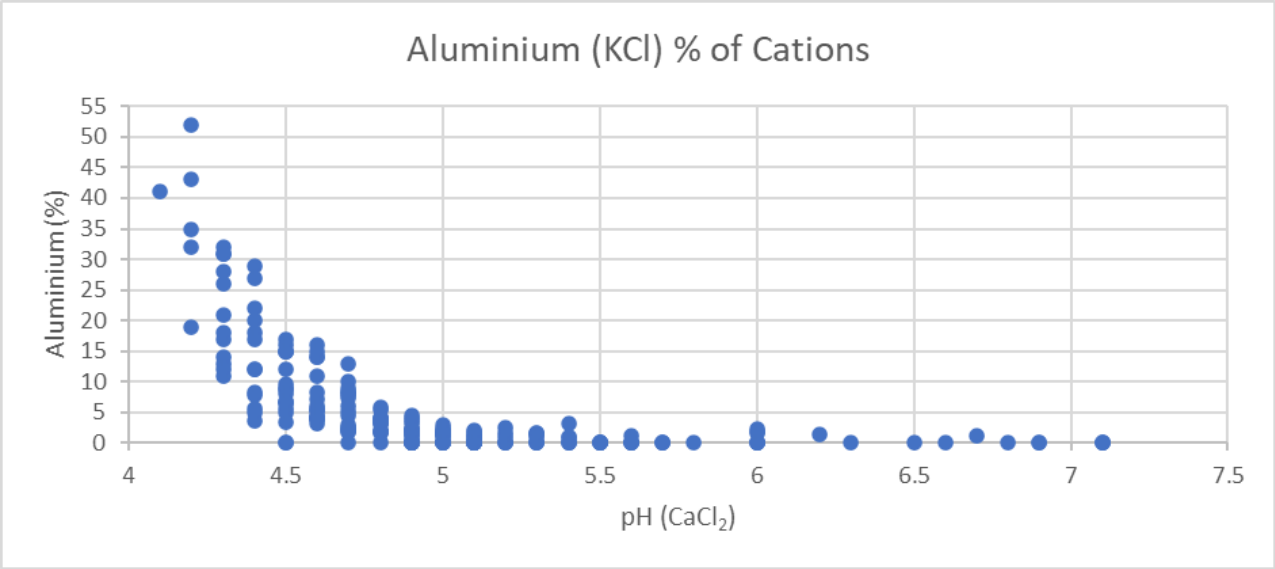

Figure 4. Relationship between soil pH and aluminium (%) in the Goulburn Broken Catchment (2022-23).

Evaluation surveys

850 people participated in From the Ground Up soil acidity-related extension activities between 2018-2023. Of these, 616 were farmers managing over 150,000 hectares.

255 event evaluation surveys were collected from 17 soil acidity-related workshops and field days across the catchment.

Evaluations were completed by farmers consisting of beef, grain, sheep, dairy and other industries (72%) and service industry workers, including agronomists and consultants (28%). Service industry workers indicated they would engage a further 1,300 people with information about soil acidity gained from project activities.

Before participating in project activities, participants rated their understanding and skills of soil acidity and its management at 5.3 out of 10 (n 159).

After the event participants rated their knowledge at 7.4 out of 10 (n 159).

Importantly, 86% (n 229) of respondents indicated they would do something different on their farm because of their learnings from events. 56 of these respondents nominated an area of 6,955 hectares that they would change or trial new practices related to soil managing soil acidity.

42% of survey respondents had a soil acidity target, with a majority of these aiming for a pH above 4.8 (CaCl2), and most commonly above 5 to neutral. 8% of respondents noted soil acidity was not an issue for them. While 42% of respondents had a pH target, 48% noted that they monitored their soil acidity through soil testing.

Conclusions

Soils sampled in each SES reflected the trends we would expect to see as governed by rainfall zone and soil type with soils in the Upland Slopes and Commuting Hills having a higher portion of results below pH 4.8 (CaCl2). However, the trend is less pronounced than in earlier reports (Costin, 2019). Whether this result is a consequence of extension activities and changed practices, we are not able to tell using this data.

There was a very positive shift in knowledge, awareness and skills reported from participants due to attending extension activities as part of the From the Ground Up project, with many participants expecting to implement management changes on their properties.

The evidence presented here indicates that the project met its goals for soil acidity, having engaged over 850 participants, 86% of whom reported that they expected to make changes to their management to address soil acidity, while the median and mean soil pH across the catchment was 5.0 (CaCl2).

References

Botta, C. (2015). Understanding your soil test step by step. Yea River Catchment Landcare Group. Shepparton, Victoria.

Costin, B. (2019). Goulburn Broken Soil pH Mapping Report. Victorian Department of Jobs Precincts and Regions.

Department of Primary Industries. (2009). Property Snapshots 9. Goulburn Broken RCS (2021).

Upjohn, B., Fenton, G. and Conyers, M. (2005). Soil acidity and liming. New South Wales Department of Primary Industries.

We would like to thank our delivery partners:
Agriculture Victoria
South West Goulburn Landcare Network
Strathbogie SoilCare Group
Strathbogie Tableland Landcare Group
Maize Association of Australia

For the full version of this report contact reception@gbcma.vic.gov.au