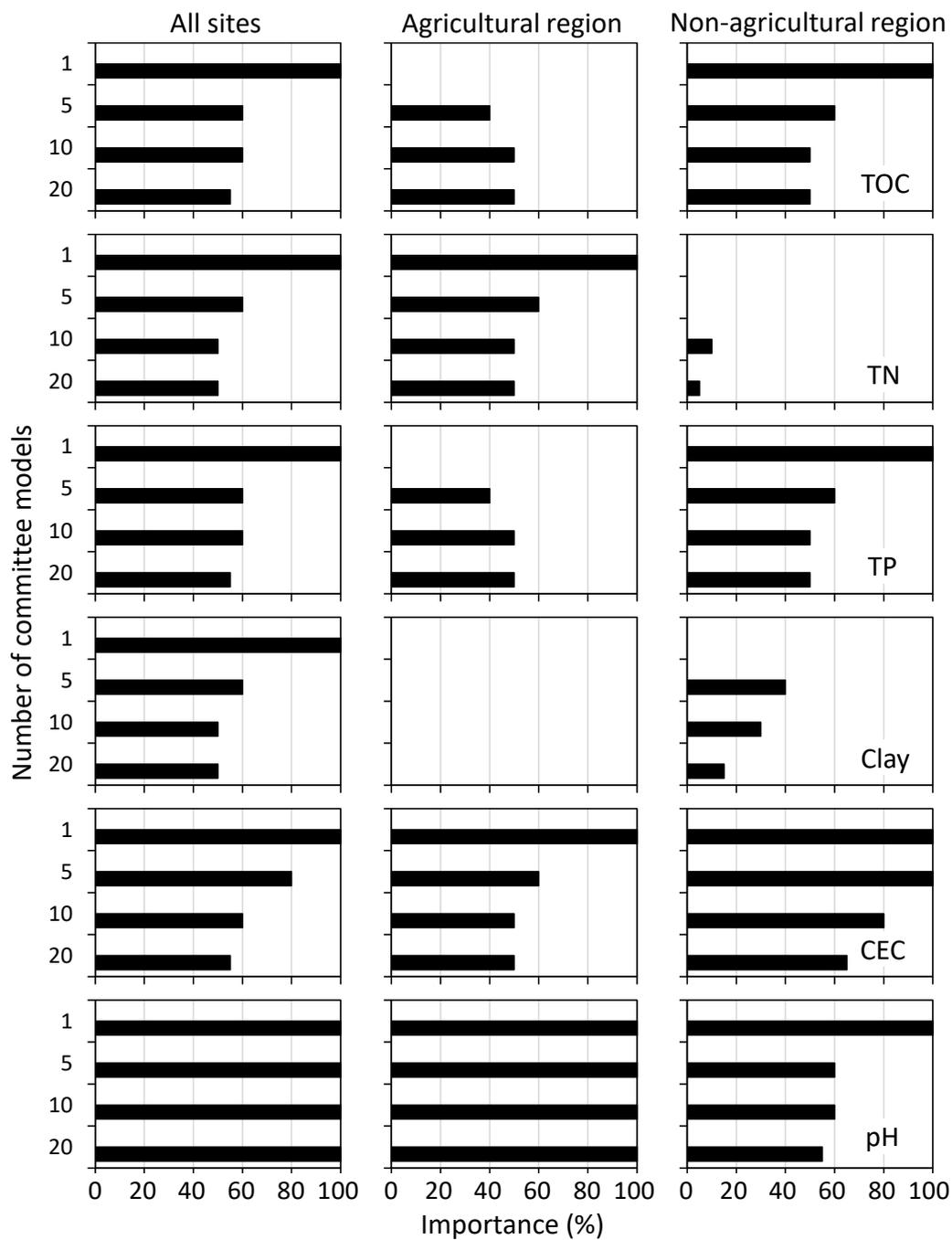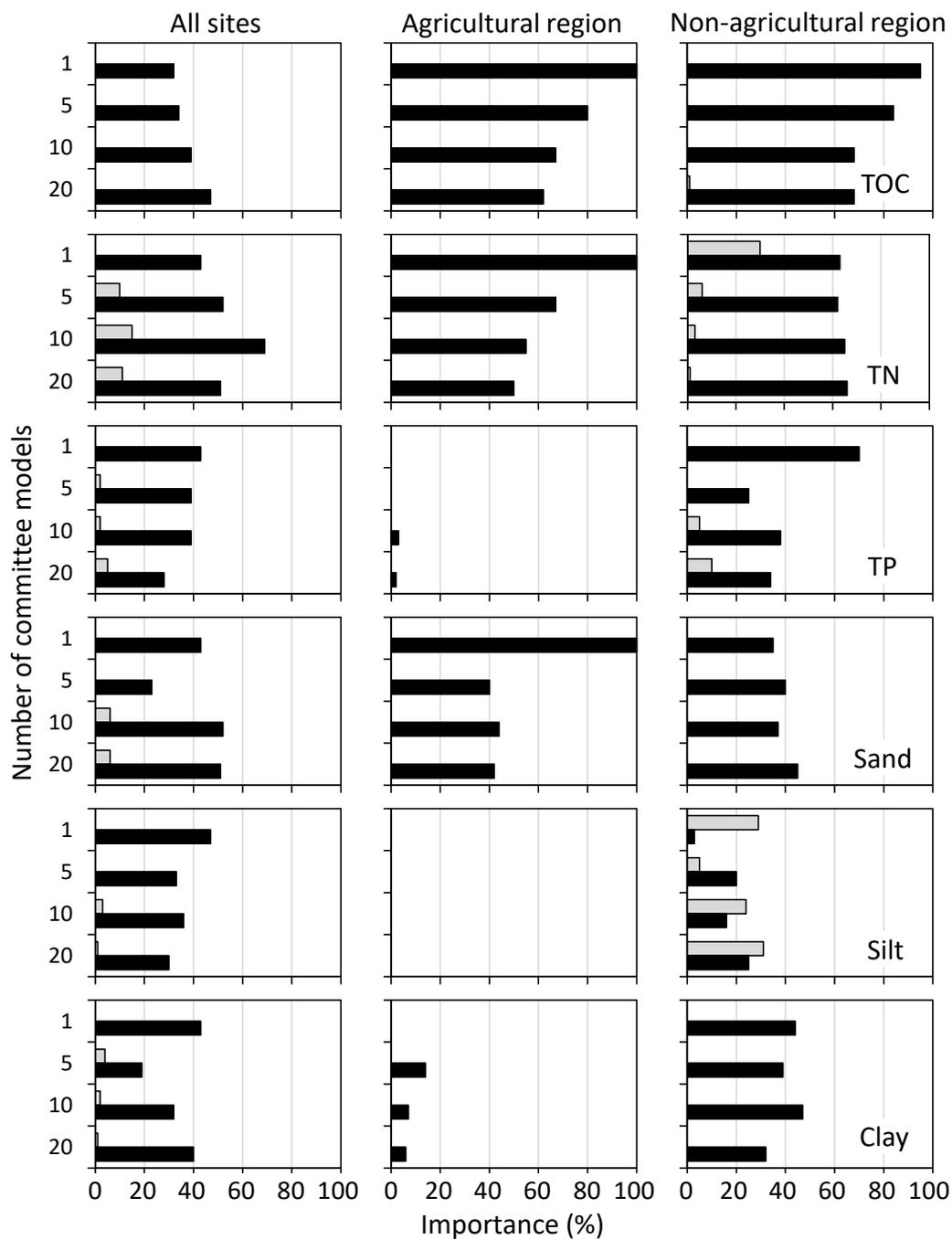**Supplementary Table 1.** Definition of land use classes in the data set (469 sites), based on the Australian Land Use and Management Classification.

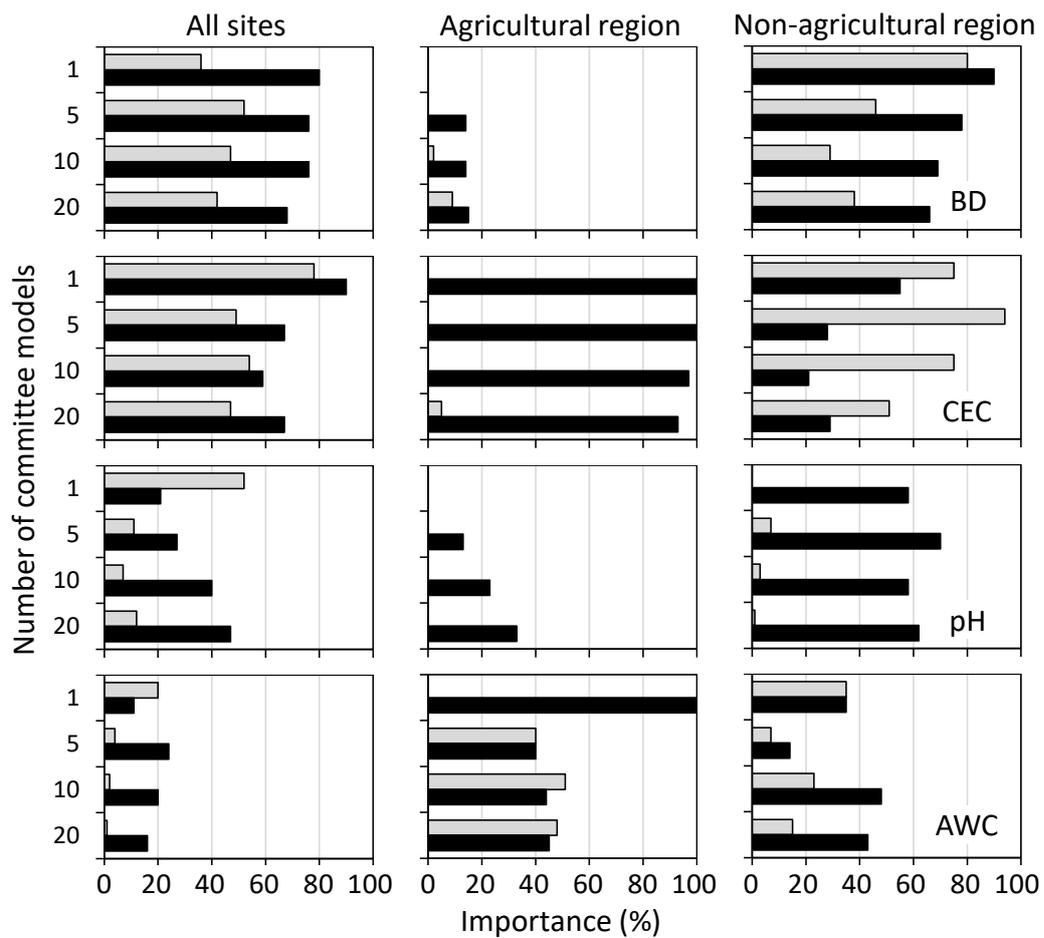| Broad land use | Detailed land use | Definition | n |
|---|---|---|---|
| Production from dryland agriculture and plantations | Cropping | Land that is under cropping | 16 |
| | Environmental forest plantation | Area managed for environmental and indirect production uses | 12 |
| | Grazing modified pastures | Pasture, both annual and perennial, for grazing | 45 |
| | Native/exotic pasture mosaic | Pastures followed by extensive active modification or replacement of native vegetation | 3 |
| | No defined use | Land cleared of intact native vegetation where the proposed land use is not known | 1 |
| | Plantation forests | Land on which plantations of trees or shrubs | 1 |
| | Seasonal horticulture | Crop plants living for less than two years that are intensively cultivated | 3 |
| Production from irrigated agriculture and plantations | Irrigated cropping | Land that is under irrigated cropping | 3 |
| | Irrigated grapes | Irrigated grapes | 2 |
| | Irrigated sugar | Irrigated sugar | 5 |
| | Irrigated vine fruits | Irrigated vine fruits | 1 |
| Production from relatively natural environments | Grazing native vegetation | Land under native vegetation, used for grazing by domestic stock | 45 |
| | Production native forests | Commercial production from native forests | 23 |
| Conservation and natural environments | Biodiversity | Area managed for biodiversity | 1 |
| | Defence land - natural areas | Stock reserves under intermittent use or unused | 1 |
| | Habitat/species management area | Protected area managed mainly for conservation through management intervention | 10 |
| | Managed resource protection | Protected area managed mainly for the sustainable use of natural ecosystems | 3 |
| | National park | Protected area managed mainly for ecosystem conservation and recreation | 171 |
| | Natural feature protection | Protected area managed for conservation of specific natural features | 21 |
| | Other conserved area | Land under forms of other nature conservation protection | 18 |
| | Other minimal use | Area of land that are largely unused | 7 |
| | Rehabilitation | Land under rehabilitation that has been restored to a near natural state | 3 |
| | Residual native cover | Land under native cover, mainly unused or used for non-production or environmental purposes | 60 |
| | Stock route | Stock reserves under intermittent use or unused | 1 |
| | Strict nature reserves | Protected area managed mainly for science | 4 |
| | Surface water supply | Area managed as a catchment for water supply | 1 |
| | Traditional indigenous uses | Crown land managed primarily for traditional indigenous purposes | 6 |
| | Wilderness area | Protected area managed mainly for wilderness protection | 2 |

Supplementary Figure 1. Importance of soil properties as the predictors of $NH_4^+$ contents (mg N kg$^{-1}$). The importance of the predictors is based on the usage of each variable in the Cubist model (black bars). None of soil properties is used to set the rule conditions.

Supplementary Figure 2. Importance of soil properties as the predictors of $NO_3^-$ contents (mg N $kg^{-1}$). The importance of the predictors is based on the usage of each variable in the rule conditions (grey bars) and in the Cubist model (black bars).

Supplementary Figure 2. Continued.