Data Article

Summary of the underlying dataset to assist in tracking resilience of rural agricultural communities

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A R T I C L E   I N F O

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A B S T R A C T

A list of indicators that can be used to track resilience of agricultural communities is presented in this brief. The provided data set covers a unique overview of policy-relevant indicators based on data on climate change impacts, vulnerability, adaptation, agriculture and rural development. This data is grouped into six critical sectors that are crucial for policy-makers to track resilience. The data is transferable and can be adjusted to different communities as the listed definitions can be modified to account for the specific local conditions. The indicators were used to identify a set of resilience indicators for rural agricultural communities in Ontario Canada (for details see “An Indicator Set to Track Resilience to Climate Change in Agriculture: A policy-maker’s perspective” [1]). © 2019 Published by Elsevier Inc. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

 Specifications table

| Subject area                  | Agriculture, rural development, climate change |
|-------------------------------|-----------------------------------------------|
| More specific subject area    | Climate change resilience                     |
| Type of data                  | Table                                         |
| How data was acquired         | Literature review, authors and stakeholders’ inputs |

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Data format

Experimental factors
For data collected from the literature and for additional data identified by
the authors, definitions were developed by the authors to cover resilience
of rural agricultural communities.

Experimental features
The data provide a comprehensive set to describe key features of resi-
lience for rural agriculture communities.

Data source location
Global

Data accessibility
Data is with this article

Related research article
Bizikova L., Waldick R., Larkin P. and Mitchell S. (in press) An Indicator Set
to Track Resilience to Climate Change in Agriculture: A policy-maker’s
perspective. Land-use Policy [1]

Value of the data

• The data provide a comprehensive baseline for rural agricultural regions to create their own
indicator system to monitor resilience.
• The data cover critical sectors that are crucial for building resilient agricultural communities such as
rural infrastructure, demographics and others.
• The data can serve as a basis to design indicator sets that are adjusted to specific local situation by
using the information on how the data were defined to address local needs.

1. Data

This brief provides a list of indicators to monitor rural regions with considerable agricultural
activity. The data includes 72 indicators covering several themes that are critical for rural, agricultural
regions (Table 1). The data is based on the information available on the literature on climate change
impacts, vulnerability and adaptation as well as additions by authors to cover critical aspects of rural
agricultural communities. The data table includes definitions were developed by the authors. These
definitions can be adjusted to a specific community needs and, so the data are transferable in terms
tracking resilience.

2. Experimental design, materials and methods

Database of potential indicators to track resilience to climate change was developed using peer-
reviewed and grey literature with additional indicators developed by the authors to address the
potential information needs of themes relevant for the study area. Most of the indicators were based
on issues/challenges listed in peer-reviewed and ‘grey’ literature published by major international
and national agencies, such the European Environmental Agency (EEA), the U.S. Environmental
Protection Agency (US EPA), Food and Agriculture Organization of the United Nations (FAO), Agri-
culture and Agri-food Canada (AAFC). The list of literature is presented in the references. In total, 72
potential indicators were selected listed in Table 1.

The 72 indicators were further assessed and modified based on stakeholders’ inputs to create a
final indicator system for the study area in Ontario (Canada) presented in [1].
Table 1
Summary of indicators to measure resilience of the agricultural system in the studied area.

| Themes and sub-themes developed for the study area | Indicators are selected from the literature | Definitions developed by the authors to reflect on resilience of rural agricultural communities<sup>a</sup> |
|---------------------------------------------------|--------------------------------------------|----------------------------------------------------------------------------------|
| Farmland production activities                    | Farm size                                  | Relative shares of small, medium, large farms using locally relevant estimation of different farm sizes |
| Productivity                                      | Agricultural productivity (yield) in the studies area | Yearly agricultural output compared with long-term average (5 or 10 years average) |
| Vegetated cover by agricultural production        | Vegetated cover by agricultural production | Number of days in year agricultural land is covered in vegetation               |
| Agricultural pesticide use [5]                    | Agricultural pesticide use [5] with focus on water contamination | Use of pesticides in the agricultural area (kg of active ingredients per hectare) |
| Agriculture fertilizer use [5,6]                   | Agriculture fertilizer use [5,6]           | Fertilizer use in the agriculture area (kg per hectare)                         |
| Feed production [7–9]                             | Feed production [7–9]                      | Feed production (kg per hectare)                                                |
| Crop structure [5,9]                              | Crop structure [5,9]                       | Proportion of crops of total hectares to indicate perennial and annual crops     |
| Types of crops [9,10]                             | Types of crops [9,10]                      | Proportion of total hectares of transgenic, organic, root, and vegetable (non-organic and non-transgenic) |
| Livestock dentistry [7]                           | Livestock dentistry [7]                    | Number of animals per hectare and by type of the breed                          |
| Veterinary drug use                                | Veterinary drug use [5,7]                  | Veterinary drug use in milligrams of active ingredient per animal                |
| Extent of manure management strategies [5,7]      | Extent of manure management strategies [5,7] | Proportion of the total area under variety manure management strategies         |
| Nutrient use [3,5]                                | Nutrient use [3,5]                         | Nutrient inputs in kilogram per hectare                                         |
| Manure storage type [5,7]                         | Manure storage type [5,7]                  | Amount of manure (kg) per different types of storage                            |
| Water irrigation costs [5,7]                      | Water irrigation costs [5,7]               | Irrigated water application rates and/or per season                             |
| Barn quality [2,5–7,11,12]                        | Barn quality [2,5–7,11,12]                 | Proportion of barns with air conditioning                                       |
| Greenhouses usage [5,6,11]                        | Greenhouses usage [5,6,11]                 | Amount of production from greenhouses                                           |
| Proportion farm infrastructure in high flood risk zone [5,6,11] | Proportion farm infrastructure in high flood risk zone based on 1:100 years floodplain map |
| Conversation management [5,7]                     | Conversation management [5,7]              | Proportion of hectares of farmland under conservation practices such as use of no-till and rotational grazing |
| Portion of land with tile drainage [5,7]          | Portion of land with tile drainage [5,7]   | Portion of land with tile drainage                                              |
| Land cover [4,11]                                 | Land cover [4,11]                          | Proportion of total hectares shoreline permanently vegetated using thresholds for 120 m for certain wetlands |

<sup>a</sup>Definitions developed by the authors to reflect on resilience of rural agricultural communities.
| Themes and sub-themes developed for the study area | Indicators are selected from the literature | Definitions developed by the authors to reflect on resilience of rural agricultural communities |
|--------------------------------------------------|------------------------------------------|-----------------------------------------------------------------------------------------------|
| Undisturbed land cover                            | Suggested by the authors                 | Portion undisturbed land cover compared to cover under different managed cover               |
| Rate of deforestation                             | Suggested by the authors                 | Portion of total land deforested                                                             |
| Areas with woodlots and wetlands                  | Suggested by the authors                 | Proportion woodlots or wetlands from the total area                                          |
| Land fragmentation                                | [4,5]                                    | Land fragmentation to indicate unsuitable habitat for local wildlife                         |
| Municipal zoning and buffer zones                 | [12] focused on riparian buffer zones    | Municipal zoning classifications                                                              |
| Species diversity                                 | [12,13]                                  | Species biodiversity based on critical species monitoring, mapping                          |
| Species range shifts (e.g., hantavirus, invasive) | [3,6]                                    | Incidence of reported pests and disease                                                     |
| Wildfire risks                                    | [6]                                      | Forestry Wildfire Risk Index developed by the government                                     |
| Heat extremes                                     | [6,14,15]                                 | Heat Spell Duration Index: Extreme – changes in annual length, by month; changes in annual length of impact (drought) by month; frequency (multi-year trend); ratio of water withdrawals to availability (UNH Water Stress Index); for the regional context three or more days > 32 °C |
| Heat spell duration                               | [6,13]                                   | Max number of consecutive days when daily max temp is greater than 5 °C above the normal max temp, by month |
| Air pollution                                     | [16]                                     | Air quality represented by the number of days with smog levels over national standards       |
| Extreme cold and wind chill                       | [4,17]                                   | Temperature or wind chill expected to reach -35 °C for at least two hours; Cold weather extremes are defined as days when minimal temperature is – 20 °C or less |
| Storms                                            | [4,14]                                   | Freezing rain (in terms of hail, freezing rain and ice) in number of hours and intensity    |
| Other extreme weather                             | [4]                                      | Occurrence of local tornadoes                                                               |
| Phenological risk by crop                         | [3]                                      | Changes in annual length, by month. Crop-specific for different phenological stages.        |
| Water excess/deficit           | [5,6] | Streamflow/discharge rates |
| Drought severity             | [5,6] | Changes in annual length, by month thresholds for crops and compared to available moisture is 20% less than crop water requirement. |
| Drought frequency            | [5,6] | Provincial policy defines current thresholds for drought severity. Threshold is changing in terms of timing or seasonality (it is becoming an issue in other seasons) |

**Flooding and excess water**

| Consecutive wet days (wet spell duration) | [5,18] | Consecutive wet days by season (over ≤ 1 mm) – including microburst and excessive rainfall over short period |
| Short duration intense           | [5,6] | Microburst or short duration rainfall using locally relevant thresholds |
| Water retaining capacity         | [14] | Water retaining capacity using local land cover and soil data |
| Accidental/non-accidental deaths | [5] | Excess accidental and non-accidental deaths related to extreme weather (including occupational injury) |
| Water borne disease incidence   | [5] | Water borne disease incidence – number and severity of incidents per year |
| Summer peak flow                | [5,6] | Summer peak flow |
| Late season precipitation       | [3,5,6] | Late season precipitation defined by local conditions |
| Crop use in floodplain          | [2,19,20] | Crop choices in floodplain |
| Erosion risk                    | [5] | Land use on clay soils |
| Living alone                    | [18] | Proportion population living alone |

**Demographics and Markets**

| Age of farmers                  | [2,7,18] | Portion of farmers over 65 years; proportion of agricultural producers relative to total rural population |
| Number of farmers               | [2,18] | Number of farmers with predominantly source of income from farming |
| Rural population                | [2,18,19] | Proportion agricultural producers relative to total rural population |
| Income trends                   | [7,18,19,21] | Trends in income level – average income and share of households with low income |
| Self-rated health/well-being    | [18,19] self-reported disease occurrence | Self-rated mental and physical health index based on the census data, which are available for small communities and from the Canadian Health Survey |
| Percentage of farms with off-farm income | [2,7,21] | Trends in off-farm income using farm census data |
| Gross domestic product in rural areas | [18,19,21] | Monetary value of all finished goods and services for bounded region |

**Population characteristics**

| Occurrence of chronic diseases | [7,18,19] | Population health status groups according to the proportion with chronic disease |
| Level of debt per farm type    | [19] focused on rural areas | Average and median debt levels |
| Medium and average farm size with insurance coverage | [2,7] focus on business | Percentage of farms of certain size with insurance |
| Housing in need of major repairs | [2,7] | Using data from Statistics Canada on housing that needs major repairs |
| Index of rural cohesiveness    | [19] | Sense of belonging index based on the census data, which are available for small communities |

**Rural Infrastructure vulnerability**

| Proportion infrastructure in high flood risk zone | [11] focused on major infrastructure | Proportion infrastructure in high flood risk zone using 1:100 years flood reference rate |
**Table 1 (continued)**

| Themes and sub-themes developed for the study area | Indicators are selected from the literature | Definitions developed by the authors to reflect on resilience of rural agricultural communities\(^a\) |
|---|---|---|
| **Themes** | **Sub-theme** | **Indicator title** | **Similar indicator ideas listed in the literature\(^b\)** |
| Proportion of population on private/small/municipal drinking water systems | [11,19] population without water access | Working with the definition of private and small drinking water systems under regulation; using government drinking water guidelines – not suitable for ingestion |
| Water quality based on water regulations’ standards | [4,6] | Drinking water quality disaggregated by municipal, other regulated, private ownership |
| Frequency of water contamination | [4,7] | Frequency of water contamination – using methodologies development by water protection agencies |
| Frequency of water shortage measure | [5,6] | Measured per year or season, and at the discharge measurements (m\(^3\)/s) |
| Road density in floodplain | [11] focused on major roads | Road density in the floodplain (in kilometers and types of roads) |
| Access to telecommunication infrastructure | [2,22] | Proportion of population with access to wifi and availability of local radio/TV signal |
| Age and condition of infrastructure | [2] | Age and condition of infrastructure – using age and quality categories |
| Access/location/density of health emergency systems | [22] | Number and percentage of communities with lower than average rural provincial access to services |
| Unmapped/unregulated flooding control structures | [11] | Unmapped, unregulated flooding control structures on private lands |

\(^a\) For additional detail see [1].

\(^b\) In this column, we list literature sources that already mention similar type of indicators and/or indicated similar challenges that may need monitoring even though the cited literature may not list the specific indicator.
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Transparency document. Supplementary material

Transparency document associated with this article can be found in the online version at https://doi.org/10.1016/j.dib.2019.01.024.

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