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Brief communication: Lessons learned and experiences gained from building up a global survey on societal resilience to changing droughts

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SUPPLEMENT S1

Table S1 - List of indicators from the literature and final selection for the survey

Indicators	Reference	Final selection
1. Annual mean normalized difference vegetation index	(Veettil et al. 2018; Nhamo et al. 2019)	No
2. Annual Rainfall (Mean or Distribution)	(Ranjan 2013; Chen et al. 2019; Hoque et al. 2021; Xu et al. 2021; Lindoso et al. 2011; Simelton et al. 2009; Antwi-Agyei et al. 2012; Murthy et al. 2015; Epule 2021)	No
3. Aridity index	(Meaza et al. 2021; Elagib 2014; Lindoso et al. 2011; Alonso et al. 2019)	No
4. Climatic Moisture Index	(Nhamo et al. 2019; Hogg et al. 2013)	No
5. Evaporation	(Hoque et al. 2021)	No
6. Level of groundwater	(Ranjan 2013; Lin et al. 2021)	Yes: "Groundwater level"
7. Normalized Difference Vegetation Index (NDVI)	(Schwarz et al. 2020; Elagib 2014; Fang et al. 2011; Murthy et al. 2015)	No
8. Palmer Drought Severity Index	(Zhao et al. 2018; Chang et al. 2016)	No
9. Potential Soil Moisture Deficit	(Holman et al. 2021)	No
10. Precipitation Anomaly Percentage (PAP)	(Chang et al. 2016; Carrão et al. 2016; Fang et al. 2011)	No
11. Runoff Anomaly Percentage	(Chang et al. 2016)	No
12. Soil depth	(Hoque et al. 2021; Murthy et al. 2015; Leguizamo et al. 2020)	No
13. Soil Moisture Index	(Lee and Yoo 2021; Hoque et al. 2021; Fang et al. 2011; Xu et al. 2021; Luetkemeier and Liehr 2018)	No
14. Soil Type	(Xu et al. 2021)	No
15. Soil Water Holding capacity	(Huai 2017)	No
16. Standardized Precipitation Evapotranspiration Index (SPEI)	(Veettil et al. 2018; Bernal et al. 2017; Tefera et al. 2019; Niu et al. 2019; Zhao et al. 2020; Alonso et al. 2019; Luetkemeier and Liehr 2018)	No
17. Standardized Precipitation Index (SPI)	(Lin et al. 2021; Dabanli 2018; Chang et al. 2016; Holman et al. 2021; Wang et al. 2011; Walz et al. 2020)	No
18. Standardized runoff index	(Wang et al. 2011)	No
19. Standardized soil water index SSWI	(Wang et al. 2011)	No
20. Temperature	(Hoque et al. 2021; Antwi-Agyei et al. 2012)	No
21. Total Season rainy Days	(Murthy et al. 2015)	No
22. Vegetation Condition Index (VCI) or VHI	(Walz et al. 2020; Alonso et al. 2019; Luetkemeier and Liehr 2018)	No
23. Vegetation Coverage	(Antwi-Agyei et al. 2012)	No
24. Vegetation Supply Water Index (VSWI)	(Fang et al. 2011)	No
25. Water levels in hand-dug wells and boreholes	(Meaza et al. 2021)	No
26. Water Requirements Satisfaction Index (WRSI)	(Jayanthi and Husak 2013)	No
27. Population and Population Density	(Simelton et al. 2009; Yuan et al. 2015; Lin et al. 2021; Zhao et al. 2020; Dabanli 2018; Xu et al. 2021)	No
28. Total agricultural and irrigated land	(Dabanli 2018; Xu et al. 2021; Zhou et al. 2022; Walz et al. 2020; Zhao et al. 2020; Simelton et al. 2009; Wu et al. 2013; Antwi-Agyei et al. 2012; Alonso et al. 2019)	No
29. Grassland or Pastureland	(Walz et al. 2020; Zhao et al. 2020)	No

Indicators	Reference	Final selection
30. The proportion of the population depended on agriculture	(Xu et al. 2021; Zhou et al. 2022; Walz et al. 2020)	Yes: "Employment in small farms"
31. Crop Damage / Failure /Loss	(Hao et al. 2012; Simelton et al. 2009; Huai 2017)	Yes: "Crop loss"
32. Ratio of the irrigated area to cropland	(Simelton et al. 2009; Wu et al. 2013; Alonso et al. 2019)	No
33. The ratio of cultivation area to the total land area	(Wu et al. 2013)	No
34. The ratio of the irrigation area to cropland	(Zhao et al. 2020; Kampragou et al. 2015; Wu et al. 2013)	No
35. Water Pressure / Stress / Water availability per km2	(Zhao et al. 2020; Wu et al. 2013; Leguizamo et al. 2020)	Yes: "Water stress"
36. Number of reservoirs	(Zhao et al. 2020; Wu et al. 2013; Leguizamo et al. 2020)	No
37. Groundwater level/sources	(Kampragou et al. 2015; Wu et al. 2013; Alonso et al. 2019; Murthy et al. 2015)	No
38. % of the population employed in small farms	(Lindoso et al. 2011; Kampragou et al. 2015)	Yes: "Employment in small farms"
39. Net income of rural populations or farmers	(Wu et al. 2013; Antwi-Agyei et al. 2012)	No
40. % of establishments with rainfed farming	(Lindoso et al. 2011)	No
41. Water consumption per agriculture value-added	(Yuan et al. 2015)	Yes: "Crop water use efficiency (WUE)"
42. Water consumption per industry value-added	(Yuan et al. 2015)	No
43. Irrigation water usage ratio	(Wu et al. 2013)	Yes: "Crop water use efficiency (WUE)"
44. Percentage of participation of crop and livestock production in the income of smallholder farming	(Lindoso et al. 2011)	Yes: "Crop income dependence"
45. Access to water for human consumption	(Lindoso et al. 2011; Luetkemeier and Liehr 2018)	No
46. Crop Damage & Sensitivity (Crop Loss)	(Hao et al. 2012; Antwi-Agyei et al. 2012; Simelton et al. 2009; Epule 2021)	Yes: "Crop loss"
47. Crop Pattern Diversity	(Kampragou et al. 2015; Antwi-Agyei et al. 2012)	Yes: "Crop varieties"
48. Water and food demand	(Luetkemeier and Liehr 2018)	No
49. Agriculture land	(Simelton et al. 2009; Yuan et al. 2015)	No
50. Paddy fields	(Yuan et al. 2015)	No
51. Access to fodder (kg purchased per year)	(Meza et al. 2019)	No
52. Agricultural machinery in use (#)	(Meza et al. 2019)	No
53. Agriculture (% of GDP)	(Meza et al. 2019)	No
54. Area protected and designated for the conservation of biodiversity (%)	(Meza et al. 2019)	Yes: "Protected area"
55. Baseline water stress (ratio of withdrawals to renewable supply)	(Meza et al. 2019)	Yes: "Water stress"
56. Degree of land degradation and desertification	(Meza et al. 2019)	Yes: "Land degragation"
57. Dependency on agriculture for livelihood (%)	(Meza et al. 2019)	No
58. Access to electricity (Acess to energy)	(Meza et al. 2019)	Yes: "Electricity"

Indicators	Reference	Final selection
59. Expenditure on health (out-of-pocket) (%)	(Meza et al. 2019)	No
60. GDP per capita, PPP	(Meza et al. 2019)	No
61. Gender inequality (categorical)	(Meza et al. 2019)	Yes: "Gender inequality"
62. GINI index (income inequality)	(Meza et al. 2019)	No
63. Illiteracy rate (%)	(Meza et al. 2019)	No
64. Use of Insecticides and pesticides (Use of agricultural inputs)	(Meza et al. 2019)	Yes: "Use of agricultural inputs"
65. Life expectancy at birth (years)	(Meza et al. 2019)	No
66. Livestock health	(Meza et al. 2019)	No
67. Market fragility	(Meza et al. 2019)	No
68. Population ages 15-64 (% of the total population)	(Meza et al. 2019)	Yes: "Working-age population"
69. Population below the national poverty line (%)	(Meza et al. 2019)	Yes: "Poverty"
70. Population undernourished (%)	(Meza et al. 2019)	No
71. Population with ill-health (%)	(Meza et al. 2019)	No
72. Population without access to (improved) sanitation (%)	(Meza et al. 2019)	Yes: "Sanitation condition"
73. Population without access to clean water (%)	(Meza et al. 2019)	No
74. Presence of drivers of migration and displacement	(Meza et al. 2019)	Yes: "Drivers of migration"
75. Percentage of the population displaced internally or transboundary	(Meza et al. 2019)	Yes: "Displaced population"
76. Risk perception (% of the population who has experienced droughts in the past 10 years)	(Meza et al. 2019)	No
77. Rural population (% of the total population)	(Meza et al. 2019)	Yes: "Rural population"
78. Soil depth (mm)	(Meza et al. 2019)	No
79. Soil organic matter (g*kg)	(Meza et al. 2019)	No
80. Tourism (% of GDP)	(Meza et al. 2019)	No
81. Unemployment rate (and/or proportion of formal work)	(Meza et al. 2019)	Yes: "Unemployment"
82. Use of fertilizer (ton)	(Meza et al. 2019)	No
83. Water quality (categorical)	(Meza et al. 2019)	Yes: "Water quality"
84. Percentage of retained renewable water	(Meza et al. 2019)	Yes: "Retained renewable water"
85. Corruption (e.g. Corruption Perception Index)	(Meza et al. 2019)	No
86. Cultivation of drought-resistant crops (%)	(Meza et al. 2019)	Yes: "Drought resistant crops"
87. Disaster risk taken into account in public investment and planning decisions (yes/no)	(Meza et al. 2019)	Yes: "Drought management policies"
88. Distance to closest market (km)	(Meza et al. 2019)	No
89. Existence of adaptation policies/plans (yes/no)	(Meza et al. 2019)	Yes: "Drought management policies"
90. Farmers use different crop varieties (%)	(Meza et al. 2019)	Yes: "Crop varieties"

Indicators	Reference	Final selection
91. Farmers with crop, livestock, or drought insurance (%)	(Meza et al. 2019)	Yes: "Drought insurance"
92. Farmers/laborers without access to bank loans/(micro-) credits (%)	(Meza et al. 2019)	Yes: "Financing and credit"
93. Farmers/laborers without savings (%)	(Meza et al. 2019)	No
94. Prevalence of conflict/insecurity	(Meza et al. 2019)	Yes: "Conflict"
95. Government effectiveness	(Meza et al. 2019)	No
96. Irrigated land (% total arable)	(Meza et al. 2019)	No
97. National investment in disaster prevention & preparedness (US$/Year/capita)	(Meza et al. 2019)	No
98. Number of (drought-related) adaptation projects in the past 10 years	(Meza et al. 2019)	No
99. Public participation in local policy	(Meza et al. 2019)	Yes: "Participation in local policy"
100. Research and development expenditure (% of GDP)	(Meza et al. 2019)	No
101. Total dam capacity	(Meza et al. 2019)	Yes: "Dam capacity"
102. Participation in farming cooperatives or associations	(Lindoso et al. 2011)	Yes: "Cooperatives or associations"
103. Connectivity to external connectors	(Leguizamo et al. 2020)	No
104. Availability of drought prediction and warning systems or climatic predictions	(Lee and Yoo 2021; Xu et al. 2021; Leguizamo et al. 2020)	Yes: "Prediction systems"
105. Water-conservation irrigation technologies	(Xu et al. 2021; Zhou et al. 2022; Kampragou et al. 2015; Yuan et al. 2015; Wu et al. 2013)	No
106. Water storage and harvesting capacity	(Xu et al. 2021; Zhou et al. 2022)	Yes: "Retained renewable water"
107. Access to electricity	(Lindoso et al. 2011)	Yes: "Electricity"
108. Electricity usage	(Huai 2017)	No
109. Access to alternative water sources	(Kampragou et al. 2015; Yuan et al. 2015)	No
110. Fixed assets for drought mitigation	(Yuan et al. 2015)	No
111. Emergency irrigation	(Yuan et al. 2015)	No
112. Transportation network	(Simelton et al. 2009)	Yes: "Transportation network"
113. Machinery power	(Simelton et al. 2009)	No
114. Fertilizer usage	(Simelton et al. 2009; Antwi-Agyei et al. 2012)	No
115. GDP	(Yuan et al. 2015)	No
116. Crop revenue	(Huai 2017)	No
117. Labor Usage	(Huai 2017)	No
118. Poverty Rate	(Antwi-Agyei et al. 2012; Epule 2021)	Yes: "Poverty rate"
119. Fixed capital per farmer	(Simelton et al. 2009; Huai 2017)	No
120. Investment in agriculture	(Simelton et al. 2009)	No
121. Access to financing and credit	(Huai 2017; Leguizamo et al. 2020)	Yes: "Financing and credit"
122. Phone Chargers	(Huai 2017)	No
123. Diversity of income sources	(Lindoso et al. 2011; Simelton et al. 2009)	No

Indicators	Reference	Final selection
124. Housing quality	(Leguizamo et al. 2020)	No
125. Land rights clearly defined (yes/no)	(Lindoso et al. 2011; Leguizamo et al. 2020)	Yes: "Land rights"
126. Literacy / Education	(Lindoso et al. 2011; Wu et al. 2013; Antwi-Agyei et al. 2012; Epule 2021; Leguizamo et al. 2020)	No
127. Livestock production	(Maltou and Bahta 2019)	No
128. Household Produced Food	(Maltou and Bahta 2019)	No
129. Food source reliability and diversity	(Luetkemeier and Liehr 2018)	Yes: "Food source reliability"
130. Technical assistance from cooperatives or government	(Lindoso et al. 2011; Leguizamo et al. 2020)	Yes: "Technical assistance"
131. Water use rights are clearly defined	(Kampragou et al. 2015)	Yes: "Water use rights"
132. Existence of drought management policies	(Kampragou et al. 2015)	Yes: "Drought management policies"
133. Technology assistance	(Leguizamo et al. 2020)	Yes: "Technical assistance"
134. NDWI (Normalised Difference Water Index)	(Shashikant et al. 2021)	No
135. Integrated land and water management policies	(Lerner et al. 2018)	Yes: "Intagrated policies"
136. Existence of concurrent multi-hazard risks (dynamic vulnerabilities)	(Boult et al. 2022)	No

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SUPPLEMENT S2

Final survey submitted

Consent_EU

Dear Researcher:

We are a Belmont Project Consortium requesting your expert opinion to evaluate drought vulnerability and resilience indicators.

Research on drought risk modeling relies on numerous indicators to quantify the magnitude and frequency of drought, its ecological, economic, and social impact, and coping mechanisms that can reduce or avoid the negative impacts of drought. The use and selection of indicators depend on the objectives, data availability, and the target region. **In this survey, you will rank the importance of the indicators related to drought, classifying them in their representativeness of the risk and resilience components and their relevance in different local contexts.**

This survey has been approved by the Institutional Review Board (IRB) of Penn State University for Human Subjects Protection (IRB # STUDY00021208). Your participation is voluntary, and you may decide to stop at any time. You do not have to answer any questions that you do not want to answer.

The survey will take approximately **15-20** minutes to complete. All of your answers will be kept in strict confidence, and the information will be used only for research purposes.

Consent to Collect, Use, Store, and Process Personal Information under the General Data Protection Regulation: As part of this study The Pennsylvania State University will be collecting, using, storing, and processing the personal research information that you will provide in connection with the research for the purposes described in this Consent for Research. Because you are in the European Union, all personal research information that you provide in connection with the research study will be collected, used, stored, and processed in accordance with the provisions of Regulation (EU) 2016/679 ("Regulation on the protection of natural persons with regard to the processing of personal data and on the free movement of such data"), as well as all other applicable laws and The Pennsylvania State University policies. These laws and regulations, depending on the type of information involved, provide you certain rights with regard to your personal information. You may elect to withdraw your consent to the collection, use, storing and processing of your personal research information prior to completing the research procedures described in this Consent for Research. If you decide to withdraw your consent during the study, to the extent required by law and we are able to identify you from the information retained as part of this study, any personal research information you have already provided will be destroyed or deleted, and will no longer be collected, used, stored, or processed. You may also withdraw your consent to the use, storing, and processing of your personal research information from the research study after your participation in the study has ended. If you withdraw your consent to the use,

storing, and processing of your personal research information after the study has been completed, to the extent required by law and we are able to identify you from the information retained as part of this study, your personal research information will be destroyed or deleted, and will no longer be collected, used, stored, or processed. You may withdraw your consent to the use, storing, and processing of your personal research information at any time by contacting the Principal Investigator of the study, Michael Jacobson at 814-865-3994, (email mgj2@psu.edu). You can also contact the Office for Research Protections at (814) 865-1775, (email irb-orp@psu.edu) if you are not able to reach the investigator. We do not believe that the information about you that we will retain for use in this study will allow us to identify you at a later date.

I have read the preliminary description of this study. I agree to allow my survey evaluations to be released to this study's principal investigator and the research team. I understand that I am free to discontinue my participation without penalty. By selecting YES, I allow de-identified data to be used in publications and presentations.

You must be 18 years or older to consent to participate in this research study. If you agree to participate in this research study and the information outlined above, select **YES** and **click the following button to complete this Consent for Research.**

- ○ YES
- ○ NO

Consent

Dear Researcher:
We are a Belmont Project Consortium requesting your expert opinion to evaluate drought vulnerability and resilience indicators.

Research on drought risk modeling relies on numerous indicators to quantify the magnitude and frequency of drought, its ecological, economic, and social impact, and coping mechanisms that can reduce or avoid the negative impacts of drought. The use and selection of indicators depend on the objectives, data availability, and the target region. **In this survey, you will rank the importance of the indicators related to drought, classifying them in their representativeness of the risk and resilience components and their relevance in different local contexts.**

This survey has been approved by the Institutional Review Board (IRB) of Penn State University for Human Subjects Protection (IRB # STUDY00021208). Your participation is voluntary, and you may decide to stop at any time. You do not have to answer any questions that you do not want to answer.

The survey will take approximately **15-20** minutes to complete. All of your answers will be kept in strict confidence, and the information will be used only for research purposes.

If you have any questions regarding the survey or this research project in general, please contact me. If you have any questions concerning your rights as a research participant, please contact the office for Research Program at Penn State at (814)865-1775 or protections@psu.edu and inquire about IRB# STUDY00021208.

I have read the preliminary description of this study. I agree to allow my survey evaluations to be released to this study's principal investigator and the research team. I understand that I am free to discontinue my participation without penalty. By selecting YES, I allow de-identified data to be used in publications and presentations.

You must be 18 years or older to consent to participate in this research study. If you agree to participate in this research study and the information outlined above, select **YES** and click the following button to complete **this Consent for Research.**

- ○ YES
- ○ NO

Questions

Instructions:
In this survey, you will rate the relevance and data quality of a set of indicators for a drought resilience index **for small to medium size farms.**

At the end of the survey, you will be asked for your willingness to participate in an **online workshop** about drought resilience indicators. The online workshop will take place in Spring 2023, and workshop participants will be compensated with a $20 digital gift card.

Indicator Relevancy:

Please rate how **relevant** the following indicators are in terms of the information needs of decision-makers for improving drought resilience policies and better managing resources.

Option	Definition
Low	The indicator is irrelevant to the information needs of decision-makers.
Medium	The indicator is moderately relevant to the information needs of decision-makers.
High	The indicator is highly relevant to the information needs of decision-makers.

	Relevancy			
	Low	Medium	High	Don't know
Percentage of the contribution of crop and livestock production in the income of smallholder farming	○	○	○	○
Crop loss	○	○	○	○
Percentage of drought-resistance crop varieties cultivated	○	○	○	○
Percentage of farmers who use different types of crops	○	○	○	○
Percentage of area protected and designated for the conservation of biodiversity	○	○	○	○
Use of agricultural inputs (e.g., insecticides, pesticides, fertilizer, machinery)	○	○	○	○
Crop water use efficiency (WUE)	○	○	○	○
Degree of land degradation and desertification	○	○	○	○

	Low	Medium	High	Don't know
Land rights clearly defined (yes/no)	○	○	○	○
Existence of drought management policies (mitigation/adaptation/prevention/preparedness)	○	○	○	○
Technical assistance from local entities (e.g., cooperatives/NGO/government)	○	○	○	○
Percentage of farmers with crop, livestock, or drought insurance	○	○	○	○
Water use rights clearly defined	○	○	○	○
Availability of drought prediction and warning systems or climatic predictions	○	○	○	○
Produce storage and transportation capacity	○	○	○	○
Access to energy	○	○	○	○

	Low	Medium	High	Don't know
Prevalence of conflict/insecurity	○	○	○	○
Percentage of the population without access to (improved) sanitation	○	○	○	○
Gender inequality	○	○	○	○
Percentage of the rural population	○	○	○	○
Unemployment rate and/or proportion of formal work	○	○	○	○
Percentage of population ages 15-64	○	○	○	○
Percentage of population displaced internally or transboundary	○	○	○	○
Presence of drivers of migration and displacement	○	○	○	○

	Relevancy			
	Low	Medium	High	Don't know
	Low	Medium	High	Don't know
Poverty Rate	○	○	○	○
Food source reliability and diversity	○	○	○	○
Level of public participation in local policy	○	○	○	○
Participation in farming cooperatives or associations	○	○	○	○
Percentage of the population employed in farms	○	○	○	○
Access to financing and credit	○	○	○	○
Ratio of annual withdrawals to available water	○	○	○	○
Water quality	○	○	○	○
	Low	Medium	High	Don't know
Groundwater level/sources	○	○	○	○
Integrated land and water management policies	○	○	○	○
Percentage of retained renewable water	○	○	○	○
Total dam capacity	○	○	○	○

Ease of Understanding:

Please rate the following indicators for **ease of understanding by decision-makers** to be used in a drought resilience index for **small to medium size farms**.

Option	Definition
Low	The indicator may be interpreted differently by various decision-makers. The indicator is not clearly connected to a policy objective.
Medium	The indicator is understood by most decision-makers with some clarification. The indicator conveys useful information.
High	The indicator is readily understood by decision-makers and, preferably, the broad audience. The indicator conveys useful, relevant information for decision-makers on a specific policy objective.

	Ease of understanding by decision-makers			
	Low	Medium	High	Don't know
Percentage of the contribution of crop and livestock production in the income of smallholder farming	○	○	○	○
Crop loss	○	○	○	○
Percentage of drought-resistance crop varieties cultivated	○	○	○	○
Percentage of farmers who use different types of crops	○	○	○	○
Percentage of area protected and designated for the conservation of biodiversity	○	○	○	○
Use of agricultural inputs (e.g., insecticides, pesticides, fertilizer, machinery)	○	○	○	○
Crop water use efficiency (WUE)	○	○	○	○
Degree of land degradation and desertification	○	○	○	○

	Low	Medium	High	Don't know
Land rights clearly defined (yes/no)	○	○	○	○
Existence of drought management policies (mitigation/adaptation/prevention/preparedness)	○	○	○	○
Technical assistance from local entities (e.g., cooperatives/NGO/government)	○	○	○	○
Percentage of farmers with crop, livestock, or drought insurance	○	○	○	○
Water use rights clearly defined	○	○	○	○
Availability of drought prediction and warning systems or climatic predictions	○	○	○	○
Produce storage and transportation capacity	○	○	○	○
Access to energy	○	○	○	○

	Low	Medium	High	Don't know
Prevalence of conflict/insecurity	○	○	○	○
Percentage of the population without access to (improved) sanitation	○	○	○	○
Gender inequality	○	○	○	○
Percentage of the rural population	○	○	○	○
Unemployment rate and/or proportion of formal work	○	○	○	○
Percentage of population ages 15-64	○	○	○	○
Percentage of population displaced internally or transboundary	○	○	○	○
Presence of drivers of migration and displacement	○	○	○	○

	Ease of understanding by decision-makers			
	Low	Medium	High	Don't know
	Low	Medium	High	Don't know
Poverty Rate	○	○	○	○
Food source reliability and diversity	○	○	○	○
Level of public participation in local policy	○	○	○	○
Participation in farming cooperatives or associations	○	○	○	○
Percentage of the population employed in farms	○	○	○	○
Access to financing and credit	○	○	○	○
Ratio of annual withdrawals to available water	○	○	○	○
Water quality	○	○	○	○
	Low	Medium	High	Don't know
Groundwater level/sources	○	○	○	○
Integrated land and water management policies	○	○	○	○
Percentage of retained renewable water	○	○	○	○
Total dam capacity	○	○	○	○

Data Accessibility and Effort:

Rate the following indicators in terms of **data accessibility for reasonable cost/level of effort** as described below.

Option	Definition
Low	The indicator data is not easily accessible or available. Collecting and processing the data requires significant time and effort.
Medium	The indicator data is mostly available, but processing the data requires some effort.
High	The indicator data is publicly accessible and readily available. Processing the data requires minimal effort.

	Data Accessibility			
	Low	Medium	High	Don't know
Percentage of the contribution of crop and livestock production in the income of smallholder farming	○	○	○	○

Data Accessibility

	Low	Medium	High	Don't know
Crop loss	○	○	○	○
Percentage of drought-resistance crop varieties cultivated	○	○	○	○
Percentage of farmers who use different types of crops	○	○	○	○
Percentage of area protected and designated for the conservation of biodiversity	○	○	○	○
Use of agricultural inputs (e.g., insecticides, pesticides, fertilizer, machinery)	○	○	○	○
Crop water use efficiency (WUE)	○	○	○	○
Degree of land degradation and desertification	○	○	○	○

	Low	Medium	High	Don't know
Land rights clearly defined (yes/no)	○	○	○	○
Existence of drought management policies (mitigation/adaptation/prevention/preparedness)	○	○	○	○
Technical assistance from local entities (e.g., cooperatives/NGO/government)	○	○	○	○
Percentage of farmers with crop, livestock, or drought insurance	○	○	○	○
Water use rights clearly defined	○	○	○	○
Availability of drought prediction and warning systems or climatic predictions	○	○	○	○
Produce storage and transportation capacity	○	○	○	○
Access to energy	○	○	○	○

	Low	Medium	High	Don't know
Prevalence of conflict/insecurity	○	○	○	○
Percentage of the population without access to (improved) sanitation	○	○	○	○
Gender inequality	○	○	○	○
Percentage of the rural population	○	○	○	○
Unemployment rate and/or proportion of formal work	○	○	○	○
Percentage of population ages 15-64	○	○	○	○
Percentage of population displaced internally or transboundary	○	○	○	○
Presence of drivers of migration and displacement	○	○	○	○

	Low	Medium	High	Don't know
Poverty Rate	○	○	○	○

Data Accessibility

	Low	Medium	High	Don't know
Food source reliability and diversity	○	○	○	○
Level of public participation in local policy	○	○	○	○
Participation in farming cooperatives or associations	○	○	○	○
Percentage of the population employed in farms	○	○	○	○
Access to financing and credit	○	○	○	○
Ratio of annual withdrawals to available water	○	○	○	○
Water quality	○	○	○	○

	Low	Medium	High	Don't know
Groundwater level/sources	○	○	○	○
Integrated land and water management policies	○	○	○	○
Percentage of retained renewable water	○	○	○	○
Total dam capacity	○	○	○	○

Data Objectivity:

Please rate the following indicators in terms of **data objectivity as described below.**

Option	Definition
Low	A subjective measure that requires expert judgment to evaluate the indicator.
Medium	Requires some degree of expert judgment to interpret quantitative or qualitative data.
High	An objective measure is based on quantifiable, impartial, and recorded data.

Data Objectivity

	Low	Medium	High	Don't Know
Percentage of the contribution of crop and livestock production in the income of smallholder farming	○	○	○	○
Crop loss	○	○	○	○
Percentage of drought-resistance crop varieties cultivated	○	○	○	○
Percentage of farmers who use different types of crops	○	○	○	○
Percentage of area protected and designated for the conservation of biodiversity	○	○	○	○
Use of agricultural inputs (e.g., insecticides, pesticides, fertilizer, machinery)	○	○	○	○

Data Objectivity

	Low	Medium	High	Don't Know
Crop water use efficiency (WUE)	○	○	○	○
Degree of land degradation and desertification	○	○	○	○

	Low	Medium	High	Don't Know
Land rights clearly defined (yes/no)	○	○	○	○
Existence of drought management policies (mitigation/adaptation/prevention/preparedness)	○	○	○	○
Technical assistance from local entities (e.g., cooperatives/NGO/government)	○	○	○	○
Percentage of farmers with crop, livestock, or drought insurance	○	○	○	○
Water use rights clearly defined	○	○	○	○
Availability of drought prediction and warning systems or climatic predictions	○	○	○	○
Produce storage and transportation capacity	○	○	○	○
Access to energy	○	○	○	○

	Low	Medium	High	Don't Know
Prevalence of conflict/insecurity	○	○	○	○
Percentage of the population without access to (improved) sanitation	○	○	○	○
Gender inequality	○	○	○	○
Percentage of the rural population	○	○	○	○
Unemployment rate and/or proportion of formal work	○	○	○	○
Percentage of population ages 15-64	○	○	○	○
Percentage of population displaced internally or transboundary	○	○	○	○
Presence of drivers of migration and displacement	○	○	○	○

	Low	Medium	High	Don't Know
Poverty Rate	○	○	○	○
Food source reliability and diversity	○	○	○	○
Level of public participation in local policy	○	○	○	○
Participation in farming cooperatives or associations	○	○	○	○
Percentage of the population employed in farms	○	○	○	○
Access to financing and credit	○	○	○	○

	Data Objectivity			
	Low	Medium	High	Don't Know
Ratio of annual withdrawals to available water	○	○	○	○
Water quality	○	○	○	○

	Low	Medium	High	Don't Know
Groundwater level/sources	○	○	○	○
Integrated land and water management policies	○	○	○	○
Percentage of retained renewable water	○	○	○	○
Total dam capacity	○	○	○	○

Data Consistency over Temporal Scales:

Is the data for the indicator **available consistently over different temporal scales** to be used in a drought resilience index for **small to medium size farms**?

Option	Definition
Low	The indicator data is collected in an ad-hoc manner, limiting the ability to monitor and compare the indicator over different temporal scales.
Medium	The indicator data is collected periodically but not frequently enough for comparing the indicator in different temporal scales.
High	The indicator data is collected regularly and available over different time scales, allowing for monitoring and comparing the indicator over different temporal scales.

	Data Temporal Consistency			
	Low	Medium	High	Don't know
Percentage of the contribution of crop and livestock production in the income of smallholder farming	○	○	○	○
Crop loss	○	○	○	○
Percentage of drought-resistance crop varieties cultivated	○	○	○	○
Percentage of farmers who use different types of crops	○	○	○	○
Percentage of area protected and designated for the conservation of biodiversity	○	○	○	○
Use of agricultural inputs (e.g., insecticides, pesticides, fertilizer, machinery)	○	○	○	○
Crop water use efficiency (WUE)	○	○	○	○

Data Temporal Consistency

	Low	Medium	High	Don't know
Degree of land degradation and desertification	○	○	○	○

	Low	Medium	High	Don't know
Land rights clearly defined (yes/no)	○	○	○	○
Existence of drought management policies (mitigation/adaptation/prevention/preparedness)	○	○	○	○
Technical assistance from local entities (e.g., cooperatives/NGO/government)	○	○	○	○
Percentage of farmers with crop, livestock, or drought insurance	○	○	○	○
Water use rights clearly defined	○	○	○	○
Availability of drought prediction and warning systems or climatic predictions	○	○	○	○
Produce storage and transportation capacity	○	○	○	○
Access to energy	○	○	○	○

	Low	Medium	High	Don't know
Prevalence of conflict/insecurity	○	○	○	○
Percentage of the population without access to (improved) sanitation	○	○	○	○
Gender inequality	○	○	○	○
Percentage of the rural population	○	○	○	○
Unemployment rate and/or proportion of formal work	○	○	○	○
Percentage of population ages 15-64	○	○	○	○
Percentage of population displaced internally or transboundary	○	○	○	○
Presence of drivers of migration and displacement	○	○	○	○

	Low	Medium	High	Don't know
Poverty Rate	○	○	○	○
Food source reliability and diversity	○	○	○	○
Level of public participation in local policy	○	○	○	○
Participation in farming cooperatives or associations	○	○	○	○
Percentage of the population employed in farms	○	○	○	○
Access to financing and credit	○	○	○	○
Ratio of annual withdrawals to available water	○	○	○	○

	Data Temporal Consistency			
	Low	Medium	High	Don't know
Water quality	○	○	○	○

	Low	Medium	High	Don't know
Groundwater level/sources	○	○	○	○
Integrated land and water management policies	○	○	○	○
Percentage of retained renewable water	○	○	○	○
Total dam capacity	○	○	○	○

Data Availability at Regional and Local Scales:

Is data for the indicator **available at regional and local scales level**? (Select all that apply)

Option	Definition
Local Level	The indicator data is available at the local level (e.g., municipality, town, village) and can be aggregated and compared across **different geographical areas.**
Regional Level	The indicator data is available at regional or sub-national spatial scales (regional) and can be aggregated and compared across **only regional levels.**

	Local	Regional	Don't know
Percentage of the contribution of crop and livestock production in the income of smallholder farming	☐	☐	☐
Crop loss	☐	☐	☐
Percentage of drought-resistance crop varieties cultivated	☐	☐	☐
Percentage of farmers who use different types of crops	☐	☐	☐
Percentage of area protected and designated for the conservation of biodiversity	☐	☐	☐
Use of agricultural inputs (e.g., insecticides, pesticides, fertilizer, machinery)	☐	☐	☐
Crop water use efficiency (WUE)	☐	☐	☐
Degree of land degradation and desertification	☐	☐	☐

	Local	Regional	Don't know
Land rights clearly defined (yes/no)	☐	☐	☐
Existence of drought management policies (mitigation/adaptation/prevention/preparedness)	☐	☐	☐

	Local	Regional	Don't know
Technical assistance from local entities (e.g., cooperatives/NGO/government)	☐	☐	☐
Percentage of farmers with crop, livestock, or drought insurance	☐	☐	☐
Water use rights clearly defined	☐	☐	☐
Availability of drought prediction and warning systems or climatic predictions	☐	☐	☐
Produce storage and transportation capacity	☐	☐	☐
Access to energy	☐	☐	☐

	Local	Regional	Don't know
Prevalence of conflict/insecurity	☐	☐	☐
Percentage of the population without access to (improved) sanitation	☐	☐	☐
Gender inequality	☐	☐	☐
Percentage of the rural population	☐	☐	☐
Unemployment rate and/or proportion of formal work	☐	☐	☐
Percentage of population ages 15-64	☐	☐	☐
Percentage of population displaced internally or transboundary	☐	☐	☐
Presence of drivers of migration and displacement	☐	☐	☐

	Local	Regional	Don't know
Poverty Rate	☐	☐	☐
Food source reliability and diversity	☐	☐	☐
Level of public participation in local policy	☐	☐	☐
Participation in farming cooperatives or associations	☐	☐	☐
Percentage of the population employed in farms	☐	☐	☐
Access to financing and credit	☐	☐	☐
Ratio of annual withdrawals to available water	☐	☐	☐
Water quality	☐	☐	☐

	Local	Regional	Don't know
Groundwater level/sources	☐	☐	☐
Integrated land and water management policies	☐	☐	☐
Percentage of retained renewable water	☐	☐	☐

	Local	Regional	Don't know
Total dam capacity	☐	☐	☐

Demographics

Gender: How do you identify?

- ○ Female
- ○ Non-binary
- ○ Male
- ○ Prefer not to say
- ○ Prefer to self describe, below

What type of institution do you (primarily) work for (choose one):

- ○ Academic/University/Research Institution
- ○ Government
- ○ International Organization
- ○ NGO
- ○ Consultancy
- ○ Industry/Private Sector
- ○ Other (please specify)

Do you have expertise in any of the following areas? (please choose as many as are applicable)?

- ☐ Agricultural Sciences
- ☐ Anthropology and Development
- ☐ Climate Change
- ☐ Climate Science/Services
- ☐ Drought Hazard and Disaster Risk Assessment
- ☐ Economics (water, environmental)
- ☐ Environmental Sciences
- ☐ Geography
- ☐ Health
- ☐ Hydrology
- ☐ Interdisciplinary
- ☐ Sociology
- ☐ Soil and Water Conservation
- ☐ Water Resource Managment
- ☐ Data and Information science
- ☐ Other (please specify)

Do you have expertise in any of the following sectors? (please choose as many as are applicable)?

- [ ] Agriculture sector
- [ ] Water sector
- [ ] Energy Sector
- [ ] Water Energy Food Nexus

If you have Disaster Risk/Resilience expertise how would you rate your level of expertise?

- ○ Not knowledgeable
- ○ Fairly knowledgeable
- ○ Knowledgeable
- ○ Highly knowledgeable
- ○ Fully profocient

Years of experience working on drought:

- ○ 1-2
- ○ 3-5
- ○ 6-10
- ○ 10+
- ○ No Previous Experience

Years of experience working on vulnerability and risk:

- ○ 1-2
- ○ 3-5
- ○ 6-10
- ○ 10+
- ○ No Previous Experience

Geographic focus of work (select all that apply):

- [ ] Asia
- [ ] Africa
- [ ] Europe
- [ ] North America
- [ ] South America
- [ ] Global
- [ ] General/Theoretical

Please provide your First Name, Last Name, and email if you are willing to participate in a drought resilience **online workshop in Spring 2023** and/or the 2nd round of this survey.

The online workshop will focus on identifying the relationships among the indicators.
As an expression of our appreciation for your time, online workshop participants will be compensated with a $20 digital gift card unless they decide to decline.

In the 2nd round of this survey, we will send the summary results of the survey and ask you to review the drought vulnerability and resilience indicators again.

Please indicate your decisions (select all that apply).

- [ ] I would like to participate in the online workshop
- [ ] I would like to receive the 2nd round of the survey
- [ ] I decline to participate in the online workshop

First Name

Last Name

Email