SOLOMON ISLANDS NATIONAL CLIMATE CHANGE RELATIVE VULNERABILITY ASSESSMENT

Prepared for Save the Children

C2O Pacific
version 25 May 2022

Solomon Islands national climate change relative vulnerability assessment

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Determining Vulnerability to Climate Change

Solomon Islands has the second highest disaster risk score of 31.16 in the world disaster risk index, indicating it is a highly exposed nation to natural hazard driven disasters (World Risk Report 2021). The population of Solomon Islands (642,000 people; 2015 data) is concentrated in the coastal zone and are therefore highly exposed to climate extremes and change. Subsistence agriculture and fisheries are particularly exposed to both land-based and marine events. Therefore, the agriculture and fisheries sectors in coastal areas, which provide food for up to 80% of rural communities, will be particularly vulnerable to climate change.

Climate vulnerability is a function of exposure to climate variability and hazards, sensitivity to that variability and those hazards, and the adaptive capacity of habitats, ecosystems, populations and/or social structures. Solomon Islands communities will be affected differently by similar hazards depending on the specific location and characteristics of each community (their exposure). Sensitivity is determined by the physical, social, economic and cultural characteristics of an ecosystem or community and their responses to change. Adaptive capacity refers to the ability of an ecosystem or community to anticipate and manage the impacts of climate change and continue to have positive outcomes under the new realities.

In addition the to Solomon Islands' biophysical characteristics, socio-economic conditions such as low-income, social stratification and marginalization, and reliance on subsistence agriculture and fisheries for food security and livelihoods increase sensitivity and limit people's adaptive capacity, contributing to the country's climate vulnerability. Community and household structures and cultural practices can result in higher vulnerability among some groups – particularly women, children, people living with a disability or less-abled. These groups, and people under-represented in decision-making, suffer an adaptation deficit. That is, high levels of *exposure* to frequent *hazards* and insecure access to essential goods and services (e.g. food, water, healthcare) that undermines *adaptive capacity* and thus increases *vulnerability* (i.e. reducing *resilience*).

The vulnerability of local communities is reflected in their experience recovering from tropical cyclones and other climate-related hazards. The National Disaster Management Office (NDMO) estimates it takes years for the most affected communities to fully recover if no other major setbacks occur. Cimate change projections for Solomon Islands show a trend towards increasing frequency of extreme rainfall events, more intense tropical storms and cyclones, continuing sea level rise and ocean acidification, and increases in the intensity and duration of heatwaves. The likelihood that communities will be impacted by more frequent extreme events is high, resulting in shorter recovery times between events. This effectively means some communities may never fully recover from climate-related events without additional support. If not addressed, these impacts will erode development gains, entrench the cycle of climate vulnerability, and place more lives and livelihoods at risk.

The project has the aspiration to target vulnerable rural communities in Solomon Islands to address their climate vulnerabilities and build resilience, at the spatial scale of Wards. The goal is to directly reach a significant percentage of the rural population, and through government upscaling, indirectly reach the balance of the population. However, Solomon Islands' communities are dispersed across nearly 1,000 islands in the 9 main island groups, comprising 183 Wards that represent a range of biophysical and socio-economic conditions. Therefore, it is critical that a robust, transparent and objective process is used to select target beneficiary communities for the project. Such an approach needs to use the best available existing data in a consistent framework that minimises bias in the selection process, thereby making decisions about beneficiary communities as defensible as possible.

Assessment framework

In order to select beneficiary communities, the design phase applied a semi-quantitative method, partially validated through government consultations, to assess all 183 Wards in Solomon Islands and rank their relative vulnerability to climate change. The method applied the IPCC structured framework that includes the elements of Exposure, Sensitivity and Adaptive Capacity, utilised by the IPCC and United Nations Framework Convention on Climate Change (UNFCCC) (adapted from Schneider et al. 2007; Figure 1).

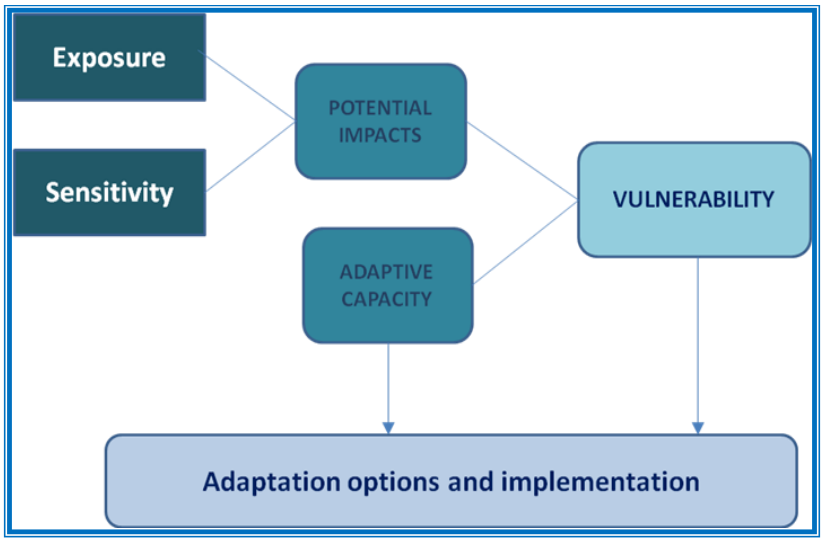

Figure 1. *Vulnerability assessment framework adopted by the Intergovernmental Panel for Climate Change (adapted from Schneider et al. 2007).*

The components of the analysis and semi-quantitative approach are consistent with other vulnerability assessments applied in the Solomon Islands and broader region (e.g. Vanuatu Community-based Climate Resilience project 2021; Solomon Islands, Basel et al. 2020; Great Barrier Reef, Johnson and Marshall 2007; tropical Pacific Island region, Bell et al. 2011, Thiault et al. 2021; Torres Strait islands, Johnson and Welch 2016; Arafura and Timor Seas, Johnson et al. 2021). The method uses a series of steps to apply a structured analysis for determining the potential impacts of climate change on communities in Wards, their relative level of vulnerability and drivers of vulnerability (Figure 2). While the full method has 10 steps, a sub-set can be selected and customised to suit the local context and objectives of the assessment. Importantly, the process is transparent and objective, and delivers clear results that can identify the most vulnerable components, sources of vulnerability, targets for management action as well as key information gaps.

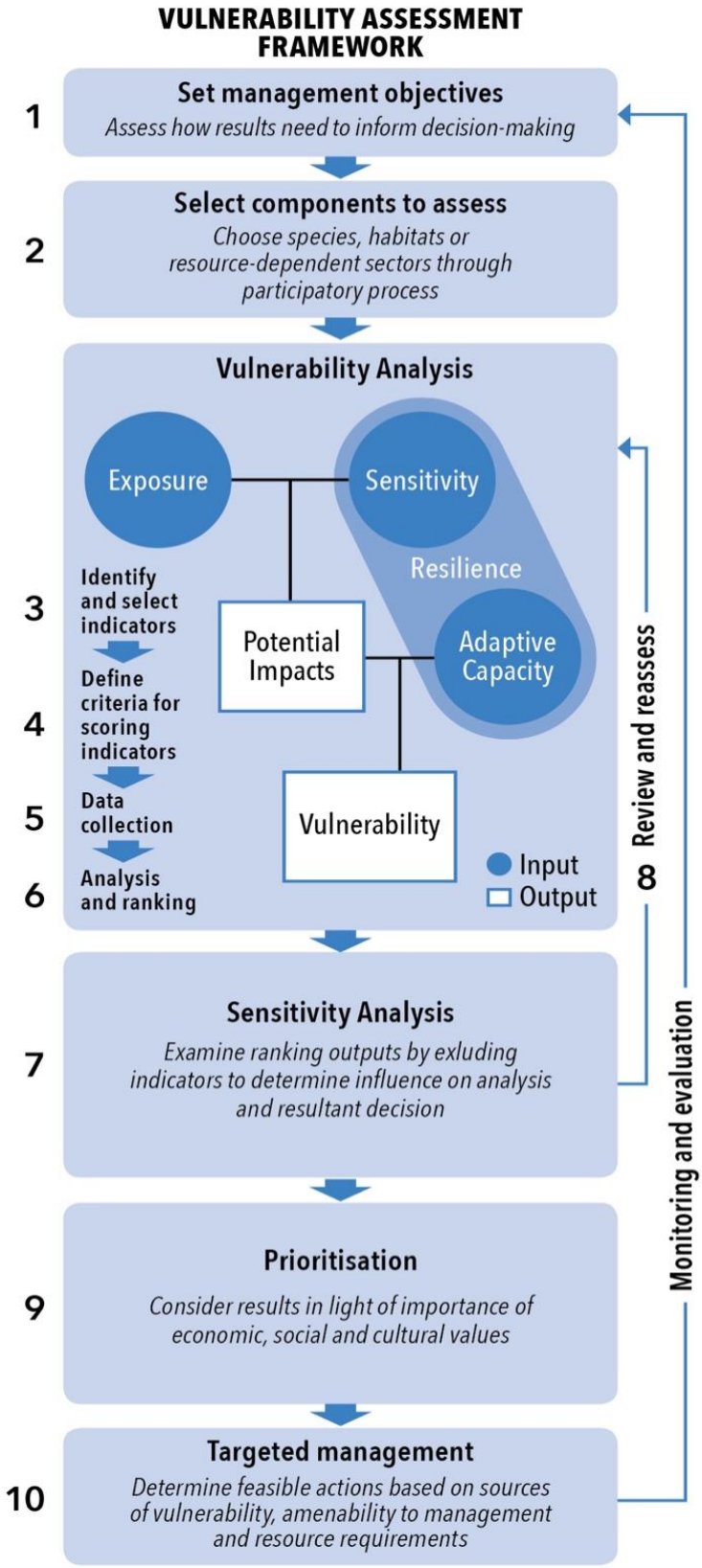

Figure 2. *The 10-steps for applying the semi-quantitative vulnerability assessment method (Source; Johnson et al. 2016).*

Assessment method

Using available data and local knowledge, the assessment used indicators for hazard (climate and non-climate threats), exposure (shoreline geomorphology, topography/ elevation), sensitivity (dependence of crops for food, dependence on natural resources for income, condition of habitats, remoteness/accessibility) and adaptive capacity (education levels, health index, current community actions) (steps 3–6).

The *hazard* and *exposure* indicators included those climate and non-climate threats that communities are likely to experience, based on historic exposure and future projections for Solomon Islands. *Sensitivity* indicators were based on known factors that contribute to negative responses of social-ecological systems to changes in climate (e.g. resource demand – using population density and growth as proxy; Gombos et al. 2013, Basel et al. 2020), resource dependence for food and/or livelihoods (Wongbusarakum and Loper 2011), and resource condition. Sensitivity is largely determined by the relationship of individuals, households or a community to resources impacted by climate events, and by the degree of dependency on those resources (Wongbusarakum and Loper 2011). Indicators for *adaptive capacity* were based on characteristics (or traits) of communities that help them adjust to impacts or support recovery, ultimately conferring resilience (e.g. governance, education and health; see Wongbusarakum and Loper 2011, Gombos et al. 2013, Johnson et al. 2016).

Notably, many indicators of vulnerability are socio-ecological factors that influence the sensitivity of communities to climate change and their capacity to adapt to future risks and change. Scores were determined for each indicator using a 3-point scale based on specific criteria, and the data were reviewed by specialists who assigned scores for each indicator. The full list of indicators and scoring criteria are provided in Table 1. All indicators were given equal weighting since interactions among and the relative importance of different indicators are not well understood (Allison et al. 2009). Where it can be empirically demonstrated that indicators should be differentially weighted, such a system can be incorporated.

A vulnerability metric was used to quantify results so that components are systematically ranked based on their relative vulnerability at a national level. The analysis followed the method outlined in Johnson et al. (2016) to calculate a vulnerability index using the metric:

$$V=(ExSx[1-AC\ standardised])+1$$

where:
V = vulnerability
E = exposure index
S = sensitivity index
AC = adaptive capacity index

Assessment data

The national vulnerability assessment drew on available published data, government statistics and local knowledge (see Table 1 for the datasets used). Some proposed indicators were removed due to lack of data, for example, ‘population growth’. Importantly, because it is a relative assessment, the data used were consistently sourced and applied across the 183 Wards for each indicator. Stakeholder consultation with government during the process also provided data for the assessment.

Table 1. *Vulnerability indicators and criteria used for Solomon Islands Wards assessment.*

Solomon Islands community-based climate resilience site selection criteria: Wards					Data type	Data source
	Indicators	**SCORING CRITERIA**				
		Low = 1	**Medium = 2**	**High = 3**		
Exposure	**Historic major climate hazards**	rarely or once every 20+ years	once every 10–20 years	once every <5 years	TC, severe storm, drought, flood, heatwave (land or marine), storm surge/coastal inundation	Major hazards/ disaster record for past 20 years - MECDM
	Non-climate major hazards	rarely or once every 20+ years	once every 10–20 years	once every <5 years	Volcanic eruption, tsunami, earthquake, saltwater intrusion in groundwater	Major hazards/ disaster record for past 20 years - NDMO
	Shoreline geomorphology	steep or rocky	low-lying and mangrove/tree dominated	low-lying beach, limited vegetation	shoreline topography influences exposure to hazards	Topographic maps, satellite imagery
	Topography/elevation	inland or upland, far from rivers, extreme slopes	moderate elevation, no steep slopes, >5km to rivers	low-lying, near coast or rivers, steep slopes	topography/elevation to risks from flooding and erosion/ landslides (7 sub-indicators)	Topographic maps, satellite imagery (*Google Earth*)
Sensitivity	**Dependence on agriculture/fishing for income (% primary jobs)**	<40%	40-60%	>60%	% primary jobs involved in fishing (marine or freshwater) or agriculture for income	Solomon Islands census 2009; Household income surveys
	Dependence on agriculture for subsistence (% crops grown by households for food)	<40%	40-60%	>60%	% households growing crops primarily for own consumption	Solomon Islands census 2009; Household income surveys
	Condition of vegetation (e.g. mangroves, upland forests, coastal mosaic)	75-100% natural vegetation intact	25-75% natural vegetation cover	Cleared landscape with <25% vegetation cover	Cover of coastal vegetation and intact habitats; land-use change/clearing over last 10 years	Satellite imagery (*Google Earth*)

	Remoteness/accessibility	peri-urban or near Provincial capital (< 50 km) with good road/boat access	medium distance from provincial capital (50-100 km) with good road/boat access	far from provincial capital (> 100 km) and no/poor road/boat access	Location, condition of roads/bridges, distance from nearest Provincial capital	Ward maps, local knowledge
		Low = 1	**Medium = 2**	**High = 3**		
Adaptive Capacity	**Education (literacy rate)**	<80%	80 to 85% (national average)	>85%	Literacy rate - % adults 15+ literate in English and/or local language	National census 2009
	Education (primary school education)	<85%	85-90% (national average)	>90%	Education level (% students enrolled in primary school). Nationally 48% enrolled in ECE; 88-89% in primary school (2013 data)	National census 2009; HEIS
	Health & equity (disability)	>5%	2-5% (national average)	<2%	% adults report a disability (national data 2011 3.5% average; range 0-20%)	Disability Nationwide Survey 2005
	Community level actions targeting climate change	none or limited actions at community level	some initiatives/actions started but not well progressed or inclusive	many established initiatives/actions being well implemented	Awareness and action of community without the risk of duplicating other project activities, noting that focus is on COMMUNITY-LEVEL actions	Other project data/reports, national project database & local knowledge

Assessment results

The results provided a relative ranking of the 183 Wards in Solomon Islands from highest to lowest vulnerability to climate change (see results in Table 2) and enable the project to strategically target beneficiaries (i.e. those that are most vulnerable and marginalised) in a transparent and defensible manner. Notably, the assessment can be improved with additional data, in particular, the 2019 national census, that will provide more current information and also allow additional indicators to be included, e.g. population growth. The results also identified the main drivers (or sources) of vulnerability, which were used to identify a suite of adaptation actions that specifically address the main sources of vulnerability and provide a 'menu' or package of adaptations for implementation. During project implementation, suitable adaptation actions will be selected from this 'menu' (adaptation package) by communities and implemented in partnership with beneficiary communities to minimise vulnerability and build resilience to climate change.

Table 2. *Relative ranking of vulnerability of Wards in Solomon Islands to climate change, and identification of drivers (in green) of vulnerability for each Ward.*

RELATIVE VULNERABILITY (HIGH TO LOW)	WARD #	WARD COMMUNITY	Hazards & Exposure (2020)				SENSIVITY				ADAPTIVE CAPACITY			
			Historic major climate hazards	Non-climate major hazards	Shoreline geomorphology	Topography/ elevation (7 sub-indicators)	Dependence on agriculture for food (% food grown by households)	Dependence on ag/fishing for income (% primary job)	Condition of vegetation (e.g. upland forests)	Remoteness/ accessibility	EDUCATION Literacy rate (% adults 15+ literate)	Education level (% children enroled in primary school)	Health (% adults reported a disability)	Community level actions targeting climate change
1	902	Polynesian Outer Islands												
2	731	Lauaniua												
3	808	Arosi East												
4	409	Banika												
5	716	Faumamanu - Kwai												
6	907	Nevenema												
7	713	Sulufou - Kwarande												
8	619	Vulolo												
9	411	Lovukol												
10	727	Siesie												
11	726	Kwarekwareo												
12	818	Rawo												
13	820	Haununu												
14	717	Gulalofou												
15	916	Tikopia												
16	611	Tetekanji												
17	718	Waneagu/Taelanasina												
18	408	North West Gela												
19	703	Buma												

20	915	Vanikoro												
21	311	Sigana												
22	712	Fouenda												
23	610	Moli												
24	613	Valasi												
25	710	Takwa												
26	914	Utupua												
27	706	Mandalua - Folotana												
28	607	Vatukulau												
29	615	Longgu												
30	733	Sikaiana												
31	609	Avuavu												
32	714	Sububenu - Burianiasi												
33	812	Wainoni West												
34	904	Lipe - Temua												
35	911	North East Santa Cruz												
36	804	Ugi and Pio												
37	905	Manuopo												
38	618	East Tasimboko												
39	704	Fauabu												
40	705	West Baegu - Fataleka												
41	410	Pavuvu												
42	813	Wainoni East												
43	711	East Baegu												
44	728	Waneagu-Taelanasina												
45	315	Susubona												

46	401	Sandfly-Buenavista													
47	707	Fo'ondo - Gwaiau													
48	912	Nanggu - Lord Howe													
49	729	Kwaimela-Radefasu													
50	622	East Ghaobata													
51	608	Talise													
52	307	Koviloko													
53	605	Wanderer Bay													
54	313	Kolomola													
55	402	West Gela													
56	407	North East Gela													
57	802	South Ulawa													
58	819	Weather Coast													
59	403	East Gela													
60	620	Malango													
61	309	Kaloka													
62	910	Nea- Noole													
63	310	Tatamba													
64	732	Pelau													
65	303	Kokota													
66	304	Hovikoilo													
67	223	Nggatokae													
68	722	Aba - Asimeuru													
69	413	South Savo													
70	501	East Tenggano													
71	730	Langalanga													

72	214	Kusaghe													
73	412	North Savo													
74	917	Neo													
75	312	Japuana													
76	709	Matakwalao													
77	816	Santa Catalina(Owariki)													
78	801	North Ulawa													
79	109	Polo													
80	308	Kmaga													
81	913	Duff Islands													
82	203	Simbo													
83	723	Asimae													
84	708	Malu'u													
85	719	Aiasi													
86	724	Mareho													
87	406	South East Gela													
88	807	Arosi North													
89	103	Vasipuki													
90	803	West Ulawa													
91	617	Paripao													
92	806	Arosi West													
93	811	Bauro East													
94	602	Saghalu													
95	612	Birao													
96	621	West Ghaobata													
97	901	Fenualoa													

98	702	Aimela													
99	903	Nipua - Nopoli													
100	504	Kanava													
101	1006	Vuhokesa													
102	725	Tai													
103	112	Senga													
104	219	North Rendova													
105	210	Irringgila													
106	301	Kia													
107	405	South West Gela													
108	614	Kolokarako													
109	314	Kolotubi													
110	909	Graciosa Bay													
111	510	Sa'aiho													
112	815	Santa Ana (Owaraha)													
113	306	Tirotongana													
114	104	Viviru													
115	715	Nafinua													
116	302	Baolo (Havulei)													
117	606	Duidui													
118	814	Star Harbour North													
119	111	Susuka													
120	720	Areare													
121	721	Rarosu'u													
122	105	Babatana													
123	110	Bangera													

124	809	Bauro West													
125	316	Samasodu													
126	101	Wagina (Vaghena)													
127	221	Mbuini Tusu													
128	218	South Rendova													
129	213	Vonavona													
130	503	Lughu													
131	616	Aola													
132	817	Star Harbour South													
133	204	North Ranongga													
134	208	Mbilua													
135	220	Nono													
136	224	North Vangunu													
137	603	Savulei													
138	508	East Gaongau													
139	507	Matangi													
140	509	West Gaongau													
141	211	Gizo													
142	217	Roviana Lagoon													
143	205	Central Ranongga													
144	604	Tangarare													
145	502	West Tenggano													
146	601	Tandai													
147	805	Arosi South													
148	102	Katupika													
149	113	Kerepangara													

150	202	Inner Shortlands														
151	106	Tepazaka														
152	220	Kolombaghea														
153	506	Mugi Henua														
154	212	South Kolombangara														
155	1002	Mbumburu														
156	107	Batava														
157	810	Bauro Central														
158	1010	Naha														
159	216	Nusa Roviana														
160	201	Outer Shortlands														
161	207	Vonunu														
162	209	Ndovele														
163	114	Kirugela														
164	701	Auki														
165	206	South Ranongga														
166	226	North Kolombangara														
167	908	Luva Station														
168	305	Buala														
169	505	Te Tau Gangoto														
170	108	Tavula														
171	215	Munda														
172	225	Noro														
173	404	Tulagi														
174	906	Nenumpo														
175	1001	Nggosi														

176	1003	Rove - Lengakiki													
177	1004	Cruz													
178	1005	Vavaea													
179	1007	Mataniko													
180	1008	Kola'a													
181	1009	Kukum													
182	1011	Vura													
183	1012	Panatina													

The results are spatially variable and show both high and low Wards exist in each Province (Table 3) and sometimes on the same island (Figure 3). Demonstrating the influence of local conditions (biophysical and socio-economic) and the need to tailor adaptation actions to local conditions. The adaptation package will provide a menu of actions to address these specific vulnerabilities.

Table 3. *Most vulnerable Wards (top 3) in each Province, showing Provincial and national vulnerability rankings.*

	PROVINCIAL RANKING	NATIONAL RANKING	WARD
Choiseul	1	79	Polo
	2	89	Vasipuki
	3	103	Senga
Western	1	67	Nggatokae
	2	72	Kusaghe
	3	82	Simbo
Isabel	1	21	Sigana
	2	45	Susubona
	3	52	Koviloko
Central	1	4	Banika
	2	9	Lovukol
	3	18	North West Gela
Rennell and Bellona	1	70	East Tenggano
	2	100	Kanava
	3	111	Sa'aiho
Guadalcanal	1	8	Vulolo
	2	16	Tetekanji
	3	23	Moli
Malaita	1	2	Lauaniua
	2	5	Faumamanu - Kwai
	3	7	Sulufou - Kwarande
Makira-Ulawa	1	3	Arosi East
	2	12	Rawo
	3	13	Haununu
Temotu	1	1	Polynesian Outer Islands
	2	6	Nevenema
	3	15	Tikopia
Honiara	1	101	Vuhokesa
	2	155	Mbumburu
	3	158	Naha

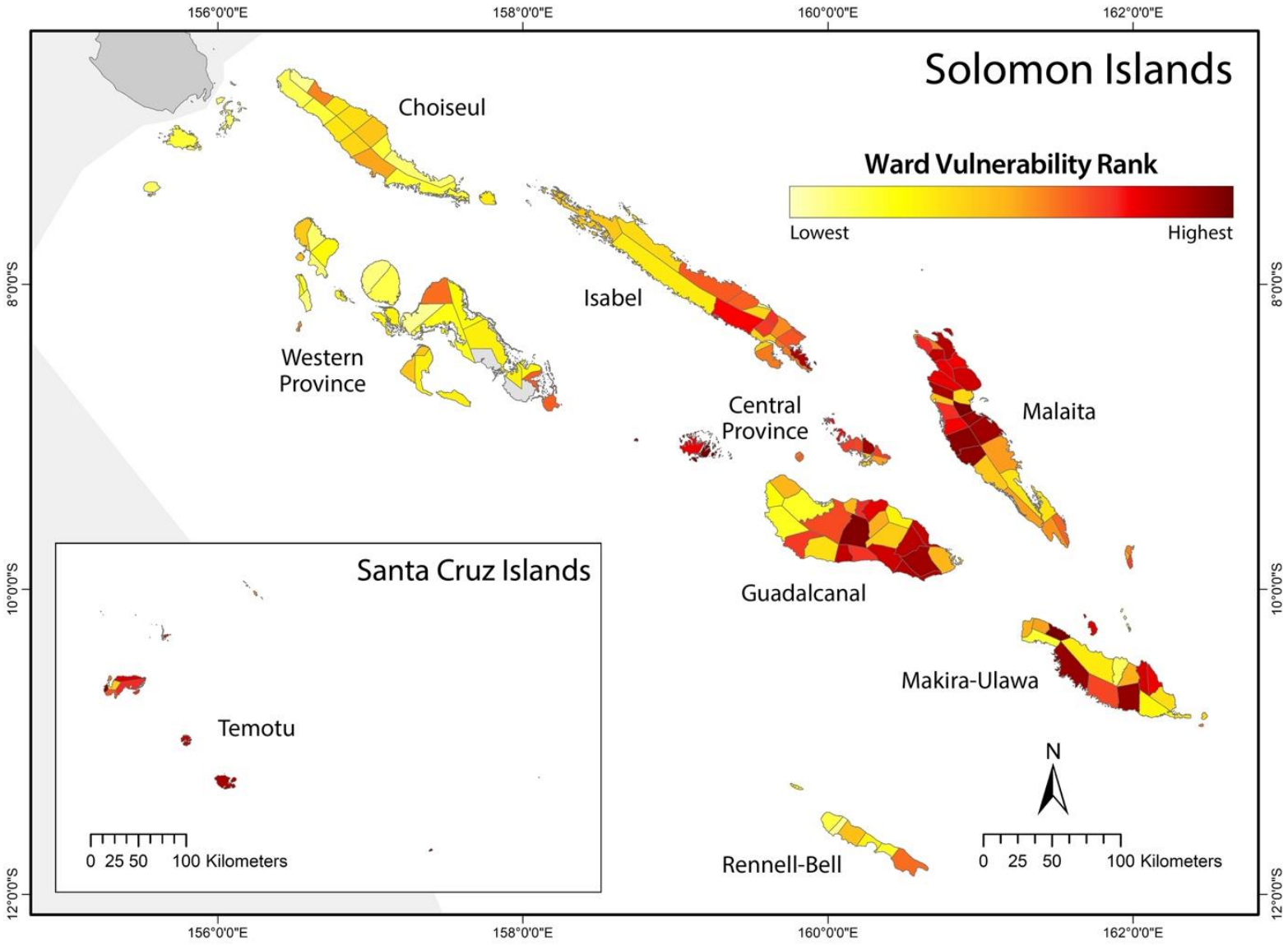

Figure 3. *Map of the national relative ranked vulnerability of all Wards in Solomon Islands to climate change, with dark red being highest vulnerability and yellow/white being lowest vulnerability.*

Targeting beneficiaries

Direct Beneficiaries

The national vulnerability assessment provides an objective and transparent basis for identifying vulnerable Wards and therefore potential project beneficiaries. Relative vulnerability however is not the only consideration, and other factors are also relevant when selecting beneficiaries for the project. Through further stakeholder consultation, additional information was collected on each Ward to inform selection of direct beneficiaries for the project.

The results of the national vulnerability assessment formed the basis for engaging with national and sub-national government to incorporate data on existing projects and government priorities, to inform selection of Wards that will be targeted for project activities. The selection of target beneficiaries considered:

1. Alignment with government priorities for climate change adaptation, including food security, livelihoods, natural resource management, disaster risk reduction and gender equity and social inclusion;
2. Alignment with government policies/regulations for climate change adaptation, including food security, livelihoods, natural resource management, disaster risk reduction and gender equity and social inclusion; and
3. Current enabling activities (i.e. opportunity to build on existing projects and activities to increase benefits) in each Ward.

These three criteria were considered as a filter to review the ranked Wards from highest vulnerability to lowest to select the Wards for the project to target. Interestingly, the response to these three criteria for each of the 183 Wards was the same and positive. Meaning that there was alignment with government priorities and policies in every Ward, and that there were current enabling activities in every Ward. Therefore, the results of the vulnerability assessment remain the same and are the foundation for identifying direct beneficiaries.

Based on the top 52 most vulnerable Wards the project will target 185,102 direct beneficiaries (ca. 30% of the total population) in six Provinces (Table 4). Through scaling-up driven by sub-national governance, 580,000 indirect beneficiaries (ca. 65% of the total population) will be reached. This reflects the goal of the project to build climate resilience in the most vulnerable rural communities and is summarised in Table 5.

Table 4. *Target Wards and direct beneficiaries and households based on the top 52 most vulnerable Wards in Solomon Islands.*

Provincial vulnerability ranking	National vulnerability ranking	Ward	Population (2019 provisional)	Households (2009)
Isabel				
1	21	Sigana	2,785	438
2	45	Susubona	2,216	361
3	52	Koviloko	1,441	253
Central				
1	4	Banika	2,350	333
2	9	Lovukol	2,477	358
3	18	North West Gela	2,004	330
4	41	Pavuvu	2,477	333
5	46	Sandfly-Buenavista	3,755	672
Guadalcanal				
1	8	Vulolo	6,440	911
2	16	Tetekanji	1,620	214
3	23	Moli	5,374	802
4	24	Valasi	2,148	272
5	28	Vatukulau	2,649	417
6	29	Longgu	5,477	654
7	31	Avuavu	3,289	470
8	38	East Tasimboko	10,815	1,419
9	50	East Ghaobata	6,565	807
10	51	Talise	2495	364
Malaita				
1	2	Lauaniua	1,589	216
2	5	Faumamanu - Kwai	4,088	648
3	7	Sulufou - Kwarande	986	157
4	10	Siesie	4,264	656
5	11	Kwarekwareo	2,186	318
6	14	Gulalofou	6,863	1,081
7	17	Waneagu/Taelanasina	3,958	636
8	19	Buma	7,082	1,049
9	22	Fouenda	2,145	321
10	25	Takwa	11,460	1,802
11	27	Mandalua - Folotana	3,128	546

12	30	Sikaiana	283	60
13	32	Sububenu - Burianiasi	5,797	884
14	39	Fauabu	10,049	1,534
15	40	West Baegu - Fataleka	2,819	454
16	43	East Baegu	5,441	839
17	44	Waneagu-Taelanasina	3,958	636
18	47	Fo'ondo - Gwaiau	6,295	1,135
19	49	Kwaimela-Radefasu	10,963	1,767
Makira-Ulawa				
1	3	Arosi East	2,643	383
2	12	Rawo	871	114
3	13	Haununu	3,403	437
4	33	Wainoni West	2,743	367
5	36	Ugi and Pio	1,556	207
6	42	Wainoni East	3,202	470
Temotu				
1	1	Polynesian Outer Islands	366	90
2	6	Nevenema	981	212
3	15	Tikopia	1,331	262
4	20	Vanikoro	1,340	266
5	26	Utupua	1,210	232
6	34	Lipe - Temua	822	158
7	35	North East Santa Cruz	1,909	349
8	37	Manuopo	1,067	209
9	48	Nanggu - Lord Howe	1,928	339
		TOTAL	**185,102**	**28,242**

Table 5. *Target beneficiary numbers by Province and households reached in each Province.*

	Wards (#)	**Population (2019 provisional)**	**Number of households (2009)**
Isabel	3	6,442	1,052
Central	5	13,064	2,026
Guadalcanal	10	46,871	6,330
Malaita	19	93,354	14,739
Makira-Ulawa	6	14,418	1,978
Temotu	9	10,954	2,117
TOTAL	**52**	**185,102**	**28,242**

Indirect Beneficiaries

While direct beneficiaries will be the primary focus of support to implement adaptations, the capacity building in sub-national and national government and the systems established will facilitate scaling-up of project adaptations and resources to many more indirect beneficiaries (see Feasibility Report for further details). The indirect beneficiaries will be up to 580,000 people (65% of the national population), living in Wards with lower relative vulnerability and peri-urban areas, who will be reached through up-scaling of adaptations by the Wards and other government structures, and through delivery of CIS and DRR outreach.

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