

Information guide and self-protection measures during the eruptive process of the Cotopaxi volcano

Risk Management Department



**Gobierno
del Ecuador**

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Cotopaxi National Park.

Cotopaxi Volcano

Located on the Cordillera Oriental (Real), 35 km northeast of Latacunga and 45 km southeast of Quito, has had, since the XVI century, five major eruptive periods: 1532- 1534, 1742-1744, 1766-1768, 1853-1854 y 1877-1880. All episodes have resulted in a volcanic phenomena that could be repeated.

From 2001 until April 2015, volcano tectonic earthquakes increased in number and magnitude compared to those in the 1990s. In 2015, an increase in the Cotopaxi volcano's seismic activity volcano was observed, which generated ash fall and secondary lahars (mudflows) that mainly affected the western flank of the volcano.

In October 2022, a volcanic tremor seismic signal was recorded with the presence of gases and ash fall in the José Rivas shelter, although the activity was lower than that of 2015, the variation in these parameters led to the declaration of a Yellow Alert status for Cotopaxi volcano risk zones.



Ash fall from Tungurahua volcano.

Volcanic Dangers

Some of the volcanic hazards such as volcanic bombs, pyroclastic and lava flows, gases, volcanic earthquakes, and shock waves can reach the areas and populations closest to the vicinity of the volcano. Additional volcanic dangers; such as, ash fall and mudflows (lahars) may travel great distances. For ash fall, the distance will depend on the height of the eruption column and the wind direction. Meanwhile, for mudflows it will depend on the volume of the melted ice cap and the amount of volcanic material transported through the river tributaries, which can reach 70 km/hour.

Materials expelled by the volcano

Falling pyroclasts: According to their size, they are classified as follows:



Minor ash:
Under 2 millimeters



Lapilli or gravel:
Between 2 and 64 millimeters



Blocks and bombs:
Over 64 millimeters

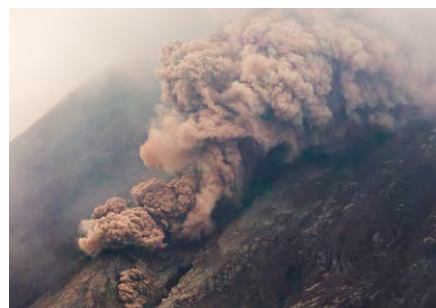
Flows:



Lava flows and domes:
These are streams of molten rock that are spewed from the crater or from cracks in the flanks of the volcano.



Mudflows (lahars):
These are a mixture of rock fragments, sand, silt, clay, and water that move through the channels of streams and rivers.



Debris avalanches:
These are huge landslides of the volcanic edifice that can occur as a result of the instability of its flanks.

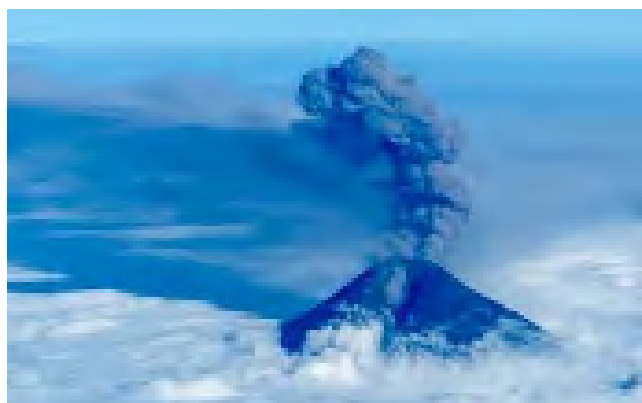
Volcanic gases:

Pyroclastic flows:

These are clouds made up of rock fragments, ash, and hot gases that can exceed a temperature of 800°C.

Volcanic gases:

Before, during and after an eruption, volcanoes emit significant quantities of gases, mostly water vapour, in addition to certain concentrations of carbon dioxide, sulphur dioxide, sulphur hydroxide and others.



Other phenomena:

Shock waves:

Pressure waves that propagate at a greater speed than sound, produced during the explosive stage.

Volcanic earthquakes:

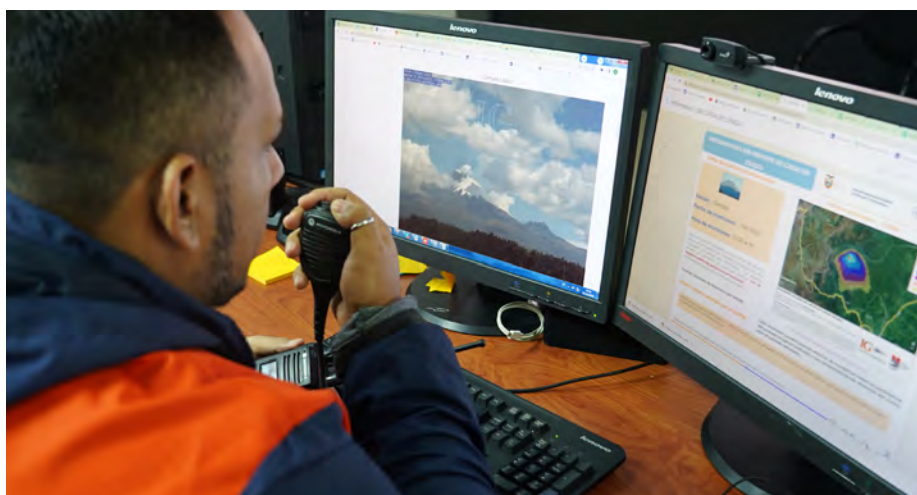
Generated by internal volcanic activity, they are generally of high magnitude.

How are volcanic alerts declared?

The Risk Management Department has the exclusive competence to declare the different alert types for different threats, whether of natural or anthropogenic origin, in any territorial area, based on the information provided by national or international technical scientific institutions, or by the entities responsible for monitoring, and according to the threat.

Alert levels may vary in order, ascending with the increasing probability of an event; or descending, with a decreasing probability.

The gradual evolution of alert levels cannot always be implemented and depends on the speed of evolution of the threat; depending on the type of event, it is possible to proceed with the



Monitoring Room of Adverse Effects of the Risk Management Department

implementation of an orange or red alert without having declared a yellow alert.

"Between 2015 and 2016 in light of the increase in volcanic activity

of Cotopaxi and as lessons learned, the Ecuadorian State prioritises the implementation of actions to strengthen the components of the Early Warning System (EWS) due to volcanic activity.

Alert levels

Following a thorough monitoring of volcanic activity and constant technical studies, resolutions are issued to generate alerts that allow responding entities to take the most appropriate measures for the benefit of the population, with the establishment of four color-based alert levels:

1

No Alert or White Alert:

Normal conditions: Null or very low probability of the occurrence of a dangerous event. This state does not need to be declared.

2

Yellow Alert:

Activation of the threat: anomalies are notified, monitoring is strengthened, response preparedness processes are initiated, and communication mechanisms for the population are activated.

3

Orange Alert:

Preparation for a possible imminent eruption: response and evacuation plans are implemented, threat monitoring is intensified, decision-makers are notified, humanitarian assistance is prepared, and news bulletins are issued.

4

Red Alert:

Notification of an ongoing volcanic eruption. Permanent Emergency Operations Committees will be installed and, if required, international cooperation channels will be activated.

Early Warning System (EWS) for volcanic activity

An early warning system brings together a set of capabilities to generate and share timely and key information, so that warnings can be prepared and acted upon appropriately, and with sufficient lead time to reduce damage and losses.

Why use an early warning system?

- Reduces loss of life
- Strengthens the capability of communities at risk to receive, analyse, and act upon receiving these alerts
- Reinforces the capability that authorities have in order to make decisions to protect communities
- Provides knowledge to communities relating to early warnings, hazards, vulnerabilities and risk

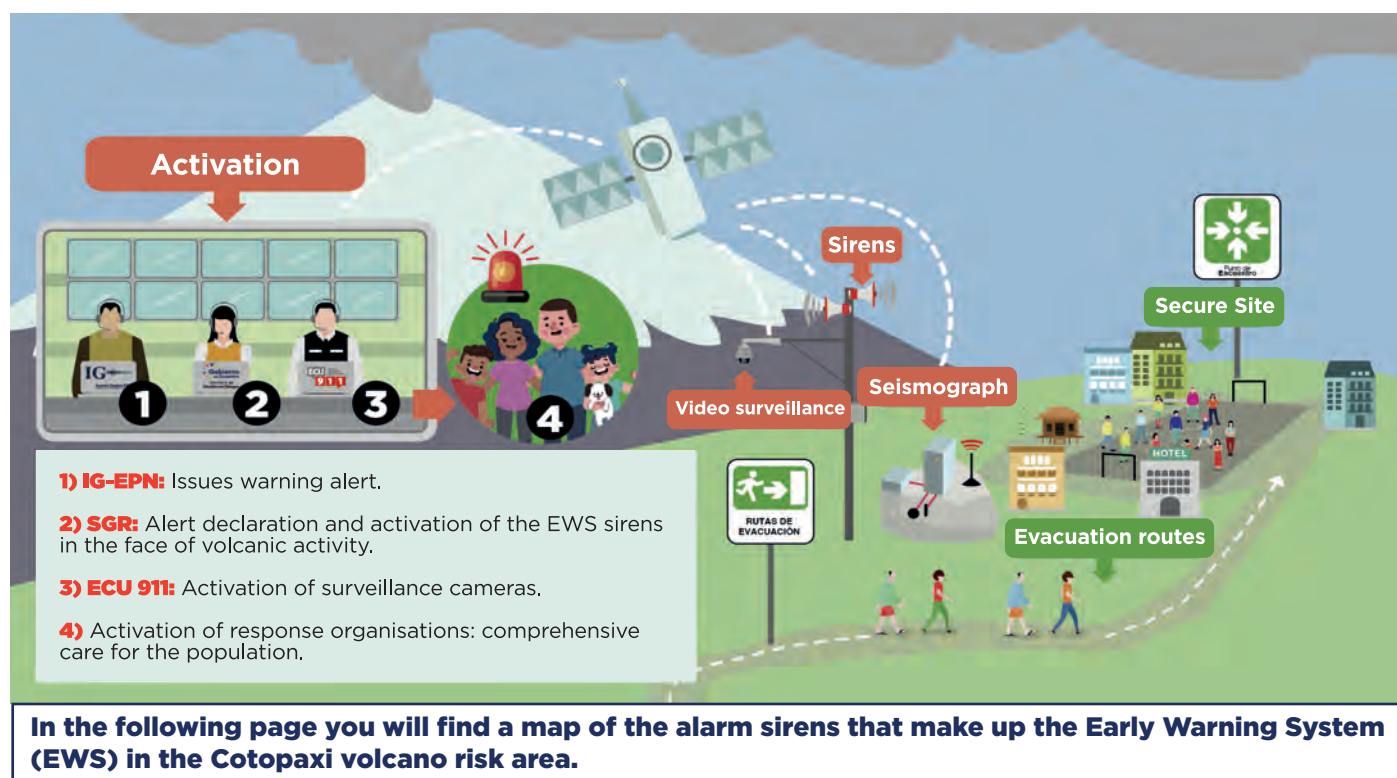
Capabilities of the early warning system

Risk awareness: Consists of the authorities and the population becoming aware of the volcanic hazards to which they are exposed, identifying their vulnerabilities and establishing the existing risk levels within their community.

Monitoring and alert: Permanent support and monitoring regarding volcanic risks based on the technical and scientific information, and on predictions and alerts; it should be in operation 24 hours a day.

Circulation and communication: Creation of mechanisms to share and warn the authorities and the population about the volcanic activity alert at the different governmental levels.

Response capacity: Activities to strengthen the capabilities of authorities and the population to respond in case of a possible volcanic eruption.



LOCATION OF COTOPAXI VOLCANO'S EARLY WARNING SYSTEM SIRENS

78 SIRENS

14 SIRENS National Department of Risk Management (SGR)
7 SIRENS MAATE - Cotopaxi National Park
57 SIRENS Municipal Secentralised Autonomous Governments

PICHINCHA

23 sirens

QUITO

1	Tumbaco	Sub Estación Tumbaco N° 36 (La Viña)
2	Tumbaco	Av. Interoceánica e Intervalles
3	Tumbaco	Intervalles
4	Tumbaco	Comuna Lumbisi
5	Conocoto	Av. Numa Pompilio Llona y Juan León Mera
6	Conocoto	Av. José Félix Gallardo y 18 De Mayo
7	Alangasi	Río Zamora Entre Isla Isabela y Puerto Rico

RUMIÑAHUI

8	San Rafael	San Rafael
9	Sangolquí	Urbanización La Colina
10	Sangolquí	Barrio San Jorge
11	Sangolquí	Cashapamba (Colegio Liceo Del Valle)
12	Sangolquí	Barrio El Cabre
13	Sangolquí	Cashapamba (Semisud) Sangolquí
14	Sangolquí	Barrio San Sebastián
15	Sangolquí	Barrio Selva Alegre
16	Sangolquí	Barrio Carlos Gayaldiez
17	Sangolquí	La Libertad
18	Rumipamba	El Vallecito

MEJÍA

19	Machachi	Loreto Del Pedregal
20	Machachi	Santa Ana Del Pedregal
21	Machachi	San José De Pedregal
22	Machachi	Control Norte
23	Machachi	Tambopaxi

COTOPAXI

50 sirens

LATACUNGA

24	Mulaló	Área De Laguna De Limpiopungo
25	Mulaló	Rinconada
26	Mulaló	Moriscal Sucre
27	Mulaló	Agualongo
28	Mulaló	Control Caspi
29	San Juan de Pastocalle	Santa Rita
30	San Juan de Pastocalle	El Chasqui
31	Mulaló	El Caspi
32	Mulaló	San Agustín De Callo
33	San Juan de Pastocalle	El Progreso
34	Tanicuchi	San Martín - Río Blanco Alto
35	Mulaló	San Ramón
36	Tanicuchi	Lasso - Cuartel De Bomberos
37	Mulaló	Callo Mancheno
38	Tanicuchi	Lasso Esc. Juan Manuel Lasso
39	Mulaló	Rumipamba De Villacis Sector San Bartolo
40	Mulaló	Callo Boyero
41	Mulaló	Rancho Saquilimala
42	Mulaló	San Antonio De Limache
43	Mulaló	Mulaló Macaló Chico
44	Mulaló	San Isidro
45	Mulaló	Barrancas
46	Mulaló	Novacero
47	Mulaló	Rumipamba De Espinozas
48	Joseguango Bajo	José Guango Bajo
49	Mulaló	San Francisco De Espinozas
50	Joseguango Bajo	Aqua Clara Cutuchi
51	Gualitacama	Unidad Educativa Patria
52	Aláquez	Laigüa De Maldonado
53	Aláquez	Aláquez Isimbo
54	San Buenaventura	Bellavista
55	San Buenaventura	Av. Miguel Iturralde (San Buenaventura)
56	San Buenaventura	Colegio 14 de Julio
57	San Buenaventura	Ciudadela Nueva Vida
58	Eloy Alfaro	Universidad Técnica De Cotopaxi
59	La Matriz	FAE (ITSA)
60	Juan Montalvo	La Cocha Colegio Vicente León
61	La Matriz	Ciudadela El Carmen
62	Eloy Alfaro	Av. Cotopaxi
63	Eloy Alfaro	UPC San Felipe
64	Juan Montalvo	El Calvario
65	Eloy Alfaro	Las Fuentes (Terminal Terrestre)
66	Eloy Alfaro	Ciudadela Del Chofer
67	Eloy Alfaro	Ciudadela Rumipamba
68	Ignacio Flores	El Bosque Alto
69	Ignacio Flores	Ciudadela Patria I
70	Ignacio Flores	Salache Rumipamba

SALCEDO

71	San Miguel	Casa Yerovi Mackuast
72	San Miguel	Edificio Del Gad Municipal
73	Panzaleo	Patatin Panzaleo

TUNGURAHUA

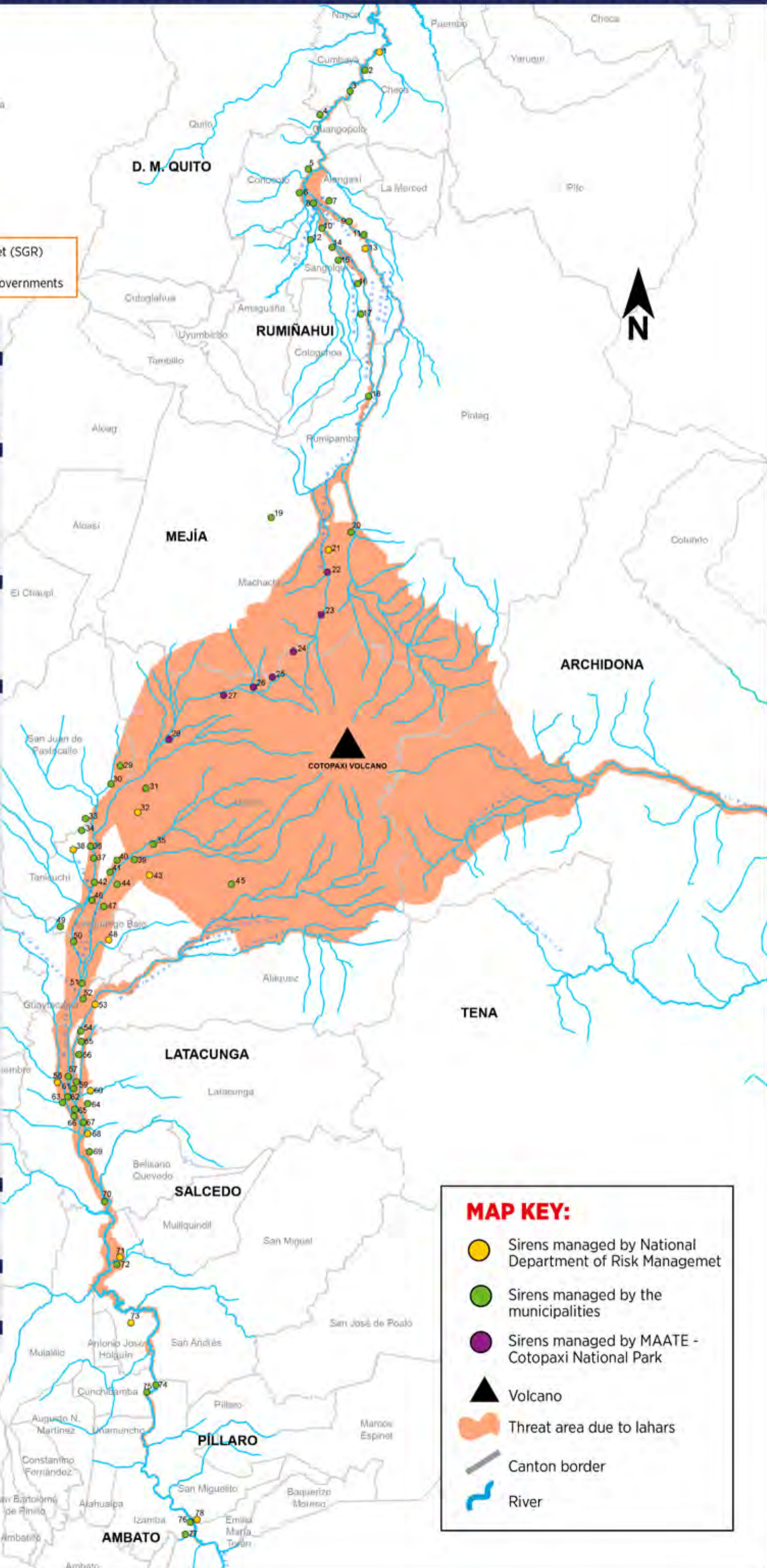
5 sirens

AMBATO

74	Cunchibamba	Sirena 1
75	Cunchibamba	Sirena 2
76	Izamba	Quillen Playas 2
77	Izamba	Quillen Playas 1

PILLARO

78	San Miguelito	Quillen Las Playas
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MAP KEY:

- Sirens managed by National Department of Risk Management
- Sirens managed by the municipalities
- Sirens managed by MAATE - Cotopaxi National Park
- ▲ Volcano
- Threat area due to lahars
- Canton border
- ~ River

Self-protection measures in case of a volcanic eruption

1. Elaborate a family emergency plan that considers:

- Identify the dangers you could face inside and outside your home in the case of an emergency.
- Draw a plan of your home and identify the safe locations within your house, neighbourhood or area; as well as those from the locations you visit the most (work, school, and family member's houses).
- Determine family meeting points in case the family is separated.
- Identify objects that could cause harm in an emergency and/or disaster.
- Have important data regarding family members as well as important telephone numbers at hand.

Prepare your emergency rucksack

- Whistle
- Portable radio
- Candles and matches
- Hygiene Products
- Pet food
- Light blanket
- First Aid Kit
- Non-perishable food
- Identification Documents
- Cash
- Battery operated flashlight
- Change of clothes
- Water
- Alcohol and facemask
- House Keys



Remember that: Your emergency rucksack may be adapted according to your family's needs.

2. Participate in evacuation drills with your family, taking into account various scenarios: family together/separated, during the day/night, during the week/weekend.

3. Always inform yourself through official sources: Risk Management Department (SGR) and the Geophysical Institute of the National Polytechnic Institute (IG-EPN).

In case of emergency
contact
9-1-1

**CLICK HERE TO
DOWNLOAD
FAMILY
EMERGENCY
PLAN**



Child care

Identify your children's most frequent medical conditions, consult the doctor in a timely manner and have their medicines at hand in case you need them.

When packing your emergency rucksack make sure you include objects which they enjoy and that do not require electricity nor internet connectivity, such as: board games, books, comics, and paper and colouring materials.

Make sure you inform the children about what is happening considering their age:

- Explain what is happening with the volcano. Talk to them and reinforce the contingency plan prepared by their school.

- Explain why they have to evacuate and where they have to go.

- Explain that, in case of an eruption, it may be the case that you will take hours or days to pick them up, and that is why they have to stay with their classmates and teachers in a calm and safe manner.

- Talk to them about the importance of taking care of their emergency rucksack, about being supportive of their classmates, and about following their teacher's instructions.

Care of the elderly

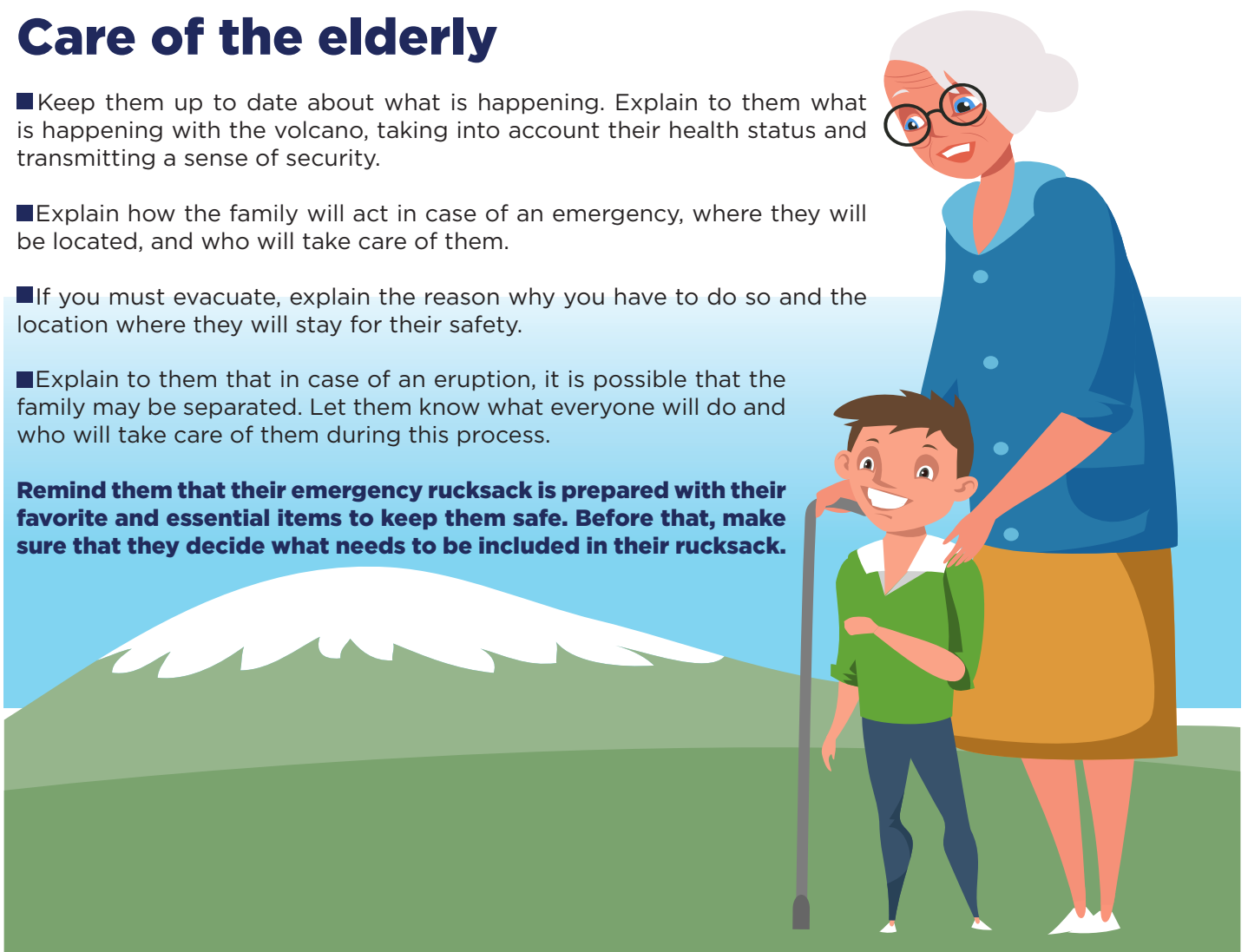
- Keep them up to date about what is happening. Explain to them what is happening with the volcano, taking into account their health status and transmitting a sense of security.

- Explain how the family will act in case of an emergency, where they will be located, and who will take care of them.

- If you must evacuate, explain the reason why you have to do so and the location where they will stay for their safety.

- Explain to them that in case of an eruption, it is possible that the family may be separated. Let them know what everyone will do and who will take care of them during this process.

Remind them that their emergency rucksack is prepared with their favorite and essential items to keep them safe. Before that, make sure that they decide what needs to be included in their rucksack.



Care for people with disabilities

Be permanently informed and discuss the family plan with your family

Always have the telephone numbers of family members who live with you and who do not live with you. Elaborate a simple and basic communication plan with your family and closest neighbours in case of emergencies.

Promptly inform yourself or ask your family, friends, or neighbours for help so that you are up to date of when and how you should evacuate if you are in a risk area.

Actions for the family caregiver or person providing help

-Make sure you confirm whether your family member with a disability is located or not in a risk area. If so, inform yourself about the actions to take in case of an evacuation.

Convey a sense of calm, inform them when they should evacuate, how and where they will stay in case the authorities so order.

Share and include your family member with a disability in the elaboration of the family plan, decision making, and input for everyone's safety.

Make sure you are in constant contact with the authorities responsible for their evacuation and inform yourself using the official channels.

Verify the correct status and performance of their technical support and do not leave them alone without a prior warning.

Be patient when listening to what they say and need.

Remember that your family member with a disability counts on you and that your support is very important to them.

Needs of people with disabilities

Remember that people with disabilities must always carry their technical assistances with them, this includes: wheelchairs, crutches, canes, pets, guides, goggles, etc.; as well as their medicine and necessary implements for their wellbeing.

Rucksack or duffel bag with personal documents, contact numbers, medicines and how to administer them.

Frequently used items that can mitigate their temporary stay away from home.



Self-protection measures in case of ash fall

Health care

Contact with volcanic ash may cause respiratory problems, eye irritation, mucus irritation, and may cause allergic reactions. Likewise, it may lower visibility and contaminate water.

Do not expose yourself if it is not necessary. If you do, cover your eyes with protective or swimming goggles.

Protect the respiratory tract with a mask or a wet scarf; and wear clothing that covers your skin.

Fruits and vegetables which have been exposed to ash may be consumed if they are washed well with clean water.

People with respiratory problems must always have their necessary medication.



Animal care

Prevent them from eating grass and drinking water with ash as this could harm their health.

Pets and farm animals should be kept indoors; if possible, allow your pet to live temporarily indoors.

Remove the food and water bowls that are kept outside. Keep extra food, water, and medicines for them.

Before going indoors, clean your pet's mouth, nose, paws, and body parts if they have been exposed to ash.

Provide abundant clean and fresh water for your pet. Store it in covered containers.

If your pet is sneezing constantly or if they have mucus secretion or red eyes take them to the veterinarian.

Water use and handling

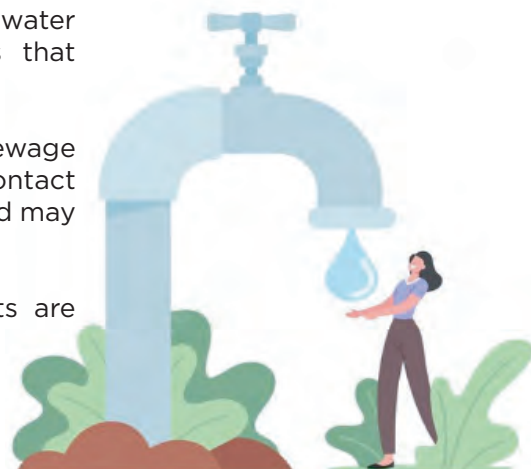
Store clean water in covered containers for personal, family, animal, and pet consumption.

If the water has been in contact with ash do not consume it.

Keep drains, where rainwater normally flows, and pipes that carry sewage water clean.

Do not flush ash down the sewage system. Ash that comes in contact with water becomes firm and may block the system.

Verify that pipes and ducts are clean.



Vehicle and machinery care

Keep your vehicle or machinery covered.

Make sure you do not turn it on before cleaning it, ash melts when it is in contact with a hot engine and may damage it.

If your vehicle or machinery has been outside during ash fall make sure you clean it with care and then wash it with abundant water.

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