Windstorms and landslides

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Introduction

Windstorms

A windstorm is a highly destructive natural hazard which is capable of destroying houses and infrastructure, ruining crops (for the present and for years to come) and taking the lives of people and their livestock.

Tropical storms develop winds of 39–73 miles per hour, but when a constant speed of 74 miles per hour or more is attained, it is then technically called a windstorm. In the Atlantic and eastern Pacific, such a storm would be called a hurricane, while in the western Pacific it is known as a typhoon and in the Bay of Bengal and Indian Ocean as a cyclone.

At these speeds, winds blow in a large spiral around a relatively calm centre known as the ‘eye’. The eye is generally small, 20–30 miles wide, but the storm itself may have a diameter of 400 miles across. As a hurricane approaches, the skies begin to darken, winds increase and heavy rainfall begins. A windstorm can last more than two weeks over open waters, changing course frequently, before eventually hitting land and creating a destructive storm surge (tidal wave).

Tornadoes

Tornadoes are much faster winds, sometimes called ‘twisters’, with wind speeds of more than 200 miles per hour. There may be sufficient warning for people to take shelter, but to find a safe place is not always easy, given the power of such winds. No defence is possible, as all building systems are vulnerable to such powerful forces. However, tornadoes are small in scale in comparison with tropical storms, and loss of life is very low.
Impact of windstorms

Windstorms cause loss of life, houses, crops, food stocks, animals and land. The greatest damage from winds is to buildings and trees, but most deaths result from drowning, because of storm surges and accompanying flooding. As a storm approaches the coastline, it generates the storm surge and raises the tide, sometimes five metres above the normal level. This rise may come rapidly and produce flash flooding in coastal lowlands. Waves and currents erode beaches, undermine buildings and wash away roads and irrigation ditches. Torrential rain can produce flooding and mudslides further inland.

Buildings collapse in high winds, injuring or killing the people inside and damaging the contents.

Other impacts include:

- people marooned on housetops, without food or water
- damage to agriculture, from wind, salty water or prolonged floods
- health hazards, as the water is often contaminated by sewage.
Preparing for windstorms

Some of the preparations are similar to those for flooding. Start by making a risk map of the area, marking on it the homes most at risk, and developing evacuation routes to higher or safer ground. Mark on the map the location of safe buildings and places where emergency water sources can be found on higher ground.

The next step is to develop a contingency plan – at least for the church, but preferably for the whole community. Each person should know the evacuation signal, and exactly where to go and what to carry with them. There should be awareness-raising meetings for all members of the community: make sure that women are fully involved as well as men, and that schools and hospitals also know what to do in preparation for the storm. As noted in Chapter 2, pages 41–45, you could consider forming a team of trained volunteers.

Early warning systems

Warning methods include local radio broadcasts and television. Internet sites may be accessible in more developed locations. Government authorities are usually responsible for giving advanced warning to threatened communities, but the messages do not always reach more remote places. If churches have wide networks, they can contribute effectively to passing on these warnings.

As well as scientific weather forecasting, a number of traditional methods can be used, for example, watching certain species of bird which migrate before a storm. In addition, animal behaviour can change dramatically when the air pressure changes.
Other methods include observing the weather patterns and seeing changes in the clouds which indicate that a serious storm is building up.

Once the early signs of a storm have been recognised, local methods can be used to warn the rest of the community. This might include hoisting special flags and using bicycle-borne megaphones. In coastal Bangladesh, a green flag indicates a hurricane is approaching; a yellow flag means people should assemble the goods and possessions they need in preparation for evacuation and send the elderly and sick people to safe places; a red flag indicates a need for urgent evacuation of all people to a safe location. A more technical method of spreading warnings is to send messages to mobile phones in high-risk areas.

Reducing damage to property

In a windstorm, communities cope with high winds in different ways. Some open windows and doors to allow the wind to blow through. Others nail wood over the doors and windows to keep the wind out!

Fishermen sometimes protect their houses by throwing nets over them and weighting them down with stones so that the thatched roofs are protected. Other communities who live on the coast have adapted to the high risk by living in houses which can be easily dismantled. They simply pick up the building materials and carry them inland to a more sheltered area!

Another method is to tie wooden houses down with ropes attached to large rocks or pegs. All the main joints of the wooden structure should be secured in this way.
Keeping valuable items safe

Store personal items such as passports, identity cards, certificates, land documents, cash and medicines in a safe place.

Wrap up seeds for planting in small plastic bags, then – if possible – in a large piece of plastic for protection.

Turn off all electrical supply points and unplug appliances. Also turn off gas appliances and shut the valve on gas cylinders: this reduces the risk of fire. Put all electrical items in a higher place to avoid flooding.

Put together enough food to feed the family for five to seven days, and some containers of clean drinking water.

Gather essential medicines, dry matches, a torch and a lantern. If you have a mobile phone, make sure it is charged and has key contact numbers on it (including local government contact numbers).
Make sure all livestock are collected and placed somewhere safe on higher land. Animals are often left untied, so that they are free to save themselves.

Make sure the sick, elderly and most vulnerable people have access to safe, warm shelter and adequate food. They should be evacuated to safety as soon as warnings appear.

Emergency shelters

Where there is a threat of windstorms and flooding, there should be a designated safe place where families can shelter for the duration of the storm. This needs to be on high ground and should have plenty of capacity to accommodate members of the community. In some countries, government, the Red Cross and NGOs have built strong cyclone shelters which are raised off the ground on pillars.

More commonly, schools, churches, mosques, government offices or grain stores are used. They need to be cleared and prepared before the storm arrives. If a disaster management committee has already been set up (see Chapter 2: ‘Organising ourselves’, page 39), or a volunteer team has been chosen and trained, then preparation of the shelter should be their responsibility.
A church may decide to offer its building as a temporary shelter. In this case, make sure that there are basic facilities available, such as water supply and toilets, emergency lighting and a First Aid kit.

**Signs for the evacuation route**

Once an evacuation shelter has been identified, the community should mark out a series of evacuation routes to the shelter with clear signs, either mounted on white-topped posts or painted on the walls of houses or on tree trunks. These white marks will help people to find their way to a place of shelter, even in darkness or under flood conditions.

Careful consideration should be given to old people, disabled people, pregnant mothers, those with long-term sickness and young children. These people should be evacuated quickly and with support from volunteers.

**What to do during intense storms**

- Stay alert and awake. Listen to weather reports on the radio. Be aware that intense, short bursts of rain may be particularly dangerous, especially after longer periods of heavy rainfall.
- If you are in a hilly area where there is a risk of landslides, consider leaving if it is safe to do so. If you have a car, remember that driving during an intense storm can be hazardous. If you remain at home, move to a second storey if possible.
- Listen for any unusual sounds that might indicate moving debris, such as trees cracking or boulders knocking together. A trickle of flowing or falling mud or debris may precede larger landslides. Moving debris can flow quickly and sometimes without warning. Staying out of its path will save lives.
What to do after an intense storm

Following a severe storm, church members can assist individuals and families to repair and rebuild their homes, especially the more needy such as widows and elderly people. The church can possibly advocate on behalf of the poorest, to ensure they receive help from the government, military or NGOs. This might include compensation for damage or loss.

The church can bring the community together to plan the reconstruction of houses and community buildings. Community schemes can include tasks such as clearing stones from damaged properties and agricultural land and removing salt water from fields. As people work together on recovery, they may also be able to explore ways of increasing their ability to face future storms. These include stronger houses, improved drainage, changes to farming systems, and perhaps self-help groups and saving and loan schemes. A disaster can become an opportunity to ‘build back better’.
Mitigation measures

Previous sections have concentrated on preparing for and recovering from storms. This section looks at ways of reducing the impact of future storms and some opportunities for the church to assist in these areas. Community cooperation and togetherness is an important foundation for many of the following mitigation ideas.

There are various ways to mitigate the effects of storms. These include:

- improving or changing the location of buildings and houses so that they are less exposed to storm damage
- strengthening the way houses are constructed so that they are less vulnerable to wind damage and overall destruction
- adopting improved agricultural practices to reduce crop damage, plus introducing more storm-resistant plants
- improved water management, such as embankments and improved drainage

Location of new buildings

Trees and land formations give some protection from high winds. Buildings with no such protection are more exposed to the power of a windstorm.

A belt of trees absorbs some of the power of the wind and redirects it over the buildings. The stand of trees must include a sufficient number of trees, and they should not be planted too close to houses – falling branches may cause damage. Where possible, plant deep-rooted trees which are less likely to be blown over by the wind.
Avoid building on a ridge or area of exposed high ground, as these are more at risk of wind damage. Building in sheltered valleys or areas protected by hills can reduce the impact of the wind.

Sometimes a lack of land can cause people to build in exposed places. The church may be able to lobby the local authorities to provide alternative land for housing in safer places.

**Design and construction of houses**

In severe winds, overhanging sections of the roof (the eaves) can be lifted up and broken.

To avoid this, hold the roof down with overhang ties. These should be used if the overhang exceeds 45cm.

Metal straps can also be used to secure roofs firmly to roof beams and to secure the roof beams to the upright posts. This can significantly reduce damage to the roof.
Another reason why a house may collapse is the lack of good foundations. One way of overcoming this is to dig holes at least one metre deep at the foot of each vertical post. These holes are filled with concrete, and a metal plate (40–50cm long) is embedded in the concrete, with about half the plate above the concrete. The exposed part of the plate should have two or three holes in it. When the concrete has set, the vertical wooden posts of the house are bolted to the metal plate. This will give greatly improved wind resistance.

The church is not a construction company! However, there may be a builder or carpenter among its members who can adopt these practices. Could the church building be strengthened in the ways described above? Could the pastor’s house become a ‘model house’ for others to see and copy? In this way, the church can take a positive lead to ensure that new houses are built properly and safely.

Agricultural practices

Crops can be affected by windstorms in the following ways:

- Crops can be flattened by the sheer force of the rain and wind.
- Crops can be waterlogged to such an extent that they rot in the fields.
- Crops can be killed by salt water and by silt/sand deposits brought by a coastal storm surge.

The following responses are ways of reducing the impact of storms on agricultural production.
Shelterbelts and windbreaks

In order to protect more fragile and vulnerable crops, bands of trees can be grown in the form of shelterbelts or windbreaks.

Mangrove swamps and sand dunes provide excellent protection from storms along the coastline.

Shrubs, trees and grasses can be used to stabilise sand dunes which may collapse during storms and allow high tides to penetrate further inland.

Crop diversification and intercropping

Another method for reducing the impact of storms is to protect vulnerable crops by mixing them with more hardy ones. One example is to mix lines of storm-resistant pineapples with weaker vegetables such as tomatoes, cabbages and root crops.
In coastal areas, coconut trees can be intercropped with banana trees. Depending on coconut harvesting methods, peppers can sometimes be grown up the trunks of coconut trees. Similarly, coffee trees can be intercropped with legumes, which have the added benefit of improving the soil.

Rural churches nearly always have farmers among their members. Some of the above methods could be adapted and used by them to reduce the damage to their livelihoods in future storms.

**Preventing salt contamination of land**

When salt concentrations in the soil are higher than normal, as would be the case after a tsunami, the water will be drawn out of the root cells of the plants and the plants will die.

The most effective way of dealing with this is to irrigate the land thoroughly with fresh water and to ensure there is good drainage to allow the salt to be removed from the affected area. Where irrigation is not possible, it is best to use simple rain harvesting techniques, such as catchment pits and bunds. It may be necessary to break up the surface layer of the soil by cultivation to improve the drainage.

Some other techniques, such as cropping systems, use of compost and use of chemicals (if available and affordable), may help to reduce soil salinity, but none of them can replace thoroughly washing the soil with clean water. Local government agricultural officials may be able to provide appropriate advice for your particular location.
**Salt-tolerant crops**

Salt-tolerant crops may be a practical option during the recovery process. The following is a brief list of such crops (source: FAO). However, it is not easy to introduce new crops, and expert advice will be essential.

<table>
<thead>
<tr>
<th>High tolerance</th>
<th>Medium tolerance</th>
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</thead>
<tbody>
<tr>
<td><strong>Field crops</strong></td>
<td></td>
</tr>
<tr>
<td>• barley</td>
<td>• rye</td>
</tr>
<tr>
<td>• cotton</td>
<td>• millet</td>
</tr>
<tr>
<td>• wheat</td>
<td>• sorghum</td>
</tr>
<tr>
<td>• lupin</td>
<td>• rice</td>
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<tr>
<td>• soybean</td>
<td>• peanut</td>
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<tr>
<td>• lupin</td>
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<td>• soybean</td>
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<td>• millet</td>
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<td>• sorghum</td>
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<td>• rice</td>
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<td>• peanut</td>
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<tr>
<td><strong>Fruit</strong></td>
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</tr>
<tr>
<td>• date palm</td>
<td>• pomegranate</td>
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<tr>
<td>• fig</td>
<td>• olive</td>
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<tr>
<td>• grape</td>
<td></td>
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<tr>
<td><strong>Vegetables</strong></td>
<td></td>
</tr>
<tr>
<td>• beetroot</td>
<td>• tomato</td>
</tr>
<tr>
<td>• kale</td>
<td>• broccoli</td>
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<tr>
<td>• asparagus</td>
<td>• cabbage</td>
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<tr>
<td>• spinach</td>
<td>• cauliflower</td>
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<tr>
<td>• tomato</td>
<td>• broad bean</td>
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<tr>
<td>• broccoli</td>
<td>• squash</td>
</tr>
<tr>
<td>• cabbage</td>
<td>• pumpkin</td>
</tr>
<tr>
<td>• cauliflower</td>
<td>• cucumber</td>
</tr>
<tr>
<td><strong>Pasture plants</strong></td>
<td></td>
</tr>
<tr>
<td>• rhodes grass</td>
<td>• berseem</td>
</tr>
<tr>
<td>• couch</td>
<td>• clover</td>
</tr>
<tr>
<td>• kikuyu</td>
<td>• paspalum</td>
</tr>
<tr>
<td>• almum</td>
<td>• sudan grass</td>
</tr>
<tr>
<td>• pangola</td>
<td>• phalaris</td>
</tr>
<tr>
<td>• Wimmera</td>
<td>• reed canary</td>
</tr>
<tr>
<td>• ryegrass</td>
<td></td>
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</tbody>
</table>

*Pasture plants* refers to grasses which can be grown for animals. Your local government agricultural or livestock officer may be able to help you locate some of these.

**Embankments and dykes**

These are usually large government schemes to protect against tidal surges. However, communities can be organised to repair or strengthen them by volunteer labour. The church could also lobby the government for improved flood defences.
Landslides and mudslides

Severe storms often result in landslides. Heavy, prolonged rain saturates the soil and causes unstable slopes to move, creating landslides. In 1998, landslides associated with Hurricane Mitch killed 18,000 people across four countries. Landslides are often most destructive in urban areas, where shortage of land has forced people to build on steep and unstable slopes. Hillside slum communities in towns are common.

Some landslides move slowly and cause damage gradually, whereas others move rapidly, destroy property and take lives. Gravity is the force driving landslide movement. Landslides and flooding often happen at the same time, both due to heavy rain.

Factors that can trigger landslides include:

- saturation by water (after heavy rain or rapid snow-melt)
- slopes being made steeper by erosion or construction
- alternate freezing and thawing
- earthquake shaking
- volcanic eruptions

Debris flows, sometimes referred to as mudslides, also generally occur during periods of intense rainfall or rapid snow-melt. They usually start on hillsides and their composition can vary from watery mud to thick rocky mud that can carry large items such as boulders, trees and cars. When the mudslide reaches flatter ground, the debris spreads over a broader area and causes widespread damage.

Landslides and mudslides may block rivers and cause upstream floods. When the temporary dam breaks, a destructive flash-flood moves down the valley.
Reducing landslide risk

The first step is to become familiar with the land around you. Find out whether landslides and debris flows have occurred in your area in the past by asking some of the older residents.

Areas that are generally prone to landslide hazards include existing old landslides, the bases of steep slopes, the bases of drainage channels, and areas where a lot of toilet waste is dispersed underground through the soil.

To be prepared, look for patterns of storm-water drainage on slopes near your home, noting especially the places where runoff water converges. Before the hurricane season, ensure that all drains and ditches are thoroughly cleaned, and new ones dug (see below).

As with areas at risk of floods and cyclones, it is a good idea to create risk maps showing the areas most likely to be affected by slides. Evacuation routes should be developed, showing people how to escape from potential mudslide areas. Maps are a good way to raise awareness in the community. Work with local authorities and community organisations when planning an awareness-raising programme.

Slopes above settlements and agricultural land can be stabilised in several ways – for example, by growing a combination of trees and soil-holding grasses.

Another method for stabilising hillsides is to create a chain of tyres wired together across the hillside. Tree seedlings are then planted into the centre of each tyre. Stake the tyres so they cannot be moved. The tyres and trees together will help to stabilise the soil.
When constructing new houses, avoid areas that have a high risk of landslides.

Where hillsides have been deforested and the land is very steep, illegal housing is often built in the form of a shanty town. The combination of unprotected hillsides and poor-quality housing means the community is very vulnerable to sudden and violent landslides. The church can help to raise awareness of the risk of landslides and mobilise the community to reforest the hillsides.

The importance of good drainage

A major cause of landslides is excessive amounts of water soaking into a slope. It is important to limit the amount of water entering the soil, because wet soil is more prone to landslides than dry soil. If there are drains on the hillside, residents should be encouraged to keep them clean to prevent flooding, soil erosion and landslides. Extra drains should be dug across the slope, higher up from the houses, to remove water. Rain falling on roofs should be channelled into water-storage barrels or into the drains. Lining these drains with plastic, covered by wire mesh or stones, is one way of reducing the amount of water soaking into the soil.

The church may be able to promote some of these methods among its members, and to warn residents against making the ground up-slope from their house excessively steep, since this can cause minor landslides.

Warning signs

Warning signs include leaning posts or trees, soil cracks, changes in spring water flow and disruption to piped water supply. If you are near a stream or channel, be alert for any sudden increase or decrease in water flow and for a change from clear to muddy water. Such changes may indicate landslide activity upstream, so be prepared to move quickly. Don’t delay – save yourself, not your belongings.
Be especially alert when driving. Embankments along roadsides are particularly susceptible to landslides. Watch the road for collapsed pavement, mud, fallen rocks and other indications of possible debris flows.

If you suspect that a landslide is about to happen, inform your neighbours immediately. Advising them of a potential threat may help to save lives. Help neighbours who may need assistance to move from their homes. Evacuate – getting out of the path of a landslide or debris flow is your best protection.

**What to do during and after a landslide**

If a landslide happens where you are, respond immediately. Quickly move out of the way of the soil or mud flow. If escape is not possible, curl into a tight ball and protect your head. A tight ball will provide the best protection for your body.
After a landslide, you should do the following:

- Stay away from the slide area. There may be a danger of additional slides.
- Check for injured and trapped persons near the slide, without entering the area of the slide itself. Note their location and inform rescue teams.
- Help neighbours who may require special assistance – infants, elderly people and people with disabilities.
- Listen to local radio or television stations.
- Watch for flooding which may occur after a landslide.
- Look for and report broken electricity lines and gas or water pipes to the appropriate authorities. Reporting potential hazards will get the power or gas turned off quickly, preventing further hazard and injury.
- Check the safety of buildings close to the landslide.
- Replant damaged ground as soon as possible, since erosion caused by loss of ground cover can lead to flash flooding.
- Do not rebuild houses in their old locations.
Case study

Cyclone Nargis response in Myanmar

Cyclone Nargis was a strong tropical cyclone that caused the worst natural disaster in the recorded history of Burma (also known as Myanmar). The cyclone hit the country on 2 May 2008, causing catastrophic destruction and at least 138,000 deaths.

Despite the devastation, acts of compassion by the church were spontaneous. One pastor took in 30 neighbours into his own house before it collapsed. People from all ethnic and religious groups set up temporary shelter in his church and its compound for many months afterwards. They expressed their thanks later by contributing money and labour to rebuild the church tower that had fallen during the storm.

Another pastor took in more than 300 people, allowing them to take shelter in his church, where the church members cared for them to the best of their ability.

The church gave assistance quickly in the early stages of the crisis. ‘The church knew where its people were and was in a position to assist immediately,’ said one cyclone survivor. The pastor, who lost his own house, was wading through the mud and rubble the very next morning, gathered six boats and 16 people from a nearby village, and then he began rescuing people from isolated areas in the delta.

Beneficiaries of the project (believers and non-believers) knew that the church belonged to a wider network of people, and would not leave their community. This gave them an added sense of security and an opportunity for continued learning. ‘We have got to know the church better and we are thankful,’ said one beneficiary.

Some key points:
- rapid response to the disaster
- compassionate action to help people of all faiths
- use of church and its compound for temporary shelter
- self-sacrifice and taking risks to save others.
BIBLE STUDY

Fighting injustice  Nehemiah 5

Background

The situation in this chapter occurred during the rebuilding of the wall of Jerusalem (see also the Bible study on Nehemiah 2 in Chapter 3, page 91). It reminds us that even in a process of reconstruction and rehabilitation, the rich may use the situation to exploit the poor. As well as opposition from Sanballat, Tobiah and friends, the people were being badly treated by their own nobles and officials. After some thought, Nehemiah confronted them about their behaviour (verses 6–11) and was able to reform the situation.

Nehemiah’s leadership is an example to churches to speak out boldly against injustice and to raise awareness of the issues that are making people poor.

Key points

- The poor complain of being oppressed by the rich (Nehemiah 5:1-5).
- Nehemiah removes the oppression (Nehemiah 5:6-13).
- He sets an example of compassion for poor people (Nehemiah 5:14-19).

Questions

1. In Nehemiah 5, how were the rich exploiting the poor? How does Nehemiah respond? In what ways could poor people be exploited during the reconstruction phase following a windstorm or mudslide?

2. The church can help to ensure that at all stages of disaster recovery, the poor are protected from exploitation and helped to find ways out of their poverty. What practical actions could your church undertake to ensure that poor people are not exploited?

3. How can the church ensure that the poorest people are not missed out when there is a distribution of relief goods by the government or by NGOs?

4. What does your church need in order to become more confident and effective in speaking out on behalf of poor people?
CHAPTER 6: WINDSTORMS AND LANDSLIDES

Review of this chapter

- What are the main features of a severe windstorm, and what are the common effects that it has on a community?
- What are the things a community can do to practically prepare for a severe windstorm?
- How can a community identify who is most vulnerable to windstorm damage, and how can the community ensure that they are protected and evacuated in time?
- If the church or church hall or school is being used as an evacuation centre, how can you ensure that the needs of women and children will be met, as well as the needs of men (eg in providing latrines)?
- What can the church and community do to protect property from the impact of windstorms?
- What are some of the ways you can tell that there is a threat of a landslide?
- What can the church and community do to reduce crop damage from the impact of a windstorm?
- How can we reduce the risk of landslides?
CHAPTER 6: WINDSTORMS AND LANDSLIDES