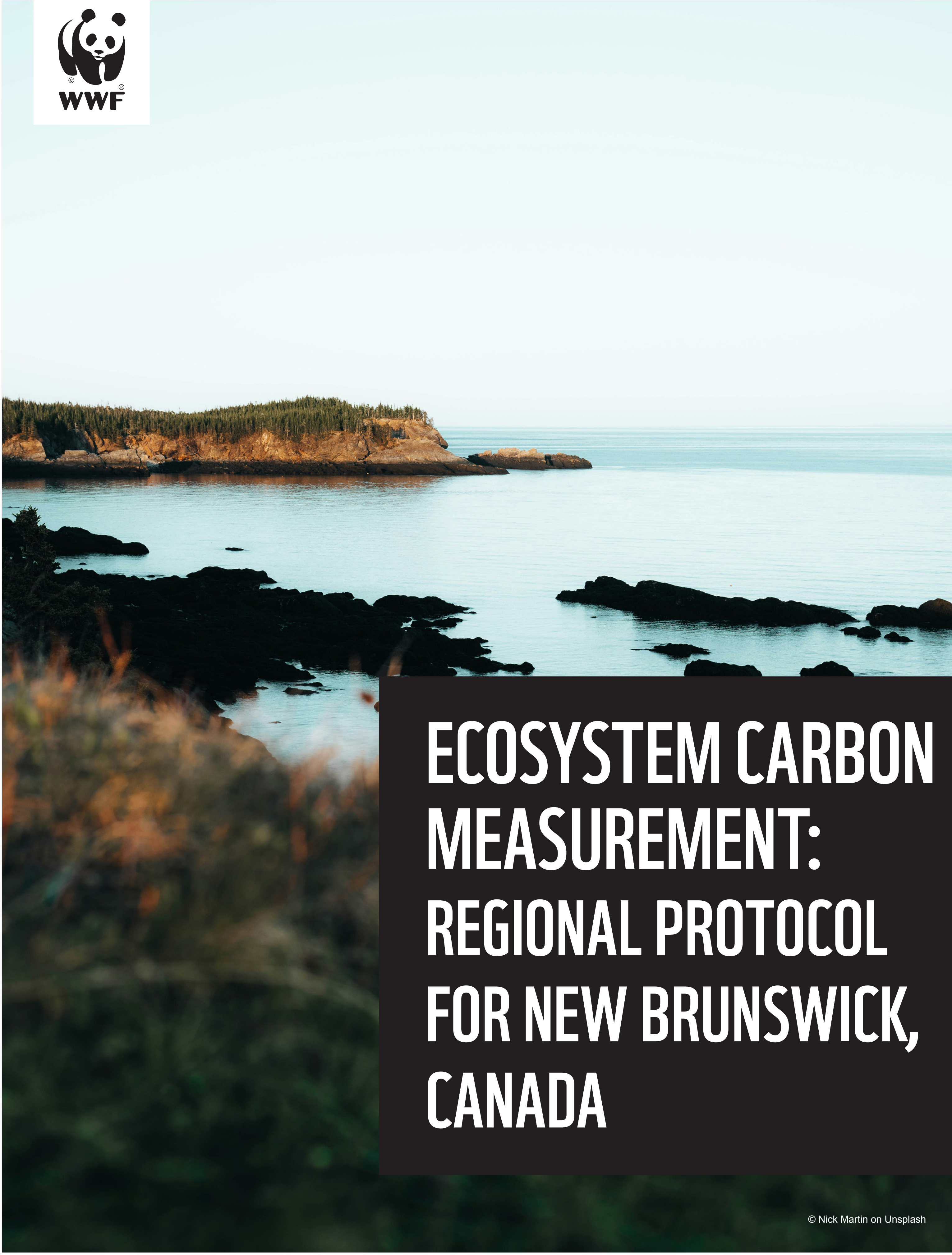

ECOSYSTEM CARBON MEASUREMENT: REGIONAL PROTOCOL FOR NEW BRUNSWICK, CANADA

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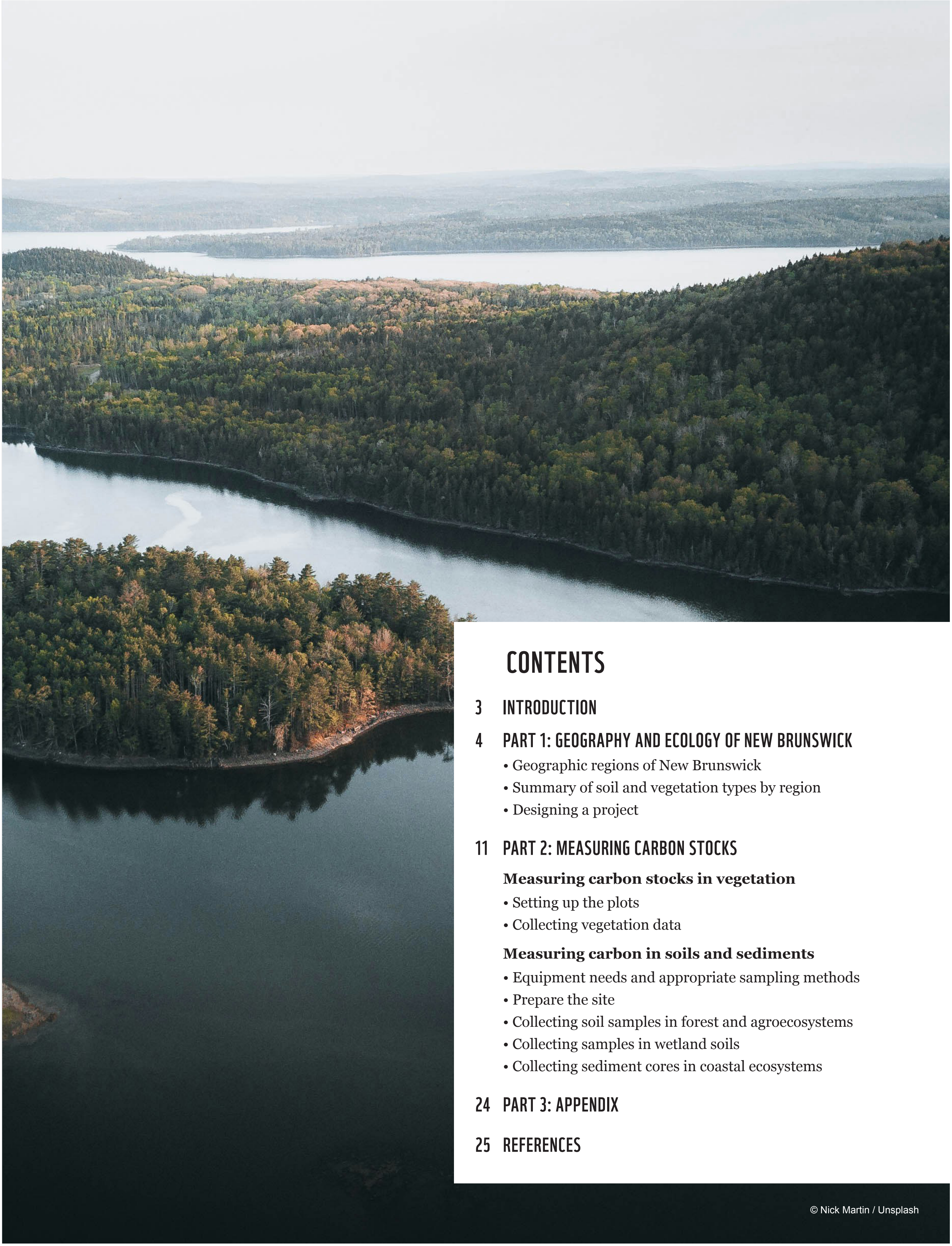


CONTENTS

INTRODUCTION

Field sampling is essential for estimating carbon stock, which is the amount of carbon stored in an ecosystem at a specific point in time. The carbon stock of an ecosystem is made up of two main carbon pools:

1) Vegetation or "biomass," including:

- trees
- shrubs
- herbaceous plants

2) Soils, including:

- peat soils (consisting of partially decomposed plant materials)
- non-peat soils (consisting of a mix of decomposed plant matter and other mineral sediments)

Ecosystems can vary in soil types, vegetation and geographic characteristics. Measuring their carbon pools therefore requires different methods and tools depending on the ecosystem being studied. Having background knowledge about your study area can help guide your project, anticipate conditions you might encounter and determine the specific equipment needed to accurately estimate carbon stocks.

This field guide is intended for use in the ecosystems found in New Brunswick. It is divided into two parts:

Part 1 introduces the diverse landscapes in New Brunswick, highlighting common vegetation communities and soil types in each region. This information will assist in developing a strategy for a carbon measurement project.

Part 2 contains abbreviated in-field carbon measurement instructions (full guides for each ecosystem type are available through WWF-Canada's Carbon Measurement Learning Library) as well as specific instructions for measuring ecosystems in New Brunswick.

1 GEOGRAPHY AND ECOLOGY OF NEW BRUNSWICK

GEOGRAPHIC REGIONS OF NEW BRUNSWICK

New Brunswick is characterized by its diverse landscapes, including vast forests and wetlands, which host a unique variety of vegetation communities. For the purposes of this guide, the province is divided into four distinct geographic regions (Fig. 1):

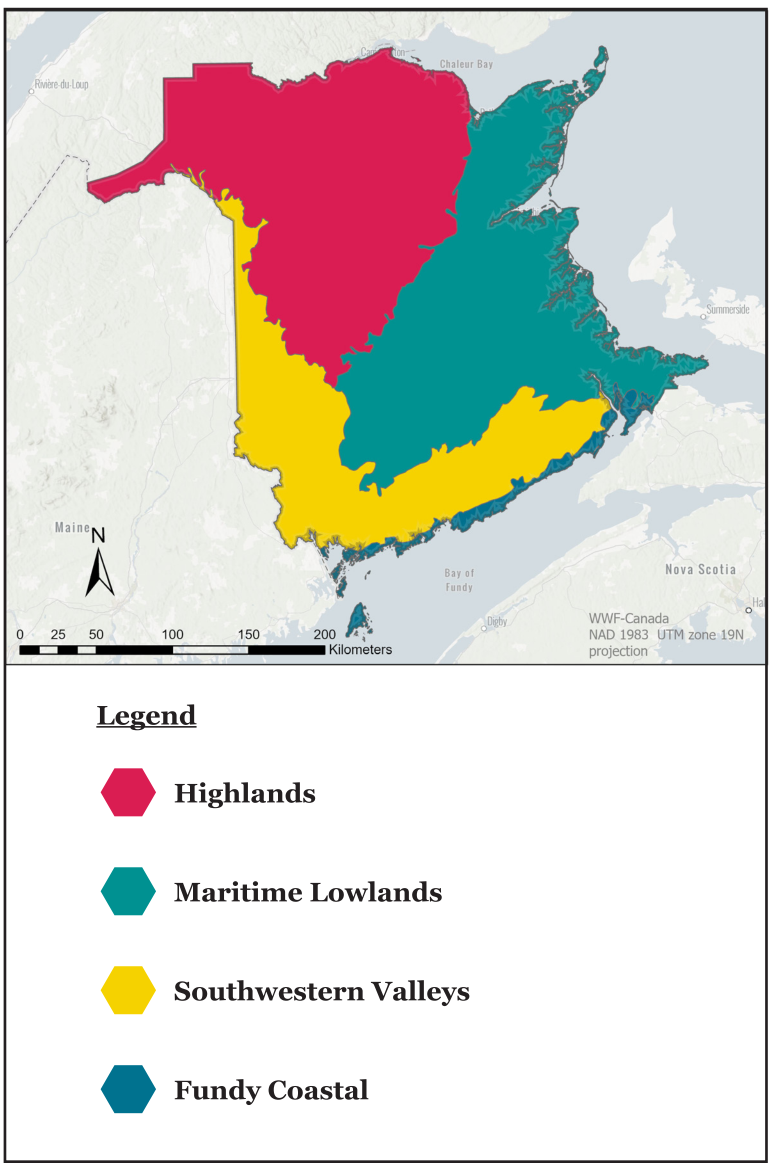


Figure 1: *Map of New Brunswick, highlighting the Highlands, Maritime Lowlands, Southwestern Valleys and Fundy Coastal region (data from Agriculture and Agri-Food Canada, 2024).*

HIGHLANDS

This area is marked by rolling hills and mountain ranges, including the Miramichi and the Notre Dame ranges. The terrain here is steep, leading to rapid water drainage, thin soils and limited wetland development. The cool climate and mountainous characteristics result in less soil development and shorter growing seasons, which means that this region has the smallest carbon stocks of the four described here (Table 1).

MARITIME LOWLANDS

This region has mostly flat to gently rolling terrain, resulting in slow water drainage as well as many wetlands and peatlands with distinct soils and a unique assemblage of plant species. The productive ecosystems in combination with the water-saturated soils result in this region having the highest average carbon stocks of the province (Table 1).

SOUTHWESTERN VALLEYS

The western portion of this region is situated in the valleys of the mountainous regions, where the primary feature is the Saint John River and watershed. The St. Croix watershed also extends into the eastern border of this region. The landscapes here are varied, leading to diverse vegetation communities influenced by the warmer, dryer climate and undulating terrain. In the southeastern portion of this region, there is a relative increase in topographic variation, shifting from gently rolling hills with slow water drainage to mountainous areas progressing south and east. The western portion supports a larger area of wetland and conifer forest types, while the eastern portion is mixed forest, with most variation resulting from the difference in water drainage properties between the upland and valley lowlands areas (Table 1).

FUNDY COASTAL

Stretching along the southern coastline, this area has a cool and wet climate, ideal for coniferous forest types, which dominate the region. It also features unique raised bogs and has the world's highest tides, which support large mudflats and coastal marsh ecosystems (Table 1).

SOIL AND VEGETATION IN NEW BRUNSWICK

Understanding these regions is crucial for carbon measuring and monitoring projects because each supports different types of vegetation and soil. Ecosystems can also vary considerably within each region, largely due to differences in water flow, nutrients and local climatic conditions. Figure 2 summarizes the effects of these three factors on the soil and vegetation properties across New Brunswick.

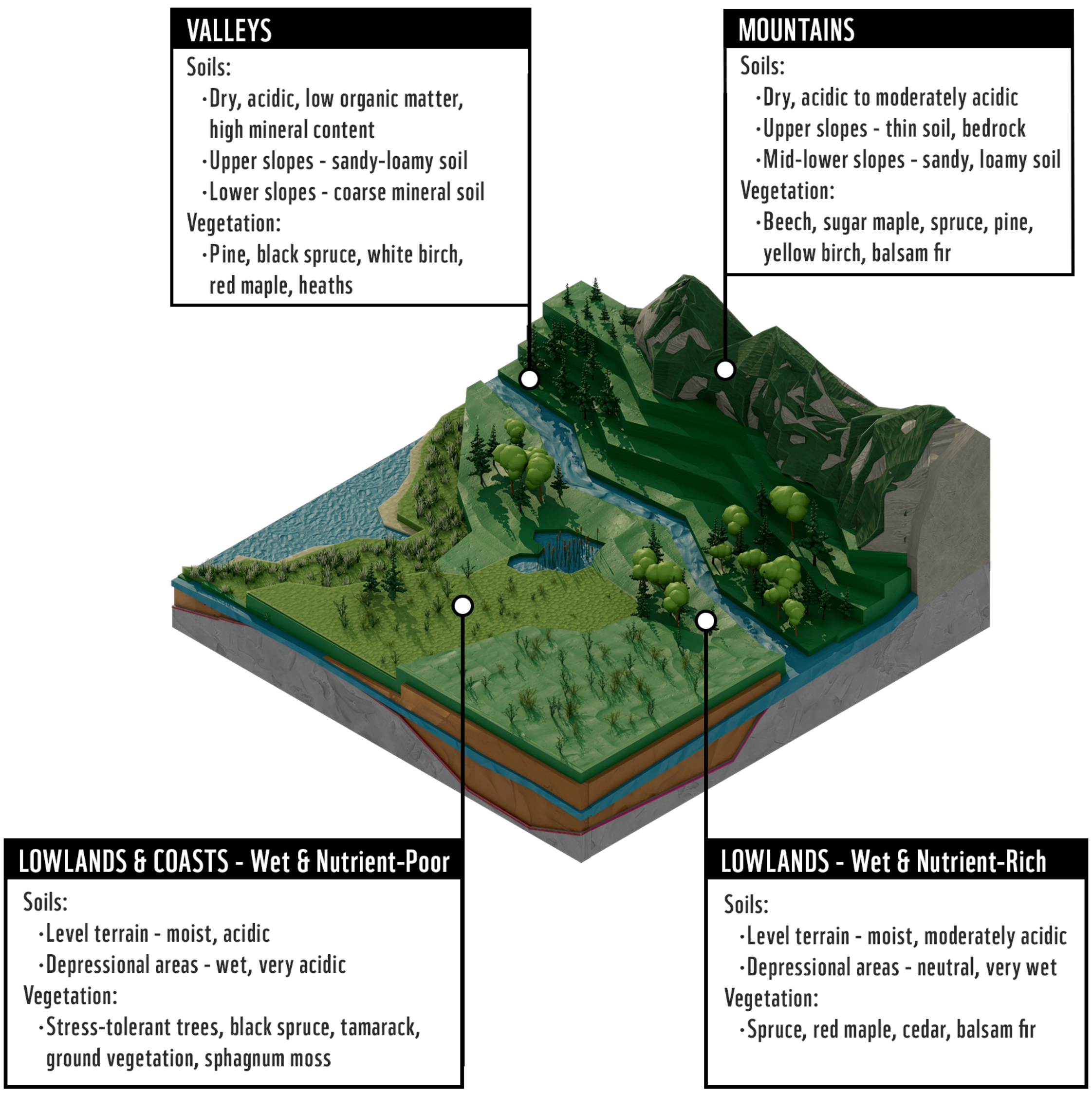


Figure 2: *Common soil properties and associated vegetation communities of New Brunswick across gradients of nutrients, micro-climate and water content.*

Table 1: *Summary of carbon stocks (data from Sothe et al. 2022) for each geographic region of New Brunswick (from Fig. 1), separated into soil carbon, forest biomass carbon (above-ground biomass, below-ground biomass and downed-woody biomass), and total carbon (soil and forest biomass). Maps for each component can be found in the Appendix (Fig. 6).*

Region	**Total area of region (ha)**	**Area of terrestrial soil cover (ha)**	**Average soil carbon stock (kg/m²)**	**Total soil carbon stock** *1 metre [m] depth;* **(kilotonnes)**	**Area of forest cover (ha)**	**Average forest biomass carbon stock (kg/m²)**	**Total forest biomass carbon (kilotonnes)**	**Total carbon** *soil carbon + forest biomass carbon* **(kilotonnes)**
HIGHLANDS	2,627,211	2,560,929	24.2	619,744	2,288,063	5.2	118,979	738,724
MARITIME LOWLANDS	2,804,688	2,772,452	31.8	881,640	2,584,360	6.2	160,230	1,041,870
SOUTHWESTERN VALLEYS	1,654,022	1,569,793	29.8	467,798	1,368,080	5.7	77,981	545,779
FUNDY COASTAL	195,172	185,609	32.4	60,137	161,963	6.0	9,717.8	69,855

ECOSYSTEM SPOTLIGHT

Fundy Coastal bogs

These unique wetland systems are shaped by the cool, foggy climate and their proximity to the Bay of Fundy coastline.

As plants grow in waterlogged environments, the plant tissue accumulates, forming layers of peat that “fill-in” these depressional regions.

Over time, the peat grows above the water table and the vegetation switches from receiving water from the ground to receiving it through precipitation. A significant portion of the Fundy Coastal ecosystem water is also derived from fog and salty ocean spray, which influences plant composition and growth. This results in large stores of carbon and critical habitat conditions for many species.

SUMMARY OF SOIL AND VEGETATION TYPES BY REGION

Knowing the types of soil and vegetation of a study area is crucial for choosing the appropriate method to collect samples and design an effective project. The information below and Figure 3 provide detailed information about the soil and vegetation commonly found in each region. Use this information to answer some key questions that will guide your carbon measuring and monitoring work:

1. What kinds of soils and vegetation can I expect to find in my study area?
2. Based on the expected soils and vegetation, what equipment is most suitable for this specific ecosystem?
3. Which carbon pools am I focusing on?
4. How can I design a project that covers all these components effectively?

HIGHLANDS *(includes the Appalachians, Northern New Brunswick Highlands and Northern New Brunswick Uplands)*

- **Soils:** High mineral content, thin organic layers. Shallower, less nutrient-rich and drier at higher elevations/steeper slopes.
- **Vegetation:** Cool, wet climate-adapted species. Dominants: balsam fir, white birch, black spruce, white spruce.
- **Sampling considerations:** High variability due to slope and elevation; sample across gradients. Use soil cores if possible, which allows more samples than soil pits. Sample vegetation in the same plots as soil cores (Fig. 5).

MARITIME LOWLANDS

- **Soils:** Mostly flat; leads to wetlands with water-saturated, deep, organic/peat-rich soils. Forest soils are moderately drained, acidic and deeper than other regions.
- **Vegetation:** More than 30 hardwood tree species. Dominants: basswood, butternut, ironwood, silver maple, green ash, white ash. More conifers on cooler, lower slopes.
- **Sampling considerations:** Wet conditions require specialized equipment. Sample to substratum depth to capture high carbon stocks. For large, homogenous ecosystems, sample sites should be spaced farther apart.

SOUTHWESTERN VALLEYS *(includes Saint John River Valley and Southern New Brunswick Uplands)*

- **Soils:** Highly variable: compact on ridges, saturated in valleys/wetlands.
- **Vegetation:** More than 30 hardwood species. Dominants: basswood, butternut, ironwood, silver maple, green ash, white ash; conifers (e.g., red spruce) in cooler, lower areas.
- **Sampling considerations:** Soil type dictates equipment (forest vs. wetland). High diversity; increase number of samples per ecosystem. Field identification of species is time-consuming, so advance preparation is recommended.

FUNDY COASTAL

- **Soils:** Hills/ridges: acidic, sandy, shallow. Depressions: low fertility. Peat bogs: deep organic layers.
- **Vegetation:** Forests: red spruce, balsam fir, black spruce, white spruce, tamarack, cedar. Wetlands: dwarf huckleberry, lichens, mosses. Coastal: salt marshes with seagrasses.
- **Sampling considerations:** Diverse ecosystems (hilltops, peat bogs, salt marshes). Peat and coastal soils need special sampling tools.

LAND COVER

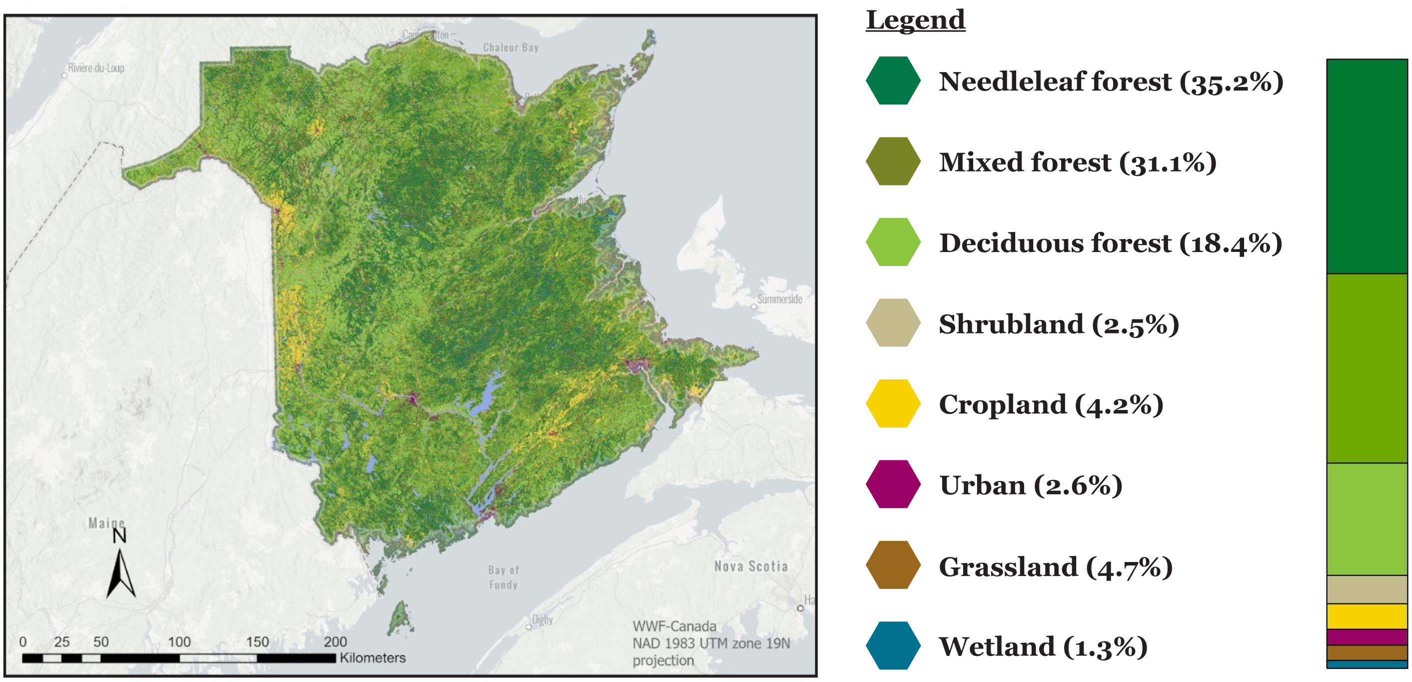


Figure 3: *(Left) Map of ecosystem and land cover class for the province of New Brunswick. (Right) Bar graph showing relative proportion of each class at a 30-by-30m resolution (data from Natural Resources Canada, 2020).*

SOIL GREAT GROUPS

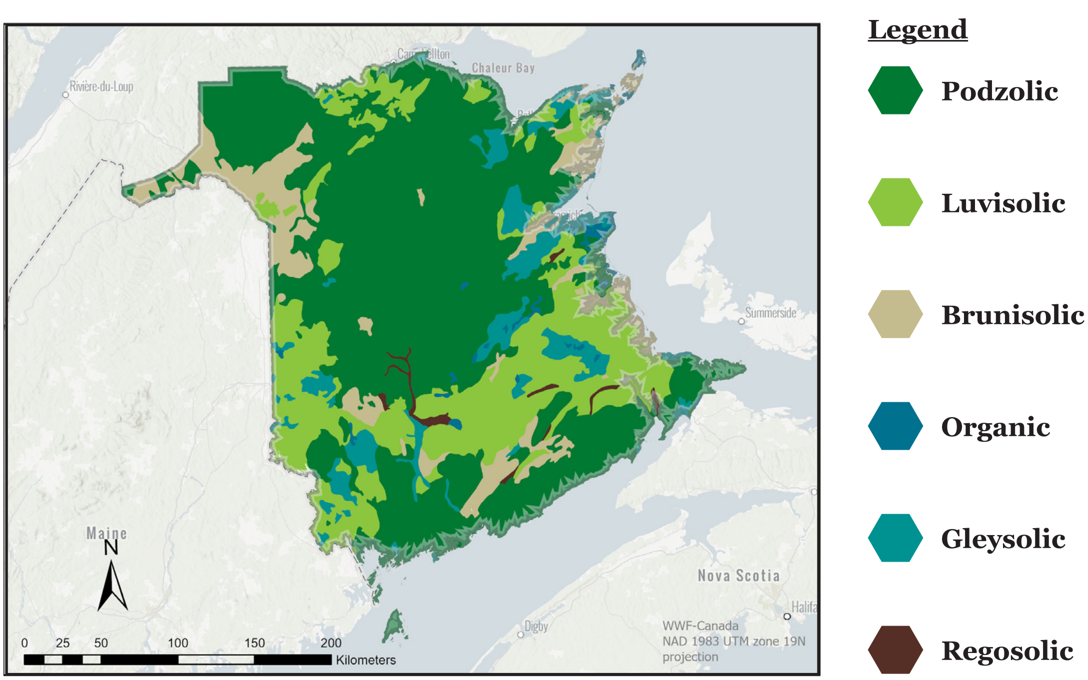


Figure 4: *Soil types divided into ecosystem groups and soil order (data from Canadian System of Soil Classification) and the distribution of these soils in New Brunswick (data from Canadian National Soil Database, 2021).*

Table 2: *Summary of the carbon stocks for each soil component, grouped into the ecosystem type (forest, wetland and undeveloped) and soil order (from Fig. 4) (data from Sothe et al., 2022).*

Soil type	**Soil type coverage (ha)**	**Average soil carbon stock (1m depth; kg/m²)**	**Total carbon stock (kilotonnes)**
FOREST SOIL	6,449,045	28.6	1,844,427
Podzolic (sandy/loamy soils; compact and brittle)	4,106,461	29.9	1,227,832
Brunisolic (less developed forest soils; faint horizons)	673,503	28.4	191,275
Luvisolic (loamy forest soils; compact and consolidated)	1,669,081	25.2	420,608
WETLAND SOIL	587,879	29.1	171,073
Organic (deep, carbon-rich soil; heavily saturated with water)	72,919	51.6	37,626.2
Gleysolic (prolonged water saturation; lack mineral-organic surface soils; very low organic carbon)	514,960	25.9	133,375
UNDEVELOPED **Regosol** (no distinguishable soil layers; mineral-rich and highly varied)	47,829	25.7	12,292

ECOSYSTEM SPOTLIGHT

Saint John River Valley forests

The Saint John River and its tributaries enrich the surrounding floodplain with nutrient-dense water during seasonal-high water levels, supporting a dense and diverse forest.

The hydrology that has shaped this landscape continues to enrich the fertile soil and supports a moderate climate with long growing seasons.

Increased forest production and wetland environments also help reduce soil erosion and floods, and act as significant carbon sinks.

DESIGNING A PROJECT

Designing your project depends on your goals. For more information on designing a project, please refer to the guide "Carbon Measurement: Sampling Design," in WWF-Canada's Carbon Measurement Learning Library, which includes information on:

A) **Sample allocation (how many samples are needed)**, which depends on how big the area of interest is and the degree of accuracy you wish to achieve in your estimates.

B) **Sample distribution (where to take your samples)**, which can be achieved using a statistically rigorous sampling approach (i.e., random, systematic or stratified-random), or by convenience, depending on your project goals. Be sure to consider the ecosystems and soil types where you are sampling (Fig. 4), as they may affect the anticipated carbon stock (Table 2).

Convenience sampling | Systematic sampling | Stratified-random sampling | Random sampling

In addition to the sampling design resources, Table 3 (in Appendix) summarizes relevant carbon measurement protocols for the New Brunswick region for communities interested in participating in larger-scale projects and points to the federal and international standards associated with forest carbon monitoring projects.

2 MEASURING CARBON STOCKS

To estimate the carbon stock in ecosystems, you'll need to survey and collect samples from different carbon pools, including soils, biomass, or both. If you aim to measure multiple carbon pools in the same area, you can use an "integrated plot design." This means setting up overlapping plots.

Here's how it works:

A) **Create separate plots** for large vegetation, medium vegetation, small vegetation and soil carbon with the same centre mark, such that the plots are overlapping (Fig. 5).

B) **Collect data** for each carbon pool within their respective plots. Consider the order in which the carbon pools are sampled; to avoid damaging samples, the order is usually small vegetation ⟶ medium vegetation ⟶ large vegetation ⟶ soils. This ensures no samples are damaged from another sampling method.

C) **Extrapolate values to the study area and add them up to obtain** the total ecosystem carbon stock of a study area.

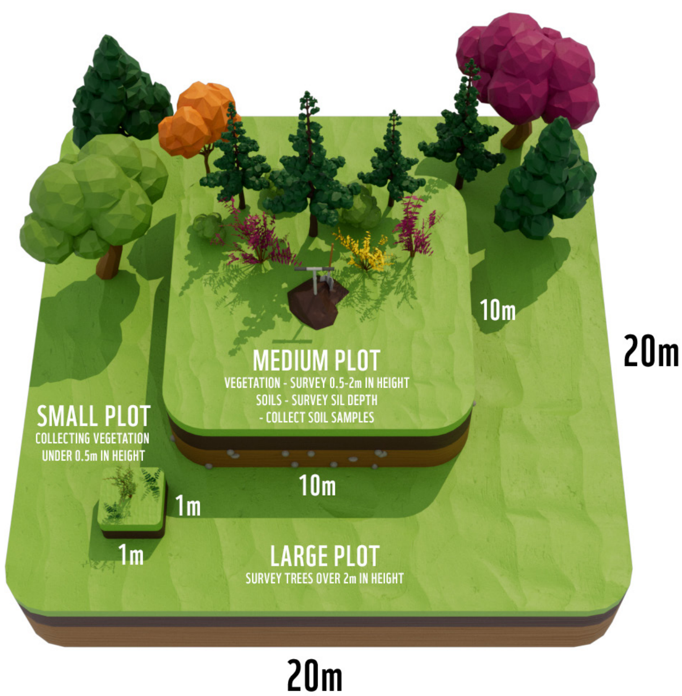


Figure 5: *Integrated plot design where soils are sampled alongside the three vegetation types, within their respective large, medium and small plots.*

MEASURING CARBON STOCKS IN VEGETATION

Carbon measurement of vegetation involves categorizing plants based on their heights in three groups:

A) **Large vegetation** (trees): plants over 2m in height.

B) **Medium vegetation** (shrubs and short-statured trees): plants that range from 0.5 to 2m in height.

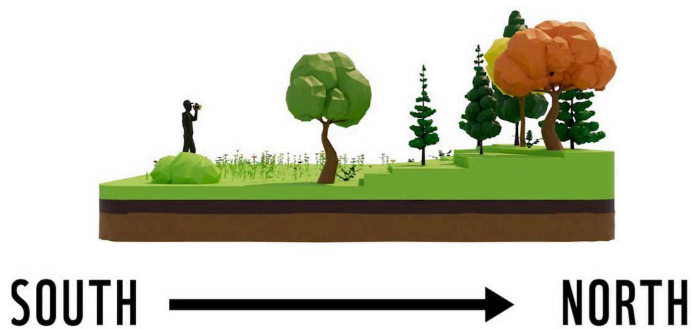
C) **Small vegetation** (ground vegetation): plants that are under 0.5m in height.

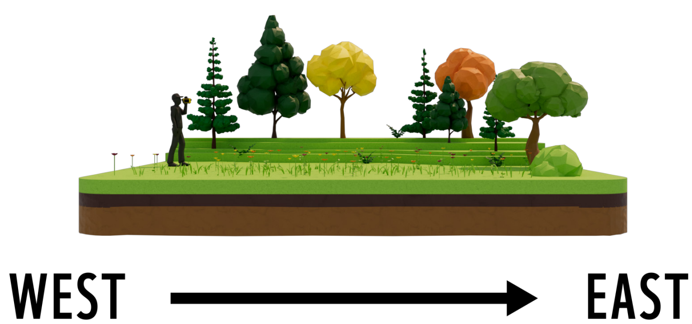
SETTING UP THE PLOTS

For each plot:

- **Record** the **date, location, plot ID, latitude, longitude** and **elevation** of the plot centre.
- For large and medium plots:
  - Mark out the border of your plots using a compass, laser rangefinder and measuring tapes, marking the trees on the border with flagging tape.
  - Using a laser rangefinder, **measure** and **record slope** in both the north-south and east-west directions.
- For small plots:
  - Mark out your plots using a compass and 1m-by-1m quadrat.

If additional sampling is being conducted within the same plot (e.g., measurements of soil carbon or other biomass), be sure to avoid disturbing these sample locations.

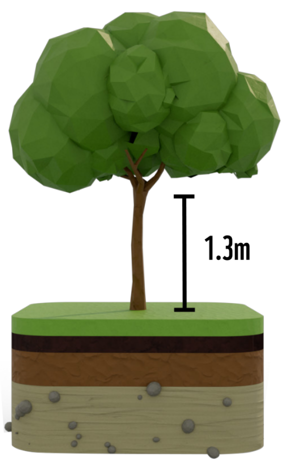




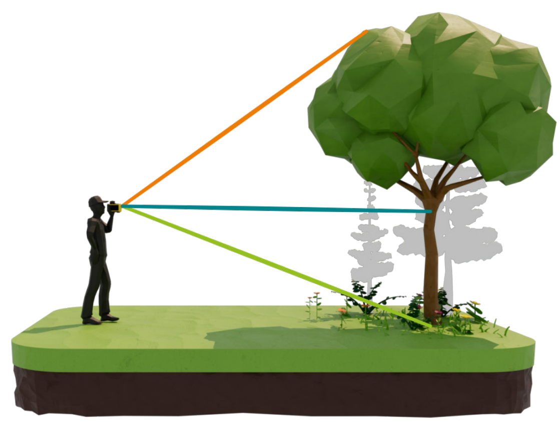
COLLECTING VEGETATION DATA

LARGE VEGETATION PLOTS (trees)

- In a systematic way (such as flagging each tree before surveys), choose a tree to measure and identify the species. **Record** the **tree ID** and **species name**.
- Measure the tree diameter at breast height (DBH). **Record** the **DBH (cm)** in a notebook or datasheet.
- Measure the tree height using a laser rangefinder. **Record** the **tree height (m)**.
- Repeat this for all trees in your plot.
- Input data into the accompanying datasheets found on WWF-Canada's Carbon Measurement Learning Library to calculate the carbon mass of each tree.

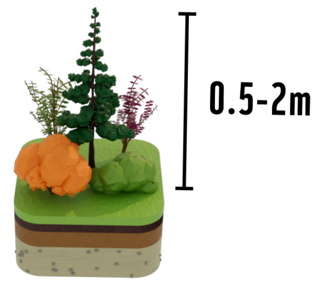


TREE HEIGHT REQUIRES THREE MEASUREMENTS



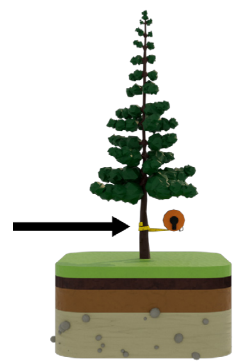
MEDIUM VEGETATION PLOTS (trees and vegetation)

- Using a systematic method (such as flagging all plants 0.5–2m in height before surveys), identify each plant.



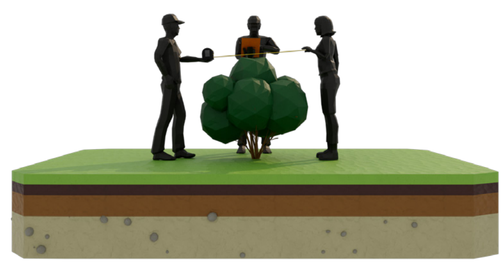
- **Record** the **unique species ID** and **species name**. Another option is to take a photo of the plant components for later identification in the lab.

- If the species is a **short-statured tree**, measure the tree diameter (cm) of the stem at 0.3m in height (diameter at stem height, or DSH) and record this value in a notebook.



- If the species is a **shrub** or **herbaceous plant**, measure the plant's volume (m^3) instead of its diameter:
  - Measure the height (m) of the plant.
  - Measure the width (m) of the plant (east-west direction).
  - Measure the length (m) of the plant (north-south direction).

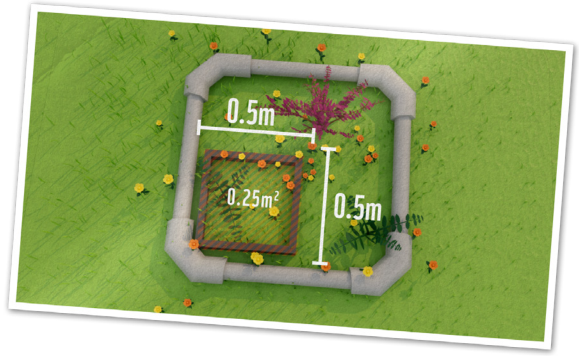
- **Record** these values in a notebook.



- **Upload** the data to the accompanying datasheets found on WWF-Canada's Carbon Measurement Learning Library, which will automatically calculate the carbon stock value for each plant.

SMALL VEGETATION PLOTS

- Take a photo of the entire plot from directly above the quadrat. **Record** the **photo ID** and **plot ID**.



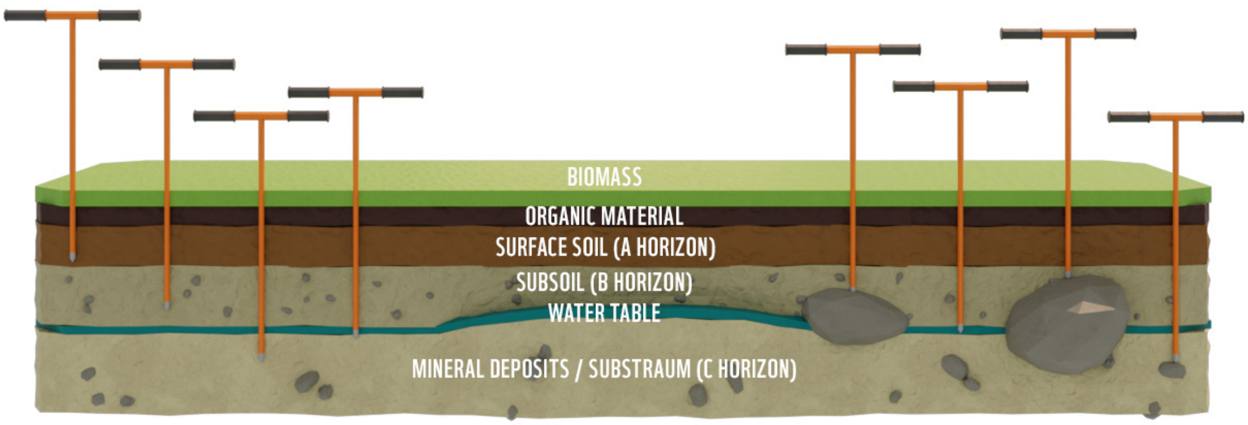
- Section off one quarter of the plot by using a $0.25m^2$ quadrat or a circle with a radius of 0.28m ($0.25m^2$).

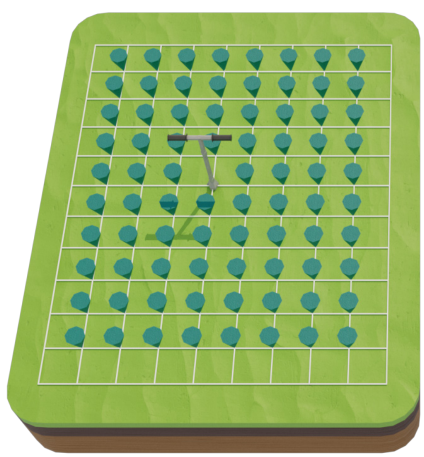
- Within this $0.25m^2$ area, clip all vegetation under 0.5m at 3cm above the ground. Place each unique species clipping into its own resealable bag labelled with a unique plot ID, species name and date.

MEASURING CARBON IN SOILS AND SEDIMENTS

EQUIPMENT NEEDS AND APPROPRIATE SAMPLING METHODS

The equipment and methods for collecting soil samples depends on the water content and condition of the soil. Across New Brunswick, soil conditions vary from well-drained, dry soils, with shallow layers of organic matter and topsoil in upland areas, to poorly-drained, wet soils with more organic materials in lowland areas that may be saturated, especially during certain seasons. Use a soil probing tool to measure the depth of the soil at regular intervals (every 10-100m) in a grid pattern across the study sites. The number of sample points depends on the size of the site, but there should be enough soil depth measurements to cover the variation across the study site.





Example survey grid, where at each dot a measurement of peat depth is taken and recorded. This information is used to understand the variation in peat depths across the site, which will help to ensure sampling is effective.

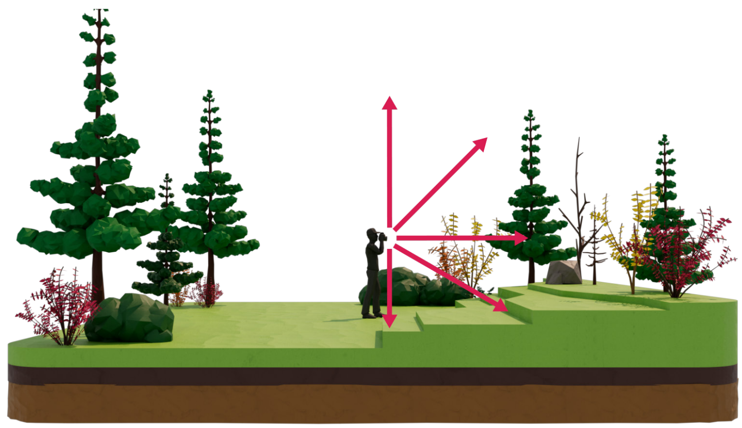
Based on your investigations, plots can be mapped out within each site to capture the variability in soil depths across the study site. The larger the site and the more variation in soil depth, the more plots you'll need. Here is a basic plot design for setting up study plots:

Step 1: Establish plots within the site to capture the variation in soil depth.

Step 2: Survey every 1m-by-1m within a 10m-by-10m plot to ensure the coring/sampling locations are representative of the plot area.

PREPARE THE SITE

- **Record** the **Core ID**. For example, PE-01-B represents "location-site-sample number."
- **Record** the **latitude**, **longitude** and **elevation** of the coring site.
- **Document the vegetation** of the coring site using a 14-photo series protocol by taking photos from the coring site that capture views pointing:
  - straight up (canopy)
  - straight down (vegetation)
  - for all cardinal directions: one parallel with the ground; one 45 degrees up; and one 45 degrees down
- Find a flat area close to the coring spot, lay down a tarp and prepare the required equipment.



14 PHOTOS

3 PHOTOS FOR EACH CARDINAL DIRECTION

1 DOCUMENTING VEGETATION

1 DOCUMENTING CANOPY COVER

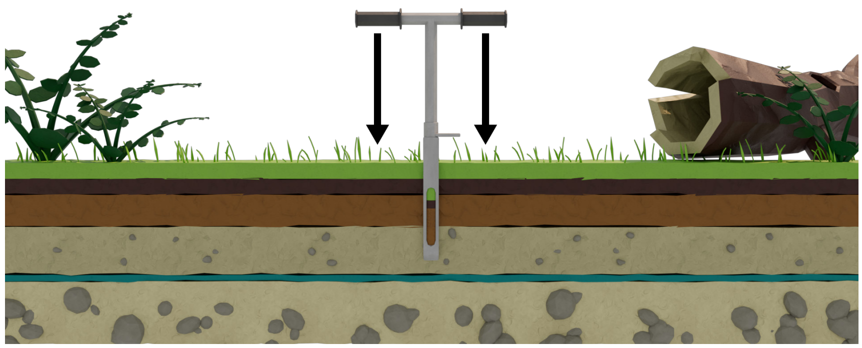
COLLECTING SOIL SAMPLES

COLLECTING SOIL SAMPLES IN FOREST AND AGROECOSYSTEMS

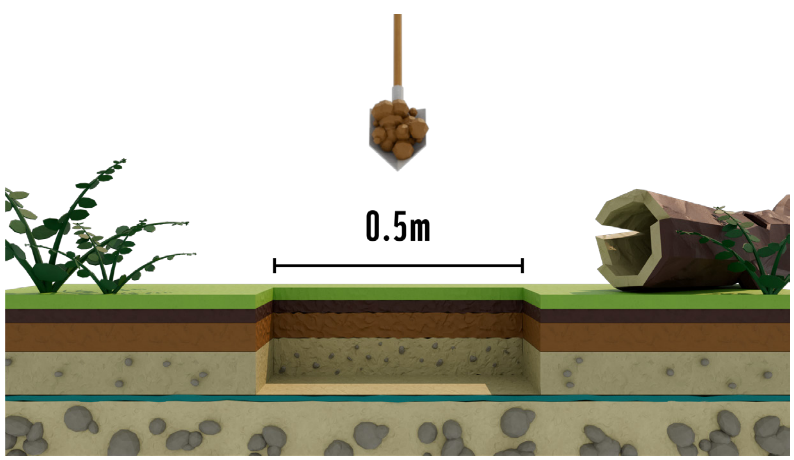
Forests and agricultural ecosystems in New Brunswick have diverse soil properties that support both natural and anthropogenic landscapes. The local terrain, especially in the mountainous Highland regions, can vary considerably.

Here are two recommended methods for collecting soil samples in this region:

1. **Soil coring:** Use this method in areas where the soil is softer, holds together well, and has noticeable layers of organic matter or topsoil.



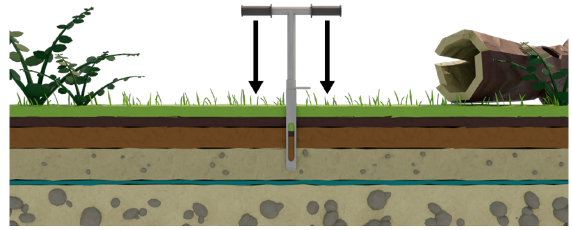
2. **Soil pit digging:** Use this method if the soil is too hard and/or too loosely packed (i.e., breaks apart easily) for soil coring.



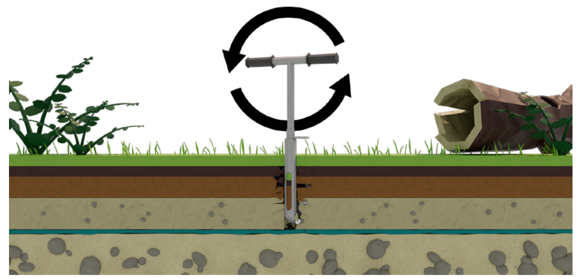
NOTE: In some situations, it may be practical to use both methods.

METHOD 1 – SOIL CORING

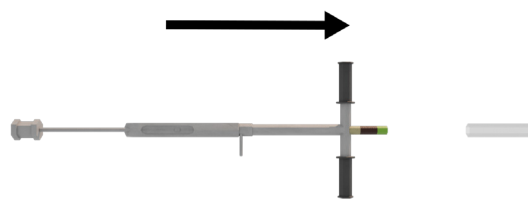
1. Gently push the corer into the soil, keeping it as straight as possible.



2. With the corer fully inserted, twist and jiggle the corer to release the bottom part of the core sample from the base sediment.



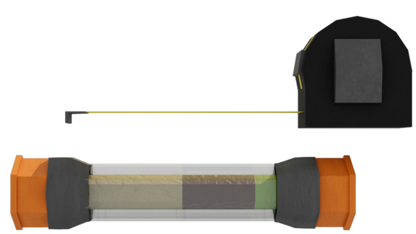
3. Remove the corer with the sample inside. Keep pressure on the bottom of the corer to prevent the sample from falling out.



4. Turn the corer horizontally and place a plastic core sleeve around it.

5. Use a core extraction tool to push the core out of the corer into the sleeve. Place the appropriate end caps on the top and bottom of the core tube and secure it with tape.

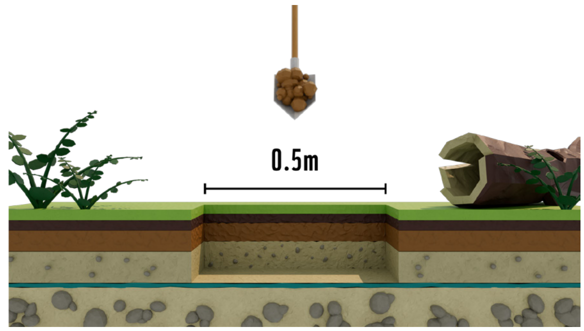
6. Measure and **record** the **core length** and the **depth of the hole**.



7. Label the sample and place it in a cooler.

METHOD 2 – DIGGING SOIL PITS

1. At the selected site, dig a hole 0.5m wide and to the desired sampling depth.



2. For each soil layer, **record** the **depth interval**, **colour** and **texture**.

3. Label resealable bags with a unique Core ID and sample depth interval for each layer.

4. With a soil sampling ring/bulk density disk, obtain a sample from the middle of each of the soil layers and transfer each of the samples to its respective labelled bag.

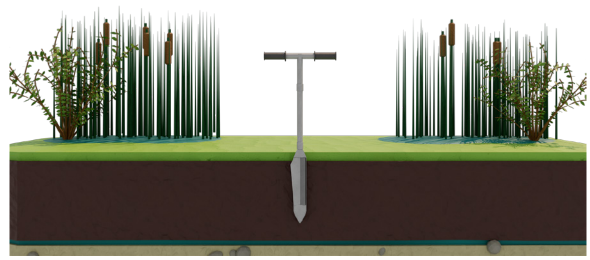
5. **Note:** Additional samples from each layer can be collected and transferred to a separate bag.

6. Place samples in a cooler.

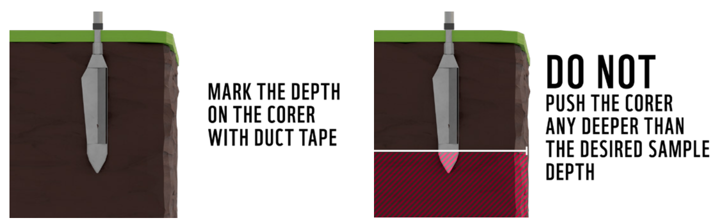
COLLECTING SAMPLES IN WETLAND SOILS

If the soil is heavily saturated by water, such as in a bog, fen or swamp ecosystem, then the soil will be too unconsolidated to use an open soil corer and the water level will be too high to dig a soil pit. Therefore, specialized sampling tools are required. A tool called a Macaulay peat corer is recommended to extract soil samples from wetlands.

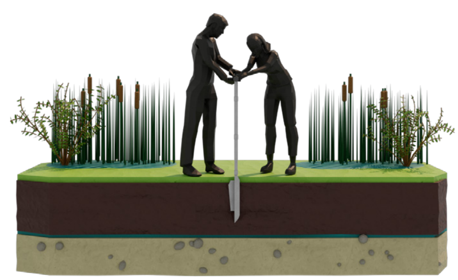
STEP 1: EXTRACT A CORE SAMPLE



- With the corer in the "open" position, align the corer as straight as possible in the coring spot and push it into the ground.

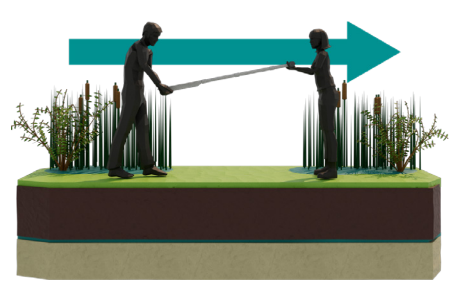


- Continue pushing the corer into the ground to its desired depth, which can be marked with tape on the corer itself.



- Turn the corer handle 180 degrees into its "closed" position.

- Lift the corer out of the ground, clasping the barrel and the guard together as it is pulled from the ground.



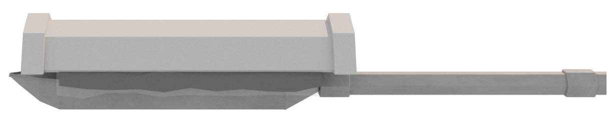
- Turn the corer horizontally with the core barrel facing upwards and transport to the processing area.

STEP 2: REVEAL THE CORE

- Lay the corer flat on the tarp with the barrel facing upwards.
- Keeping the sample inside the corer facing upwards, reveal the core by opening the guard and turning the corer. Lay the corer back on the tarp with the sample exposed.
- Record the:
  - **core length (cm)**
  - any transitions in **soil colour** or **texture**
  - any visibly **large materials**
  - **gaps** in the sample
  - **water saturation** (mucky, semi-saturated, dry, etc.)
  - label poster board and PVC-pipe cutouts (see Step 3 below) "top" and "bottom"

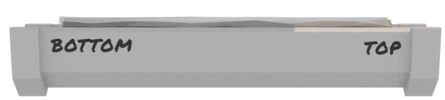
STEP 3: PACKAGE THE CORE

- Line the PVC pipe with aluminum foil and plastic wrap.
- Place the PVC pipe over the core, with the top (closest to the surface) and bottom label in the appropriate position.



- Flip the corer and PVC pipe over so that the core sample falls inside the PVC pipe. Use a knife to separate the sample from the corer if needed.
- Wrap the sample in plastic wrap and aluminum foil.

- Place a piece of poster board over the sample, ensuring the "top" and "bottom" labels are in the right position, and secure it with duct tape.
- Transport the sample to a cooler for short-term storage.



- Wash the corer and tools before taking another core sample.

COLLECTING SEDIMENT CORES IN COASTAL ECOSYSTEMS

Coastal ecosystems are unique landscapes characterized by tidal fluxes that periodically inundate the land. The Bay of Fundy is the largest coastal ecosystem in New Brunswick and has the largest tidal flux of any coastal habitat in the world. A mix of marshes and seagrass beds populate the region, typically containing large carbon stocks in the sediments. To measure the carbon in these ecosystems, consider the PVC-corer method outlined below.

STEP 1:
PREPARE THE SITE

In a notebook or datasheet, **record**:

- date and time
- site conditions
- weather
- tidal conditions

STEP 2:
INSERT THE CORER

- Align the corer in the coring spot and push it into the ground.
- Place a piece of lumber over the corer and hammer the PVC-tube into the ground to the desired depth.
- Measure core compaction by taking two measurements and **record them in a notebook**:
  - outside of the core from top of corer to the ground surface
  - inside of the core from the top of corer to the top of the core

STEP 3:
EXTRACT THE CORE

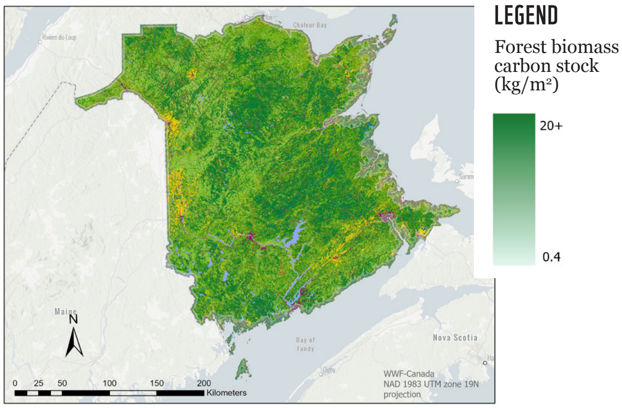
- Release the core from the suction of surrounding sediment by digging around the core or gently rocking the PVC pipe.
- Once the bottom of the core is revealed, place an end cap on the bottom of the core.
- Keep the core in an upright position while transporting the core to the processing location.

STEP 4:
SECTION AND PACKAGE THE CORE

- Place the core in position over the core-extruding device.
- Place the PVC collar in position at the top of the corer and push the PVC tube downward so that the sediment appears at the top. Keep pushing until the sediment is in line with the top of the PVC collar.
- Cut between the PVC collar and the top of the corer to slice off a subsection (i.e., the sample).
- Place the cut sample in a resealable bag, and **record the sample name and depth**.

* For field datasheets specific for each method, please find the accompanying materials in WWF-Canada’s Carbon Measurement Learning Library.

3 APPENDIX



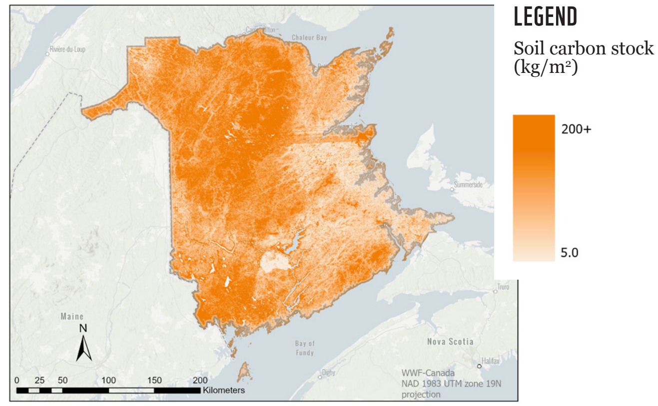


Figure 6: *Average carbon stock (kg/m²) of forest biomass (above-ground biomass, below-ground biomass and downed-woody biomass) and soils (1m depth) for the province of New Brunswick in a raster format, 250 x 250m spatial resolution (data from Sothe et al., 2022).*

Table 3: *Examples of protocols, programs and plans that may be relevant to carbon measurement and monitoring in New Brunswick. These systems involve a mix of government and non-governmental organizations, with projects ranging from local community land management projects to global climate agreements. They work together to ensure consistency and reliability in carbon measurements across different scales.*

LEVEL OF GOVERNANCE	NAME OF ORGANIZATION	RELEVANT PROJECTS	SUMMARY
International (global)	Intergovernmental Panel on Climate Change (IPCC) Verra (verified carbon standard, MRV)	Sixth Assessment Report (Agriculture, Forestry, and Other Land Uses (AFOLU)) Methodology for Improved Forest Management Using Dynamic Matched Baselines from National Forest Inventories, v1.1	International guidelines of managed lands for the benefit of biodiversity and climate mitigation Carbon crediting system with published carbon monitoring protocols in conformity with monitoring, reporting and verification (MRV) systems
National (Canada)	Canadian Council of Forest Ministers (CCFM) Natural Resources Canada (NRCan) Environment and Climate Change Canada (ECCC)	National Forest Information System (NFIS) National Forest Carbon Monitoring, Accounting and Reporting System (NFCMARS) Government of Canada's greenhouse gas reporting system	Ground observations, aerial surveys and carbon budget models to estimate carbon in Canada's forests (soils and vegetation) Reports greenhouse fluxes in Canada's managed forests and utilizes field observations and carbon budget modelling tools Values are incorporated in the AFOLU report which the ECCC compiles and reports yearly to the IPCC
Provincial	Government of New Brunswick	New Brunswick's Climate Change Action Plan	Aims to improve the understanding and increase the carbon stocks of New Brunswick's forests and wetlands

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