BIODIVERSITY & WELLBEING TOOLKIT MANAGEMENT OPTIONS

'Preserving the Past,
Protecting the Present
& Enriching the Future'

linktr.ee/montserratbiodiversitytoolkit

OVERSEAS TERRITORIES CONSERVATION.UK
DARWIN PLUS
MALHE
UK Centre for Ecology & Hydrology
Meise Botanic Garden
the species recovery trust

Table of Contents

01. •••

Introductions

The Biodiversity Toolkit project provides information on how you can improve, maintain and monitor green spaces around your site or home for wildlife and to improve quality of life.

As part of the toolkit project, the team undertook consultations with the community on Montserrat. Using the responses as a guide, a series of management options have been developed to support the community in developing the island's sustainably while protecting unique wildlife and culture. There are other things that you could also include, but most of these options have been considered as they cover a range of low-cost, easy to implement options with known benefits to people and the planet.

The options are grouped into the following themes:

- **Caring For Wildlife:** Supporting native plants, pollinators and other animals on Montserrat
- **Caring For Our Island**: Supporting sustainable living on Montserrat
- **Caring For Our Community**: Supporting wellbeing on Montserrat

Some management options will have benefits across main overarching category types. All of the management options contribute towards the **United Nations Sustainable Development Goals (SDGs)**. The ways in which each management option contributes towards the SDGs is noted below as a way for you to understand the contribution you are making to these global targets and to Montserrat's sustainability.

02. Publications & Guides

Throughout the document, there are a series of publications and information notes that are referred to. These have been put together by the Montserrat National Trust with support from a wide number of local and international experts. Unless otherwise stated the information guides are available at: **linktr.ee/montserratbiodiversitytoolkit** .

03. Measuring Biodiversity

To find out if the management options implemented have been successful, measuring the outcomes for biodiversity is important. There are several ways we can do this. Across the world members of communities who may have little training in identifying wildlife can help collect data and this can be extremely valuable to those responsible for conserving wildlife (Mandeville et al., 2023). The Montserrat National Trust, and other partners, have been developing the use of tools to do this, otherwise known as 'citizen science'. **iNaturalist https://www.inaturalist.org** is one such tool. It is a network of naturalists, citizen scientists and biologists. Records of any wildlife can be submitted with an image and an identification to whatever level the observer feels comfortable (for example, you can simply record a bird or a bee, alternatively you could have seen a Montserrat Oriole). These records are then identified by the online community after which they can become part of global recording schemes. This allows anyone to learn more about the wildlife they see, but can also help others learn about the wildlife by helping identify records. As a minimum this method is recommended for monitoring the success of biodiversity management options in the toolkit, but it can be done in combination with other methods (see box 1; FIT Counts and eBMS).

There is a dedicated page to Montserrat on iNaturalist, it is called "**Biodiversity of Montserrat**". All records uploaded will help us to understand more about Montserrat's unique environment. A guide on how to add a record to iNaturalist is included in Annex 3.

This **QR code can be used to download the iNaturalist application** for your mobile device. If you do not have a mobile device, you can also login to the iNaturalist website and upload records from a camera.

Well-being for humans can mean state of mind or feelings and health. In the same way as biodiversity, and the ecosystems they inhabit, well-being can be linked to functioning well. The The World Health Organization (WHO) describes well-being as:

'A state of complete physical, mental and social well-being and not merely the absence of disease or infirmity'.

There is growing evidence from around the world that suggests the encouragement of positive human/biodiversity interactions and time in nature provides multiple benefits for human health and well-being and can lead to greater appreciation for biodiversity and nature conservation. See box 2: Two hours a week.

There are several methods for measuring human well-being which look at states of human emotions. Throughout the project ways to measure changes in well-being relating to time in nature and positive experiences are being explored, for example through the use of emojis (De Angeli et al., 2020).

Box 1: Invertebrate recording and monitoring methods

FIT Counts

The Flower-Insect Timed Count (FIT Count) utilises a simple and widely tested method for collecting data on the number and type of flower-visiting insects there are, and which plant species are most important for insects, in an area. Counts take 15 minutes and involve observing how many insects visit the flowers of a focal plant species in a 50x50cm area. Insects are recorded to broad taxonomic group levels (such as bees, wasps, hoverflies, other flies, butterflies and moths, beetles, small insects less than 3mm long, other insects) in a tally chart. Focal plant species are generally chosen to include species that are attractive to pollinating insects to maximise observations of insect visitations, but the counts themselves can be also used to determine how attractive different plant species are to insects. Possible focal plant species on Montserrat include: Tridax daisy *Tridax procumbens*, Sage *Croton flavens,* Wild pea/Butterfly pea *Centrosema virginianum,* Lantana *(Lantana camara*), Sleepy Head (*Mimosa pudica var. pudica*), Milkweed (*Asclepias curassavica),* Silk cotton *Ceiba pentandra,* Spanish Needle (*Bidens pilosa*), Black Manjack (*Cordia alliodora),* West Indian milk berry *(Chiococca alba*) and Liana (*Cissus verticillata subsp. verticillata*).

For more information on how to carry out a FIT count, how to record observations and guides to insect groups and flowers visit **linktr.ee/montserratbiodiversitytoolkit**

eBMS

The European Butterfly Monitoring Scheme (eBMS) app is primarily designed to make standardised counts of butterflies using fifteen minute timed counts. It can also be used to record along pre-determined trasnect routes that are already registered as part of the eBMS and to record moths at light traps. Timed counts take fifteen minutes and can be conducted anywhere at any time in the day when the weather is suitable for butterflies to be active. During the count the app uses GPS to track the route of the surveyor and calculate the area searched within the time of the count. The searched area can be a walking route or just a point of interest such as a garden. Along the route surveyors add observations of all the butterflies that they see. An identification guide will eventually be available to help with identifying the butterflies of Montserrat. In the meantime we advise using the iNaturalist Butterflies of Montserrat identification guide and where possible getting photos of the species that are seen.The count can be paused at any time to allow closer inspection of species without interrupting the timed count, after which the count can be continued. The advantage of this method is that it involves a standardised survey of butterflies and you can repeat surveys in the same locations using exactly the same methodology which allows you to monitor changes over time. The eBMS App can be downloaded to your smart phone.
For more information see **linktr.ee/montserratbiodiversitytoolkit**

Box 2: Two hours per week in nature

Studies have found that health can be improved from spending only two hours per week outdoors in nature. Early exposure to allergens (including pollen) in childhood can also build up immunity to allergies in future (see reference).

"When I was sitting at the beach I felt the waves and listened to the crashes of the waves the snapping of the crab pinchers and the singing of birds, I felt at ease and calm as the salty air blew against my face."

(Montserratian Secondary School pupil)

04. Caring for wildlife: Supporting native plants, pollinators and other animals on Montserrat

Sustainable Development Goals

1. Encouraging plants that support pollinators

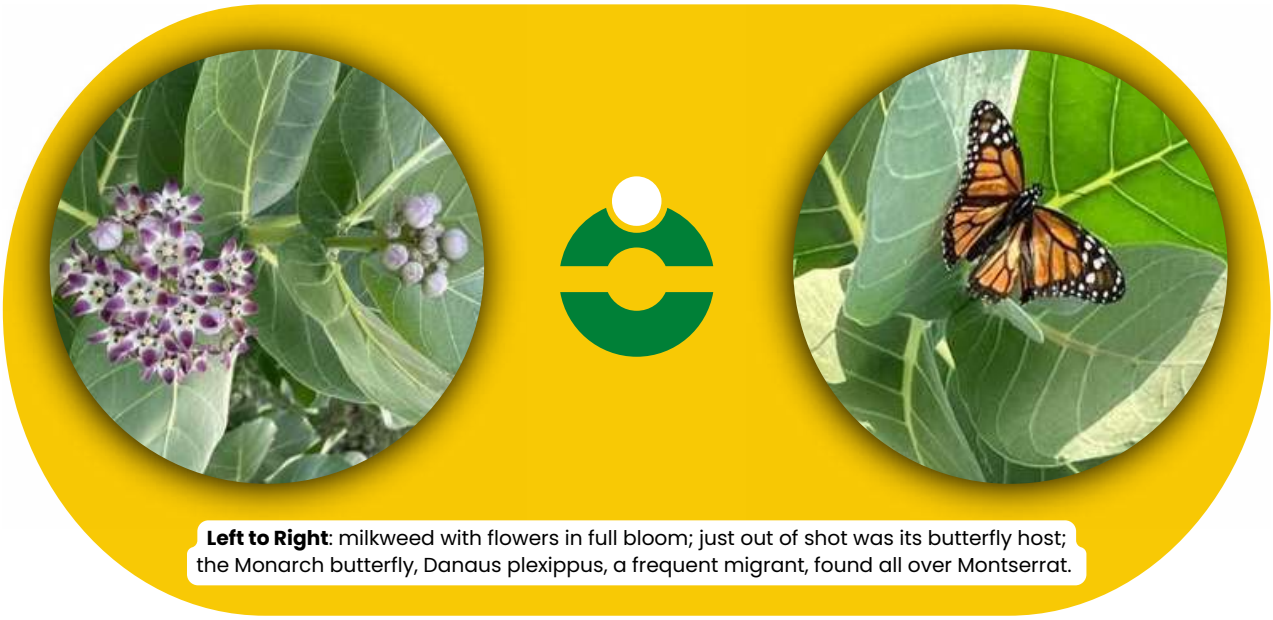
Plants that are native to Montserrat are perfectly adapted to current conditions, as a result native plants often require little maintenance or watering. Plants provide humans with many services (called ecosystem services) including slowing water to reduce erosion, shade, shelter, medicines etc. However, plants also have some basic needs and some plants need to be pollinated to reproduce. This can be done by a variety of animals including insects (bees, butterflies, moths etc), some pollinators are very specialised and have a unique relationship with the plant they pollinate, allowing only that specific animal to collect its pollen and nectar. Montserrat is home to both plants and pollinators that are only found on Montserrat and a few other nearby islands and nowhere else on earth (known as 'endemics'), for example the amazing Bottle Bee *Melipona variegatipes*.

If you are interested to know more about these or if you would like to help record species you can visit this free online portal: **www.inaturalist.org** and go to the project "**Biodiversity of Montserrat**". Some photo guides have been made for certain species on iNaturalist e.g **beetles**, **butterflies** and **spiders**.

Information on plants you can grow and the insect pollinators that they support are included in the following information sheets:

- Host Plant & Insect Pollinator Information sheet (butterflies and bees and moths) Found here: **linktr.ee/montserratbiodiversitytoolkit**

- Host Plant & Vertebrate Pollinators (hummingbirds and bats). Found here: **linktr.ee/montserratbiodiversitytoolkit**



Left to Right: milkweed with flowers in full bloom; just out of shot was its butterfly host; the Monarch butterfly, Danaus plexippus, a frequent migrant, found all over Montserrat.

Suitability	Any area where the planting of flowering plants is possible, suitable pollinator plants include shrubs, trees etc, see information sheets for suitable plants
Supplier information	Pollinator plants can be sourced from variety of places on Montserrat Mr Cassell in Manjack: Emerald Gardens, ornamentals, citrus trees and native plants (that are locally sourced); Ms Cassel (contact via MNT); Department of Environment, Department of Agriculture; Nadia sells exotic plants and orchids; Mrs Cassel; Flowers by Claudia, Os Wain.

Community engagement opportunity	Yes – the planting of the pollinator plants is a good community engagement opportunity. Also, community members can get involved in the counting and monitoring of the butterflies once the plants are established, to demonstrate the biodiversity benefits of the planting.
Benefits	Increasing nectar and food plant numbers will support population of pollinators such as butterflies, moths, bees, hummingbirds, bats
Costs/ Disbenefit	Financial cost: Low, but need to have source of appropriate foodplants
Biosecurity Issues	Please make sure you plant native species. Introducing plants from outside of Montserrat can risk bringing in pests and diseases. Please see here for more information from the Ministry of Agriculture, Lands, Housing and the Environment (MAHLE) Department of Environment and on Montserrat biosecurity **https://www.nonnativespecies.org/assets/Biosecurity-on-Montserrat_Impacts-risks-and-priorities-for-biosecurity.pdf**
Level of ongoing maintenance	Watering of plants to ensuring establishment and potentially manage
How Achieved	Please also consult the plant-area matrix (Annex 2) to see what native plants might work well for you, together with information sheets. Please source plants from local suppliers where possible. The Montserrat National Trust may be able to provide information on this: +1 664-491-3086.

Timing of activity	In theory, all year around, but please see individual plant suggestions for advice on planting time
Long-term management	Depending on the plants, regular pruning might be necessary. Please contact Montserrat National Trust to learn more about managing the plants in your garden
Monitoring success	Timed butterflies counts using eBMS protocols: **https://butterfly-monitoring.net/** Flower insect timed counts: **https://ukpoms.org.uk/fit-counts**

2. Create 'microhabitats' for invertebrates

Some animals, particularly invertebrates (bees, butterflies, beetles etc), require areas that have a series of unique conditions on a smaller scale to allow them to complete their life cycle. These are called 'microhabitats', for example some of the bees found on Montserrat require nutrients from different trees plus pollen and nectar for food, but they also require the hollow of a tree to make a hive and have their young. Additionally, some beetles that can be beneficial as they eat aphids, they need wood piles or dense leaves to provide them with shelter to lay their eggs and shelter from storms.

Information on how to create microhabitats on Montserrat can be found in the information sheet here:

- Microhabitats on Montserrat [**linktr.ee/montserratbiodiversitytoolkit**]

Left to Right: Left: Species of Oil bee, x observed at Old Road Bay; Right: Potter bee structures at the Montserrat National Museum; constructed from mud these solitary bees create structures to encase their larvae.

Suitability	Areas with space for additional wildlife homes, for example piles of logs and twigs, or areas with large stones, or wooden boxes filled with dried grass, twigs, bamboo canes/pithy plant stems/wood blocks with holes and other natural materials, would create shelter for beetles such as ladybirds, but also beetles that live in deadwood and convert it back to soil, as well as leafcutter bees important pollinators, and many other invertebrates.
Supplier information	Can easily be created using existing material and garden waste, to make more of a feature, a wood box for shelter material and wood pieces to be drilled with nesting holes could be sourced from… and bamboo from …
Community engagement opportunity	Yes a good community activity is collection natural materials and using them to make a 'bug home'
Benefits	These types of areas can provide shelter for a range of different invertebrates including beetles such as ladybirds (that also manage garden pests), as well as spiders etc. Also a very low cost activity.
Costs/Disbenefit	If twigs and logs were kept in an area that was very dry it could be a fire hazard and so recommended to keep in a damp area and this will particularly help beetles that used deadwood.
Biosecurity issues?	Make sure any wood sourced from outside of the site is from a reputable source
Level of ongoing maintenance	To replenish materials in wood piles and in bug boxes, as over time material will rot or be lost and will need replacing

How Achieved	An easy job and can be made part of the regular site maintenance works
Timing of activity	Ongoing as does not need to occur at a specific time of year
Long-term management	Aim to keep a number of bug homes ie log and twig pile and bug boxes present on each site
Monitoring success:	At a simple level the number and size of bug homes could be recorded. The Montserrat Bug count method, used in Homes for Wildlife Project, could be used to monitor the different taxon groups using the bug homes over time.

3. Help conserve endemic plant species such as the pribby

The Critically Endangered flowering shrub Rondeletia buxifolia, or as it is known locally the pribby, is only found on Montserrat. It is a member of the coffee family and grows in mountain zones. When it grows in full sunlight it is a sturdy, compact bush, but when grown in the shade it becomes long and spindly. It makes a great hedge because some feral animals e.g. goats, will not eat it. At the same time it will attract birds, bees and butterflies to its small pink-ish flowers.

The pribby has been successfully propagated in the native plant nursery at the Montserrat National Trust's botanic garden. More information is available from the Montserrat National Trust.

Pribby, Rondeletia buifolia, a shrub with pink/yellow flowers

Suitability	Grows across the island but it may look different depending on the conditions grown in. For example, where this grows in wet forest, the leaves can be much bigger and the plants grow taller than in drier areas.
Supplier information	Please contact Montserrat National Trust as this species is grown here for sale using best practice for biosecurity to ensure that pest species are not spread around the island.
Community engagement opportunity	Opportunities for community engagement, such as young people tree planting events.
Benefits	Implementing this option helps conserve Montserrat's unique species and when planted as a hedge it keeps feral goats away from crops and other vegetation. This species has pretty flowers for ornamental planting
Costs/ Disbenefit	Removal and management of existing species, growing plants (media for growing)
Biosecurity issues?	Ensure plants are sourced from pest free environment, such as the Montserrat National Trust
Level of ongoing maintenance	Depending on personal preference, hedge trimming might be necessary to maintain a neat hedge.
How Achieved	Purchase young plants from the Montserrat National Trust.

Timing of activity	All year round with good irrigation; wetter months recommended for establishment.
Long-term management	Once established, maintenance costs and effort are low.
Monitoring success	Number of plants planted and survival rate of plants Timed butterflies counts using eBMS protocols: **https://butterfly-monitoring.net/** Flower insect timed counts: **https://ukpoms.org.uk/fit-counts**

4. Leave patches (small areas) of land to "run wild"

There are many campaigns around the world to consider reduced mowing and or leaving small patches of wild areas in gardens and back-yards. The reason for this is to add diversity such as smaller flowers for example Tridax daisies can grow providing food and cover for pollinating insects.

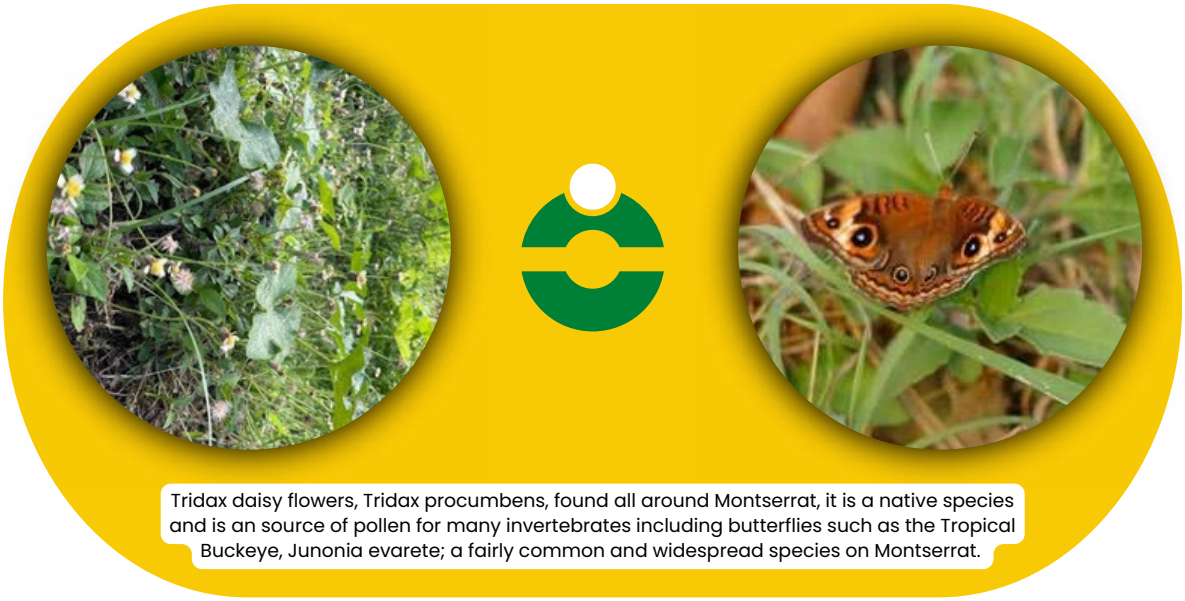
At certain times of the year vegetation grows very fast and there are some restrictions in place in certain areas on Montserrat.

Information on how to do this has been developed by the Trust and is available here:

- Management of lawns and grasses on Montserrat [**linktr.ee/montserratbiodiversitytoolkit**]

There are creative ways to enjoy these areas including mowing a path through lawns and areas to enable people to get closer to the flowering plants and look at what is growing.

Other benefits are that you may find saplings of native trees such as cedar or lignum vitae growing from areas of non-mowing which you can out-plant and share with neighbours and the community.



Tridax daisy flowers, Tridax procumbens, found all around Montserrat, it is a native species and is an source of pollen for many invertebrates including butterflies such as the Tropical Buckeye, Junonia evarete; a fairly common and widespread species on Montserrat.

Suitability	Suitable across the island.
Supplier information	N/A
Community engagement opportunity	Surveys could be undertaken of areas using citizen science toolkit such as iNaturalist.
Benefits	Increased biodiversity, reduced workload throughout the year. Potential for saplings of native trees grown from non-mowing which can be re-planted around the yard/garden.
Costs/ Disbenefit	Potential for pest species to thrive, e.g. fire ants, fast growing vegetation throughout the year may become unwieldy.

Biosecurity issues?	Potential for providing habitats for fire ants
Level of ongoing maintenance	Low but see disbenefits above.
How Achieved	Allow 4-5 inches before cut but this needs to be adaptive based on time of year and amount of rainfall. If there is heavy rain, it might need to be mowed once a week. Do not cut on the lowest level. Between June – September mowing can be reduced as the grass will not grow as high because it is dry. Reduced mowing gives a chance for flowers to grow and pollinators to visit. We recommend mowing a path through the lawn to enable people to get closer to the flowering plants and look at what is growing.
Timing of activity	Can be done throughout the year, however, wetter periods may lead to faster growth of vegetation and you may want to carefully manage these areas.
Long-term management	Reduced mowing cycle depending on conditions.
Monitoring success	Timed butterflies counts using eBMS protocols: **https://butterfly-monitoring.net/** Flower insect timed counts: **https://ukpoms.org.uk/fit-counts**

05. Caring for our Island: Supporting sustainable living on Montserrat

Sustainable Development Goals

5. Grow your own food and medicinal plants

Food produced on Montserrat has not traveled far (and so less emissions have been given off to produce it) and so is better for the planet already. Food produced at home can have other benefits such as: an enormous sense of satisfaction, appreciation for what goes into the process (which may mean less is wasted) and knowledge of what resources have gone into producing them (e.g. fertilizers). Montserrat has a Farmers Association which aims to support locally grown food. Typical foods that grow well on Montserrat include: citrus, avocado, plantain, pawpaw, passion fruit, cherryann, banana, vegetable garden sweet potato, eggplant, carrot, green leafy vegetables, pumpkin and a variety of tea bushes.

Companion planting is when you pair up plants that grow well together. Some food crops grow really well with others. The benefits of doing this include reducing pest species, increasing pollination, and increased nutrients in the soil. Examples of companion planting include marigolds, cucumbers and beans.

Some issues may include drought and pests. Irrigation and supplementary nutrients via a timed drip feeder can help food crops in the drier months. Whereas simple things like soapy water in a bottle can trap tricky pests you want to keep off your crops.

Planting smaller dwarf varieties of fruits such as dwarf bananas and crops low to the ground like pumpkins often escape the worst of the heavier storms.

Information on how a space can be transformed into a productive and vibrant space can be seen in the plan for a Montserrat garden. This is based on a real garden on Montserrat, which is productive all year round and full of wildlife.

- A Montserrat garden plan (see linktr.ee/montserratbiodiversitytoolkit)
- Montserrat companion planting (see linktr.ee/montserratbiodiversitytoolkit)

Suitability	Possible to be undertaken in communal areas and gardens, or in tubs and pots
Supplier information	Seeds are available on the island. Gardening equipment can be purchased from various stores around the island.
Community engagement opportunity	Yes, community gardens provide a great opportunity to bring people together. Contact farmers association if interested in supporting

Benefits	Increased sense of satisfaction growing own food, reduced costs of purchasing food
Costs/ Disbenefit	Regular weeding and pest clearance needed
Biosecurity issues?	Do not bring in soils or compost from outside of Montserrat. Please contact the Department of Agriculture for specific advice.
Level of ongoing maintenance	Medium. Regular weeding and harvesting is needed but this can be shared.
How Achieved	Need to prepare land / growing medium. Please see Annex XX to see what crops might grow best in your area. Please contact the Department of Agriculture if your area is not listed.
Timing of activity	Sowing and harvesting can be undertaken all year round. Please see info-sheet to learn more about this option.
Long-term management	Once established, production of fruit and vegetables will be regular.
Monitoring success	This can be tracked with monitoring the amount of money that is spent on food, the amount of produce grown, and satisfaction surveys to track the users enjoyment of the experience of time in nature.

6. Reuse house-hold items

There are lots of household items that can be reused in the garden or outdoor areas. This is a cost-effective way to source and re-use materials that would otherwise end up in the land-fill or the ocean. Examples include plastic bottles, glass, packaging, wooden sticks, old CDs or shiny materials such as foil etc.

Some uses of these items include: plastic bottles for catching pest species, ice-cream or yogurt pots and tubs for growing plants, plastic bags or foil to stop birds eating fruit on trees.

You could also re-use waste from the house such as dish-water for watering, old shredded paper as mulch for the soil and food scraps for compost.

Suitability	Everywhere on island
Supplier information	Items reused from around your house
Community engagement opportunity	Community engagement around reduce and reuse

Benefits	Reduces waste on the island and materials are free to use so save money on purchases.
Costs/ Disbenefit	Some people might not like how it looks
Biosecurity issues?	Make sure soil is not transported around the island
Level of ongoing maintenance	Low
How Achieved	Re-using household items that can be used in the garden. Old bottles used soapy water pest control, old yogurt pots for seedlings. Using shiny materials, such as foil and clear plastic bags to scare away birds.
Timing of activity	All year round
Long-term management	Plastic materials may crack and become damaged over time
Monitoring success	Reduced amount of items going to landfill

7. Build your resilience and be climate smart

Water on Montserrat comes from the natural springs. To reduce pressures on the supply of water to homes, a water butt can be installed. They can store water captured from rainfall which can then be used for watering plants. Rainwater is good for flowers, fruit and vegetables. On Montserrat, blue drums are often used as water butts. They can be connected to roofs with downpipes in order to capture rainfall and then store it for use later on.

The sun is a renewable source of energy and can help us reduce our greenhouse gas emissions and mitigate climate change. Montserrat is working towards harnessing geothermal energy, which will also reduce emissions. Installing solar panels and harnessing the sun's energy will help to maintain good air quality and reduce demands on our natural resources including water, which is also needed in energy production.

Suitability	Everywhere on island
Supplier information	Water butts can be purchased on Montserrat or from recycled materials blue barrels for rain water harvesting. 500 gallon containers are available for one household. The Department of Agriculture (DoA) can advise on irrigations, sprinklers and fittings needed. DoA supplies 1,000 gallon tanks for farmers and if not a farmer this could cost up to $EC2,000. Can get fittings from MS Osbornes, Nigel's; Emerald Plumbing. DoA advises farmers for free but can offer advice for private individuals as needed.
Community engagement opportunity	Appreciating water as an ecosystem service on International days like World Water Day

Benefits	Reduced cost of water usage for watering and reduces pressure on local island resources. Helps increase awareness of water conservation and thus increases resilience to climate change and makes people aware of how to live more sustainably.
Costs/ Disbenefit	Standing water can attract mosquito larvae. To control mosquito larvae, MAHLE has suggested using mosquito-eating fish in rainwater containers.
Biosecurity issues?	Mosquitoes and their associated diseases
Level of ongoing maintenance	Low but needs cleaning as and when required
How Achieved	Purchasing new or re-using materials (e.g blue drums/barrels) placed under downpipes coming from roofs of buildings.
Timing of activity	All year
Long-term management	Management of water butt for pest species and regular cleaning
Monitoring success	Reduced spending on water for irrigation

06. Caring for our Community: Supporting wellbeing on Montserrat

Sustainable Development Goals

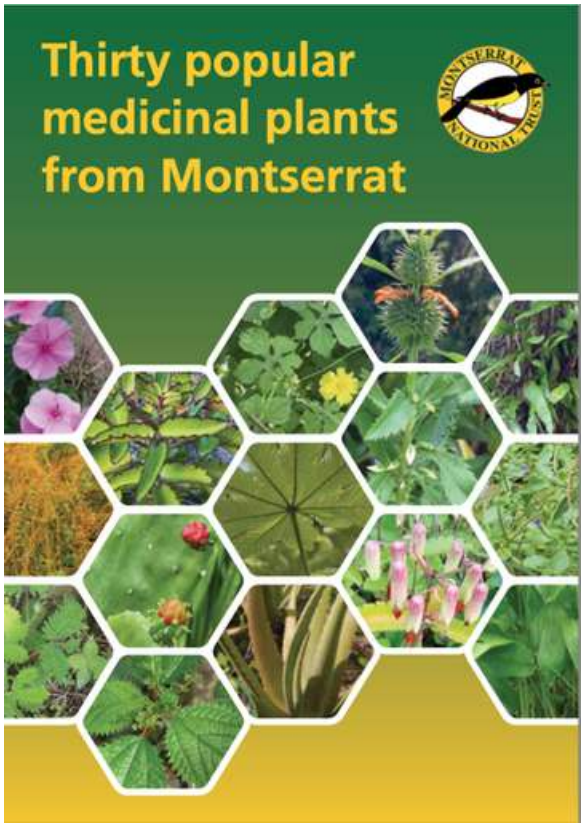
8. Grow a tea bush garden

Certain herbs or bush have played an important role in the healing and other cultural practices in Montserrat for generations. Reliable sources of information about this aspect of the island's cultural heritage are disappearing and so the Montserrat National Trust has been working on a series of booklets to preserve this knowledge. As part of this toolkit project, a second edition of a booklet outlining medicinal plants found on Montserrat was produced. It was informed by the local community and is available for purchase.

Growing your own tea bush garden from planting, pruning to picking could be rewarding in lots of ways including: encouraging you to spend more time outdoors, giving a boost to your immune system, and fresh air.

For more information on types of medicinal plants and their traditional uses:

- 30 Popular Medicinal Plants on Montserrat (see linktr.ee/montserratbiodiversitytoolkit)
- Garden Plan (see linktr.ee/montserratbiodiversitytoolkit)
- TRAMIL is also a great source of information https://www.tramil.net/en
- A medicinal plant collection from Montserrat, West Indies:
- Brussell, D.E. A medicinal plant collection from Montserrat, West Indies. Econ Bot58 (Suppl 1), S203–S220 (2004). https://doi.org/10.1663/0013-0001(2004)58[S203:AMPCFM]2.0.CO;2



3 Bay Leaf

Pimenta racemosa

Local Name: Cinnamon Bush

Found throughout the island, from dry forests to elfin forests on Katy Hill in the north of the island, the Bay Leaf tree grows to heights of over 60 feet and has a smooth light brown bark. It bears tiny white flowers which produce tiny purplish berries that have a peppery taste. The berries are edible and mainly consumed by birds and bats.

It is commonly seen in many of the native house yards in Montserrat as it is used frequently to make tea, used to alleviate period pains and stomach problems. It is said to have blood purifying capabilities.

It is traditionally used as a flavouring for porridges such as arrow root, oats, and in locally ground cocoa tea. It is also used in cooking meat as it is said to reduce the fat content and take away any raw smells when cooking meat such as goat and pork (and, traditionally, turtle).

During the 19th and 20th centuries, trees were planted intentionally to produce bay/myrica oil that was used in the Bay Rum industry on Montserrat. The leaves were crushed, and the oil extracted and mixed with rum. Bay Rum is used as an analgesic and for relief from arthritic pains. Men also use the oil as aftershave, and people use this as a room freshener or as a mosquito repellent.

It is said that the leaves are chewed to provide relief from toothache and to numb the gums before having a tooth extracted.

The interviewees also use the leaves in linen cupboards to keep away pests and to create a lovely smell.

6

Suitability	Montserrat has rich soils and with some care a tea bush garden could thrive. They could provide you with pleasant colours, tastes and smells all year round.
Supplier information	Many tea bushes can tolerate some pruning or cuttings being taken. It is recommended that you start small, try out some easy to care for tea bushes and seek advice from grandparents, parents and friends who may have surplus amounts you could try.
Community engagement opportunity	Many residents of Montserrat have knowledge of traditional plants which have medicinal uses. This knowledge has been passed down through generations and has been documented (see above). Conservations within the community and passing information on encourages strengthening of community ties and connection to nature. Tea bush is regularly consumed around Montserrat; Annual MNT Flower show includes categories including medicinal plants.

Benefits	Improved wellbeing after spending time in nature. Engagement with plants
Costs/ Disbenefit	Some species may be invasive or could inhibit growth of other plants. A way to counter this is to put them in containers.
Biosecurity issues?	Inspect your tea bushes regularly or pests or disease. If you see anything unusual you can always record it on iNaturalist.org (see above).
Level of ongoing maintenance	Low-medium
How Achieved	Some tea bushes grow rapidly and spread widely. It is strongly encouraged to grow these in pots and containers so that they do not encroach on other areas of the garden.
Timing of activity	All year
Long-term management	Some plants will require irrigation in dry periods.
Monitoring success	Wellbeing being improved through management option through monitoring of your mental and general health (**linktr.ee/montserratbiodiversitytoolkit**)

9. Plant to create shade and shelter space breeze and shade

The shade, shelter and breeze that plants and trees provide is linked to human well-being. By creating green space which incorporates trees which are native to the island there are also benefits to biodiversity as well. When palms and shade giving trees are interspaced with ferns and other plants that like to be under the shade with you, an oasis for wildlife can be created too.

Suitability	Carefully map out where you shade-giving trees will go. They will take longer than shrubs and ground layer species to grow and need the space and light to develop. Palms are ideally for the conditions on Montserrat as well as species such as lignum vitae and gumbo limbo.
Supplier information	Saplings are available for a variety of suppliers on the island. The Montserrat National Trust will be able to advise you (Tel: + (1) 664 491 3086)
Community engagement opportunity	Tree Planting days; tree sales, open garden days, village competitions, important tree register (e.g. silk cotton tree)
Benefits	Shade from sun and heat and wind
Costs/Disbenefit	New microclimate created when plant trees so it will impact what grows underneath
Biosecurity issues?	Consideration of species used

Level of ongoing maintenance	Initial planting and growth may be slow, but once established will require less care.
How Achieved	Think carefully about removing mature trees that already are established and provide shade. They can take some time to grow to maturity where they provide the most benefit.
Timing of activity	It may be possible to regenerate shade, but it will take some careful planning and patience. Saplings will need light and nutrients while they build up their root systems. Plants which do not crowd them out, but offer some cover and build nutrients into the soil can give them a helping hand.
Long-term management	Some native trees, given the right conditions can provide shade relatively rapidly. Some examples are included in Annex 2
Monitoring success	Enjoyment of experience outside and time in nature.

07. Annex 1

List of area names and the main habitat types of Montserrat where there are settlements. Habitat definitions (from the Centre Hills Report https://www.montana.edu/extension/mvmnh/documents/young%20et.%20al.pdf)

Dry Forest Types	Description
Littoral	Coastal vegetation influenced by wind and salt spray. *Typical taxa: Cordia sebestena, Argusia gnaphaloides, Ipomoea pes-caprae, Coccoloba uvifera, Ernodea littoralis, Strumpfia maritima, Suriana maritima.*
Dry Scrub	Shrubby vegetation 0.5-2.5m tall in lower elevations with low rainfall. Typical taxa: *Comocladia dodonaea, Agavaceae, Croton spp., Acacia spp., Malphigia linearis, Stigmaphyllon spp., Tetramicra canaliculata, Melochia spp., Jacquinia armillaris, Corchorus aestuans.*
Dry Scrub (Cacti Dominated)	Shrubby vegetation 0.5-2.5m tall in lower elevations with low rainfall that is dominated by cacti and succulent plants. Typical taxa: *Cactaceae, Oncidium urophyllum.*
Dry Thicket	Large shrub/small tree domintaed vegetation 2.5-5m tall in lower elevations with low rainfall. Typical taxa: *Cordia spp., Bourreria succulenta, Oplonia , microphylla, Cassine xylocarpa, Piscidia carthagenensis, Pithecellobium unguis-cati, Pisonia spp., Coccoloba spp., Verbenaceae.*
Dry Forest	Medium/Large tree dominated vegetation >5m tall in lower elevations with low rainfall. Typical taxa: *Capparis spp., Bursera simaruba, Tabebuia spp., Chiococca alba, Guaiacum officinale, Cedrela odorata.*
Dry/Mesic Transition	Medium/Large tree dominated vegetation >5m tall in low to mid elevations with low to medium rainfall. Typical taxa are a mix of *Dry and Mesic Forest species.*

07. Annex 1 - Continued

List of area names and the main habitat types of Montserrat where there are settlements.

Mesic Forest Types	Description
Mesic Forest	Medium/Large tree dominated vegetation >5m tall in mid elevations with medium rainfall. Typical taxa: Begonia obliqua, Araceae, Lauraceae, Inga laurina, Eugenia spp., Piper spp.
Mesic Forest (Disturbed)	Medium/Large tree dominated vegetation >5m tall in mid elevations with medium rainfall that has been disturbed through human activity. Typical taxa: *Mangifera indica, Thunbergia spp., Sida spp., Solanum spp., Stachytarpheta spp.*
Dry/Mesic Transition	Medium/Large tree dominated vegetation >5m tall in low elevations with low to medium rainfall. Typical taxa are a mix of *Dry and Mesic Forest species.*

Wet Forest Types	Description
Wet Forest	Medium/Large tree dominated vegetation >5m tall in high elevations with high rainfall. Typical taxa: *Elaeocarpaceae, Phyllanthus spp., Podocarpus coriaceus, Asplundia spp., Orchidaceae, Marcgravia umbellate, Arecaceae.*
Wet Forest (lower)	As Wet Forest description, tendency to be dominated by Large tree vegetation with greater abundance of the following taxa: *Sloanea spp., Phyllanthus mimosoides, Asplundia insignis.*

07. Annex 1 - Continued

List of area names and the main habitat types of Montserrat where there are settlements.

Wet Forest Types	Description
Wet Forest (upper)	As Wet Forest description, tendency to be dominated by Medium tree vegetation with greater abundance of the following taxa: *Marcgravia umbellata, Podocarpus coriaceus, Asplundia rigida, Orchidaceae.*
Elfin Woodland	Shrubby vegetation 0.5-2.5m tall in high elevations with high rainfall and greater abundance of the following taxa: *Wercklea tulipiflora.*

07. Annex 1 - Continued

List of area names and the main habitat types of Montserrat.

Area	Beach	Dry Forest	Dry Scrub	Dry Thicket	Elfin Forest	Mesic Forest
Baker Hill		■				
Banks		■				
Barzeys						■
Blakes		■				
Brades				■		
Carr's Bay				■		
Cavalla Hill		■				
Cheap End			■			
Cudjoe Head		■				
Davy Hill			■			
Dick Hill				■		

07. Annex 1 - Continued

List of area names and the main habitat types of Montserrat.

Area	Beach	Dry Forest	Dry Scrub	Dry Thicket	Elfin Forest	Mesic Forest
Drummonds				■		
Flemmings		■				
Fogarty		■				
Friths				■		
Garibaldi Hill				■		
Gerald's		■				
Hope		■				■
Jack Boy Hill						■
Judy Piece		■				
Katy Hill						■

07. Annex 1 - Continued

List of area names and the main habitat types of Montserrat.

Area	Beach	Dry Forest	Dry Scrub	Dry Thicket	Elfin Forest	Mesic Forest
Lawyers Mountain						■
Little Bay	■					
Lookout		■				
Manjack			■			
Mongo Hill		■				
New Winward Estate						■
Nixons		■				
Old Towne				■		
Olveston				■		

07. Annex 1 - Continued

List of area names and the main habitat types of Montserrat.

Area	Beach	Dry Forest	Dry Scrub	Dry Thicket	Elfin Forest	Mesic Forest
Peaceful Cottage		■				
Salem		■				
Shinlands			■			
St. John's		■				
St. Peter's		■				
Sweeney's				■		
Woodlands		■				■
Yellow Hill			■			

08. Annex 2

List of plants that grow in the main different habitat types.

Benefits: Native & good for pollinators

Name	Scientific Name	Growth form	Beach	Dry Forest	Dry Scrub	Dry Thicket	Mesic Forest	Wet Forest
Heliconia	Heliconia caribaea	Shrub						
Lantana	Lantana camara	Shrub						
Pribby	Rondeletia Buxifolia	Shrub						
12 o-clock broom	Sida Acuta	Shrub						
Sage	Wedelia Calycina	Shrub						
Gumbark	Bursera simaruba	Tree						
Red cedar	Cedrela odorata	Tree						
Silk Cotton	Ceiba pentrandra	Tree						

08. Annex 2 - Continued

List of plants that grow in the main different habitat types.

Benefits: Native & good for pollinators

Name	Scientific Name	Growth form	Beach	Dry Forest	Dry Scrub	Dry Thicket	Mesic Forest	Wet Forest
Yellow fiddlewood	Citharexylum spinosum							
Spanish Oak	*Inga laurina*	Tree						
Black Birch	*Myrcia splendens*	Tree						
West Indian jasmine	*Plumeria alba*	Tree						
Mahogany	*Swietenia mahagoni*							

08. Annex 2 - Continued

List of plants that grow in the main different habitat types.

Benefits: Weed & Bush - keep medicinals away from food in a separate area

Name	Scientific Name	Growth form	Beach	Dry Forest	Dry Scrub	Dry Thicket	Mesic Forest	Wet Forest
Aloe	Aloe vera							
Soursop	Annona muricato							
Davis Root	Chiococca alba	Shrub						
Ramgoat Bush	*Eryngium foetidum*	Herb/Shrub						
Rainfall bush	*Gliricidia sepium*	Tree						
Arrow root	*Maranta arundinacea*	Shrub						
Mosquito Basil	*Ocimum campechianum*	Herb						
Prickly Pear	*Opuntia cochenillifera*	Cactus						
Bay leaf	*Pimenta racemosa*	Shrub/ Tree						
Cattle Tongue	*Pluchea carolinensis*	Shrub						

08. Annex 2 - Continued

List of plants that grow in the main different habitat types.

Benefits: Food Production

Name	Scientific Name	Growth form	Beach	Dry Forest	Dry Scrub	Dry Thicket	Mesic Forest	Wet Forest
Aniseed								
Apples								
Aubergine								
Avocado								
Banana								
Breadfruit								
Bread nut								
Broad leaf thyme								
Cabbage								
Carrot								

08. Annex 2 - Continued

List of plants that grow in the main different habitat types.

Benefits: Food Production

Name	Scientific Name	Growth form	Beach	Dry Forest	Dry Scrub	Dry Thicket	Mesic Forest	Wet Forest
Cashew								
Cassava								
Cherry								
Cinamon basil								
Coconut								
Corn								
Dasheen								
Dill								
Dragon fruit								
Egg fruit								

08. Annex 2 - Continued

List of plants that grow in the main different habitat types.

Benefits: Food Production

Name	Scientific Name	Growth form	Beach	Dry Forest	Dry Scrub	Dry Thicket	Mesic Forest	Wet Forest
Fennel								
Fine Leaf Thyme								
Five-Finger								
Golden Apple								
Governor plum								
Grapefruit								
Grapes								
Guava								
Hog Plum								
Honey suckle								

08. Annex 2 - Continued

List of plants that grow in the main different habitat types.

Benefits: Food Production

Name	Scientific Name	Growth form	Beach	Dry Forest	Dry Scrub	Dry Thicket	Mesic Forest	Wet Forest
Jack fruit								
Japanese plum								
Lime								
Lemon grass								
Lemon Basil								
Lettuce								
Local soursop								
Lonquat								
Manciport								
Melon								

08. Annex 2 - Continued

List of plants that grow in the main different habitat types.

Benefits: Food Production

Name	Scientific Name	Growth form	Beach	Dry Forest	Dry Scrub	Dry Thicket	Mesic Forest	Wet Forest
Mint								
Onions								
Orange								
Passion Fruit								
Peaches								
Pears								
Pepper-mint								
Pigeon pea								
Pineapple								
Plantain								

08. Annex 2 - Continued

List of plants that grow in the main different habitat types.

Benefits: Food Production

Name	Scientific Name	Growth form	Beach	Dry Forest	Dry Scrub	Dry Thicket	Mesic Forest	Wet Forest
Pome-granate								
Pumpkin								
Rough Lemon								
Seagrape								
Season peppers								
Shaddock								
Spare mint								
Sorrel								
Squash								
Star fruit (normal/ purple)								

08. Annex 2 - Continued

List of plants that grow in the main different habitat types.

Benefits: Food Production

Name	Scientific Name	Growth form	Beach	Dry Forest	Dry Scrub	Dry Thicket	Mesic Forest	Wet Forest
Sugar apple								
Sugar cane								
Smooth lemon								
Surinam cherry								
Sweet potato								
Tangerine								
Thyme								
Tomato								
Water-melon								
West Indian Cherry								
Yam								

09. Annex 3: Using iNaturalist to upload a special record

1. Register for an iNaturalist account at www.inaturalist.org (better to register first on a laptop/PC)
2. Open the iNaturalist app on your smart phone
3. Touch the camera icon.
4. Take a photo (or select a photo from your photo library, or decide to just make a text observation).
5. Fill in whatever details you want to add about where you observed the species, any additional notes; to be added to the project "Biodiversity of Montserrat" you must select the location as Montserrat. You can be as accurate with the location as you want to be by using the map function.
6. Touch the Save button.
7. Touch Upload.

10. Annex 4: Medicinal Plants and Uses

Local Name	Latin Name	Medicinal Use Examples	Notes
Sensitive plant	*Mimosa pudica*	Tea is said to cure nervousness, high blood pressure, colds, and diabetes. It is used for relief from sore throats.	Children love playing with this plant to see the reaction of the leaves folding when touched.
Love vine	*Cassytha filiformis*	Said to be cleanser of the blood and when mashed with salt and lime juice relief from colds.	It is not recommended to plant this species out as it can become overgrown
Bay Leaf	*Pimenta racemosa*	Said to be an analgesic, relief from arthritic pains. It is said that the leaves are chewed to provide relief from toothache	A pollinator favourite; oil as aftershave, and people use this as a room freshener or as a mosquito repellent.
Inflammation Bush	*Peperomia pellucida*	Entire plant can be boiled to make a hot drink to alleviate symptoms of colds, coughs, and flu.	Can be overcrowding so ideal in pots.

10. Annex 4: Medicinal Plants and Uses - Continued

Local Name	Latin Name	Medicinal Use Examples	Notes
Arrowroot	*Maranta arundinacea*	Said to be very nutritious and is easily digested and eases indigestion.	Was grown commercially in Montserrat and starch processed and exported to the UK, the USA, and other regions of the Caribbean.
Mosquito Basil	*Ocimum campechianum*	The leaves, stems, and seeds are boiled to make tea to treat colds and flu.	Also combined with lemongrass to make bush rum
Soursop	*Annona muricata*	Said to alleviate bladder, gall bladder and kidney problems	Also made into drinks or ice cream
Tisane	*Capraria biflora*	Said to treat colds and digestive problems	Grows at lower elevations
Body Cutter	*Jatropha gossypiifolia*	Said to reduce incidences of high blood pressure, diabetes and belly ache	It is said that if the tree is cut around midday on Good Friday it produces a red sap.

10. Annex 4: Medicinal Plants and Uses - Continued

Local Name	Latin Name	Medicinal Use Examples	Notes
Guava	*Psidium guajava*	It is said that 3-5 leaves of this plant steeped in boiling water with some salt is said to cure diarrhea and vomiting.	It is recommended to keep this plant/tree under control as it can crowd out other species
Resurrection Fern	*Microgramma lycopodioides*	Said to relieve back pain and symptoms of cold and respiratory ailments	Creeping, epiphytic fern, found winding around large trees in moist areas of Montserrat
Lemon Grass	*Cymbopogon citratus*	Thought to relieve symptoms of cold and fever	Also an insect repellent
Broad Leaf Plantain	*Plantago major*	When boiled in tea said to treat respiratory infections	Found throughout Montserrat; grow in pots as can overcrowd.
Devil's Horsewhip	*Achyranthes aspera*	Said to treat colds, fever and colic	Seeds easily attached to clothes or the coats of animals.

10. Annex 4: Medicinal Plants and Uses - Continued

Local Name	Latin Name	Medicinal Use Examples	Notes
Bitter Ash	*Picrasma excelsa*	Thought to be used to control diabetes, hypertension, indigestion, and cooling of the blood.	Native to South America and the Caribbean it can grow to 10 ft tall.
Milk Thistle	*Silybum marianum*	Applied to skin rashes such as eczema and ringworm	Yellow flowers are attractive to pollinators
Aloe	*Aloe vera*	Said to reduce high blood pressure, as well as to treat diabetes and stomach issues	Had spiritual and decorative practices over the centuries
Trumpet Bush	*Cecropia schreberiana*	Thought to reduce their body temperature and treat wounds	Also used as a natural barometer
Periwinkle	*Catharanthus roseus*	Said to bring relief from cancer, high blood pressure, diabetes, asthma, and other bronchial problems, "stoppage of water" (urinary retention) and prostate issues.	Popular in house yards

10. Annex 4: Medicinal Plants and Uses - Continued

Local Name	Latin Name	Medicinal Use Examples	Notes
Blue Vervain	*Stachytarpheta jamaicensis*	Given to lactating mothers to increase milk production. This tea is also used to alleviate symptoms of menstrual cramps, kidney stones, jaundice, and gout.	Produces delicate flowers. Found all over Montserrat so not recommended to plant out.
Davis Root	*Chiococca alba*	Said to alleviate "stoppage of water" (urinary retention).	Traditionally mixed with rum and peanuts
Pung Coolie	*Momordica charantia*	Said to help treat high blood pressure, diabetes, and influenza.	It is not recommended to plant this species out as it can become overgrown. It is widespread across the island
Prickly Pear Cactus	*Opuntia cochenillifer*	Reduces inflammation and treats wounds.	Fruit rich in vitamins and produces a red dye that can be added to cakes and jams.

10. Annex 4: Medicinal Plants and Uses - Continued

Local Name	Latin Name	Medicinal Use Examples	Notes
Leaf of Life	*Kalanchoe pinnata*	Said to reduce infection and inflammation.	Can be found widely across Montserrat
Rainfall Bush	*Gliricidia sepium*	Said to relieve colds and coughs and to lower blood sugar levels.	Grows tall. Good for planting at borders of land
Ramgoat Bush	*Eryngium foetidum*	Said to help with stomach worms, indigestion, and vomiting.	Can be found widely across Montserrat
Stinging Nettle	*Laportea aestuans*	Said to reduce high blood pressure and diabetes	Considered a nuisance by gardeners and farmers; widespread across the island
Lord Lavington	*Leonotis nepetifolia*	Relieve colds and flu symptoms	Also known as Christmas Candle or Chandelier Bush for its striking appearance

10. Annex 4: Medicinal Plants and Uses - Continued

Local Name	Latin Name	Medicinal Use Examples	Notes
Gumbark Tree	*Bursera simaruba*	Relief from colds and influenza and menstrual pain	Native to Montserrat; its thick brown bark that contains a gummy paste.
Cattle Tongue	*Pluchea carolinensis*	Used for treating colds and flu and wounds	Found across Montserrat

11. Montserrat Garden Design

MONTSERRAT GARDEN DESIGN

This design is modelled on a real back-yard garden on Montserrat. It is possible to created everything you need to live a happy and healthy life.

* means good for pollinators

WOODY PLANTS

A variety of shrubs and small trees can create shade, foods and medicines and lessen storm damage

1. Lemon
2. Bayleaf*
3. Pomegranate*
4. Gumbark
5. Papaya
6. Rainfall bush
7. Dwarf banana
8. Banana
9. Barbados cherry
10. Sugar cane
11. Mulberry
12. Plantain

MEDICINAL PLANTS

Plant paracetemol bush in pots as this spreads. Allow thyme to flower for the bees

13. Paracetemol bush
14. Thyme*
15. Marjoram*
16. Broadleaf mint
17. Mint
18. Rosemary*
19. Basil

VEGETABLE PLOT

Mulch the soil below each plant and don't plant families together as they have the same pests

20. Tomato
21. Pepper
22. Lettuce
23. Tridax daisy*
24. Sweet potato
25. Melon
26. Squash

MOON AREA

Plants with night scent and perfume that open at night

27. Ylang ylang*
28. Avocado*
29. Dragon fruit*
30. Noni*

COMPANION PLANTS

This enables different plants to benefit from being planted with another e.g. maximising space, managing pests and improving success

31. Marigold*
32. Pumpkin
33. Spring onion

OPEN AREA

Leave space for seasonal growth, like sorrel for Christmas

34. Coriander
35. Sorrel
36. Ginger
37. Parsley

GARDEN CARE

The garden can thrive with some simple measures e.g. goats will be deterred by certain plants or a prickly hedge, such as sweet lime

38. Pribby hedge*
39. Compost heap
40. Mounds of soil
41. Water butt
42. Irrigation

Created for the DPLUS192 Biodiversity and Well-being Toolkit project (2024 v1); Design by MNT, UKOTCF & MAHLE; Illustrations by Lizzie Harper; Layout by Field Studies Council.

12. References

- Butler, C.W., Hamlin, I., Richardson, M., Lowe, M., Fox, R., 2024. Connection for conservation: The impact of counting butterflies on nature connectedness and wellbeing in citizen scientists. Biol. Conserv. 292, 110497. https://doi.org/10.1016/j.biocon.2024.110497

- De Angeli, D., Kelly, R.M., O'Neill, E., 2020. Beyond Happy-or-Not: Using Emoji to Capture Visitors' Emotional Experience. Curator Mus. J. 63, 167–191. https://doi.org/10.1111/cura.12352

- Kilpatrick, A.M., Salkeld, D.J., Titcomb, G., Hahn, M.B., 2017. Conservation of biodiversity as a strategy for improving human health and well-being. Philos. Trans. R. Soc. B Biol. Sci. 372, 20160131. https://doi.org/10.1098/rstb.2016.0131

- Mandeville, C.P., Nilsen, E.B., Herfindal, I., Finstad, A.G., 2023. Participatory monitoring drives biodiversity knowledge in global protected areas. Commun. Earth Environ. 4, 240. https://doi.org/10.1038/s43247-023-00906-2

- White, M.P., Alcock, I., Grellier, J., Wheeler, B.W., Hartig, T., Warber, S.L., Bone, A., Depledge, M.H., Fleming, L.E., 2019. Spending at least 120 minutes a week in nature is associated with good health and wellbeing. Sci. Rep. 9, 7730. https://doi.org/10.1038/s41598-019-44097-3

13. Acknowledgements

These management options were created as part of the Defra Darwin Plus project DPLUS192: Delivering biodiversity and human well-being gains for Montserrat's sustainable development and we thank Defra for this support. The authors would also like to thank the UK Centre for Ecology & Hydrology, Southern Housing Group for the adaptation of the Biodiversity Toolkit for Housing providers which was developed under grant NE/ S013989/1, funded by the UK Research and Innovation Natural Environment Research Council. The authors would also like to thank the Arts & Humanities Research Council and Natural Environment Research Council (under the UKRI) for funding the From blue iguanas to blue vervain project that supported the collation of the oral histories for the first medicinal plant booklet. Finally the authors acknowledge and thank all the contributors to this toolkit, we hope that this provides a useful resource to the people and biodiversity of Montserrat.

For more information on phytosanitary considerations and gardening pointers see: **linktr.ee/montserratbiodiversitytoolkit**

14. •••

Contact Information

+1-664-491-3086

www.montserratnationaltrust.ms

info@montserratnationaltrust.ms