BLACKMORES INSTITUTE
RESEARCH | EDUCATION | INNOVATION

SUSTAINABLE NUTRITION

The Impact of Climate Change on Nutritional and Natural Medicine

Coffee
Beer
Chocolate

CONSERVATION

Bitter Reality: Most Wild Coffee Species Risk Extinction Worldwide

Researchers surveyed the world's 124 coffee species and found more than half are threatened

ARTICLES
https://doi.org/10.1038/s41477-018-0263-1
nature plants

Decreases in global beer supply due to extreme drought and heat

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Africa cocoa industry failing on deforestation pledge – campaigners

Tens of thousands of hectares cleared in Ghana and Ivory Coast since vow to end practice

THE RISE OF PARTICIPATORY DEMOCRACY

THE VEGAN RISING

ELEVATING HUMANITY THROUGH BUSINESS

INVESTORS AND INSTITUTIONAL PRESSURE

Directors' climate liability exposure increasing 'exponentially'

Glencore moves to cap global coal output after investor pressure on climate change

QBE acts on climate change

Lloyd's warned over legal risks of underwriting a controversial coal mine project in Australia

APRA quizzes finance sector over climate change risk preparations

Why more insurance companies are taking an ethical stance against insuring coal

BP backs shareholder initiative on climate plan disclosure

The Global Context

2-3°C

Human activity is accelerating global warming at such a rate that global temperatures will increase by a further 0.5°C by 2030 and will be 3°C higher by 2100

Ocean warming, increasing acidification and UVB radiation and CO_2 levels are significantly altering ocean chemistry and marine life

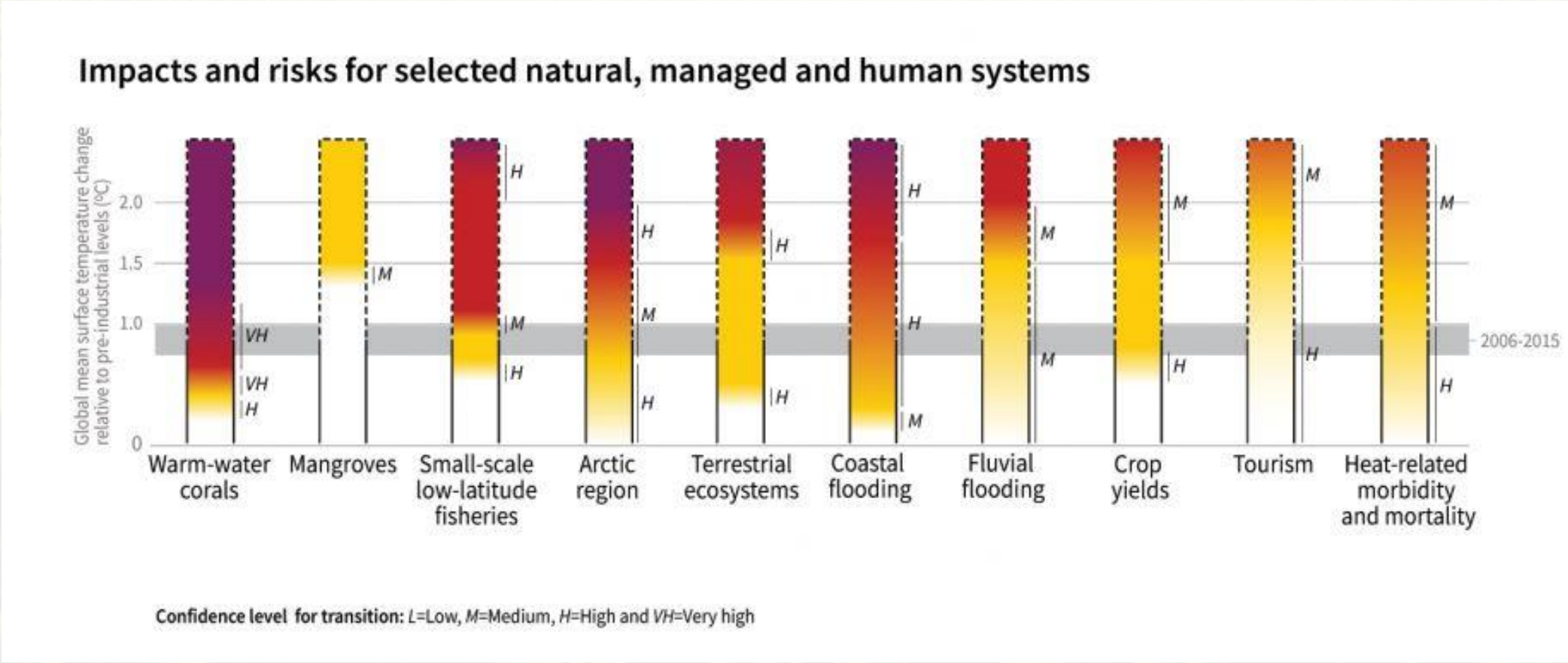
Any temperature rise affects the types of plants that grow and species that will survive and thrive and will disrupt the delicate balance of nature

These changes will compromise our food security, water supply, stability of coastlines and will put human health at risk

UN framework to address our greatest global challenges

Climate Change Effects

Predicted impacts and risks for selected systems



Why it Impacts on Medicine

25%

25% of medications currently prescribed in the developed world are derived from wild sources

80%

80% of people in developing countries totally depend on herbal medicine for their primary healthcare

Extinction rates among plants and animals are accelerating, especially among species with a narrow geographic range

Understanding the resilience of our natural ingredients empowers us to protect them for future generations

Sustainable Nutrition Literature Review

The recent release of the United Nations Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) report was a timely reminder for the complementary healthcare industry to acknowledge and understand the impact climate change will have on natural medicine.

- The literature review examines how climate change will influence:
  - **Human health and nutritional** needs
  - The need to build a **resilient, sustainable supply chain** protecting future access to nutrients from natural sources
  - The responsibility to **mitigate global warming** by managing our emissions

Climate Change Potential Impacts

1. Ecosystems & Diversity
2. Access to Nutrients
3. Medicinal Plants
4. Phytochemical properties of medicinal plants

Ecosystems and Diversity

Key Findings:

Impact of Climate Change on Ecosystems and Biodiversity

With a possible global temperature increase of 2-3°C

- **18% of insect**
- **16% of plant**
- **8% of vertebrate**

species may lose their geographical range, leading to species losses

Impact on Invertebrates:

The loss of insects will have major ramifications across both plant and animal life

- **decomposition**
- **nutrient cycling in soil**
- **pollination**
- **food source**

Key Findings:

Impact of Climate Change on Ecosystems and Biodiversity

Impact on Plants:

- Plant species steadily shifting northwards and to higher altitudes
- Changes occurring in plant phenology
- Desertification in Sub-Saharan Africa, Southern Africa and North America a threat to endemic plants
- Increased the risk of extreme weather events, invasive plant species, pests, diseases, flooding
- Warming of the Alpine regions a threat to endemic and medicinal plant species

Key Findings:

Impact of Climate Change on Ecosystems and Biodiversity

Impact on Animals:

- Impacts on fauna in rain forests and polar regions already observed
- Species are moving to higher latitudes
- Changes occurring in fauna phenology
- Endemic species most at risk

Impact on Marine Biodiversity:

- Mobile species predicted to migrate to higher latitudes
- Dramatic loss to both phytoplankton and single-celled algae
    - Toxic effects of UVB radiation and rising CO_2 levels
    - Impacts the entire marine food chain
- Non- or less-mobile ecosystems will not survive (kelp forests, coral reefs)

Access to nutrients

Key Findings:

Impact of Climate Change on Access to Nutrients

Reduced biodiversity results in reduced food variety

- Deforestation and grassland clearing
- Monoculture
- 200 plant and 5 animal species make up global food supply

Soil quality and micronutrient levels are dropping

- Top soil loss
- Monoculture
- Fertiliser, herbicide and pesticide use

Increasing soil nutrients can have unwanted effects

- Fertiliser use impacts on climate change
- An increase CO_2 and temperature increases plant yield but decreases nutrient content

Key Findings:

Impact of Climate Change on Marine Sources of Nutrients

Impact on PUFAs and Human Nutrition

- Difference in blood levels of omega-3 PUFAs in individuals globally
- Australia: consumption of omega-3 PUFAs is below recommended intakes
- NHMRC recommendation: consume 2 to 3 serves of fish per week or a fish oil supplement
- Marine phytoplankton and single-cell algae are the main producers of omega-3 PUFAs in the marine food chain

Problem

- Increased UVB radiation → reduced cellular metabolism → reduced PUFA synthesis
- Increased CO_2 → decreased omega-3 PUFAs → increases omega-6 and 9
- Other marine sources of omega-3 PUFAs also at risk → questionable sustainability

Proposed Solution:

Impact of Climate Change on Marine Sources of Nutrients

PUFAs – Sensible and Sustainable Sourcing

- Cultivated microalgae
  - Rapid turnover, reduced capacity for heavy metal and toxin accumulation
  - Residual algal lipids potentially used as biofuels
  - Remaining algal biomass used as livestock feed

- Plant sources of omega-3 PUFAs
  - Optional but not a preferred source

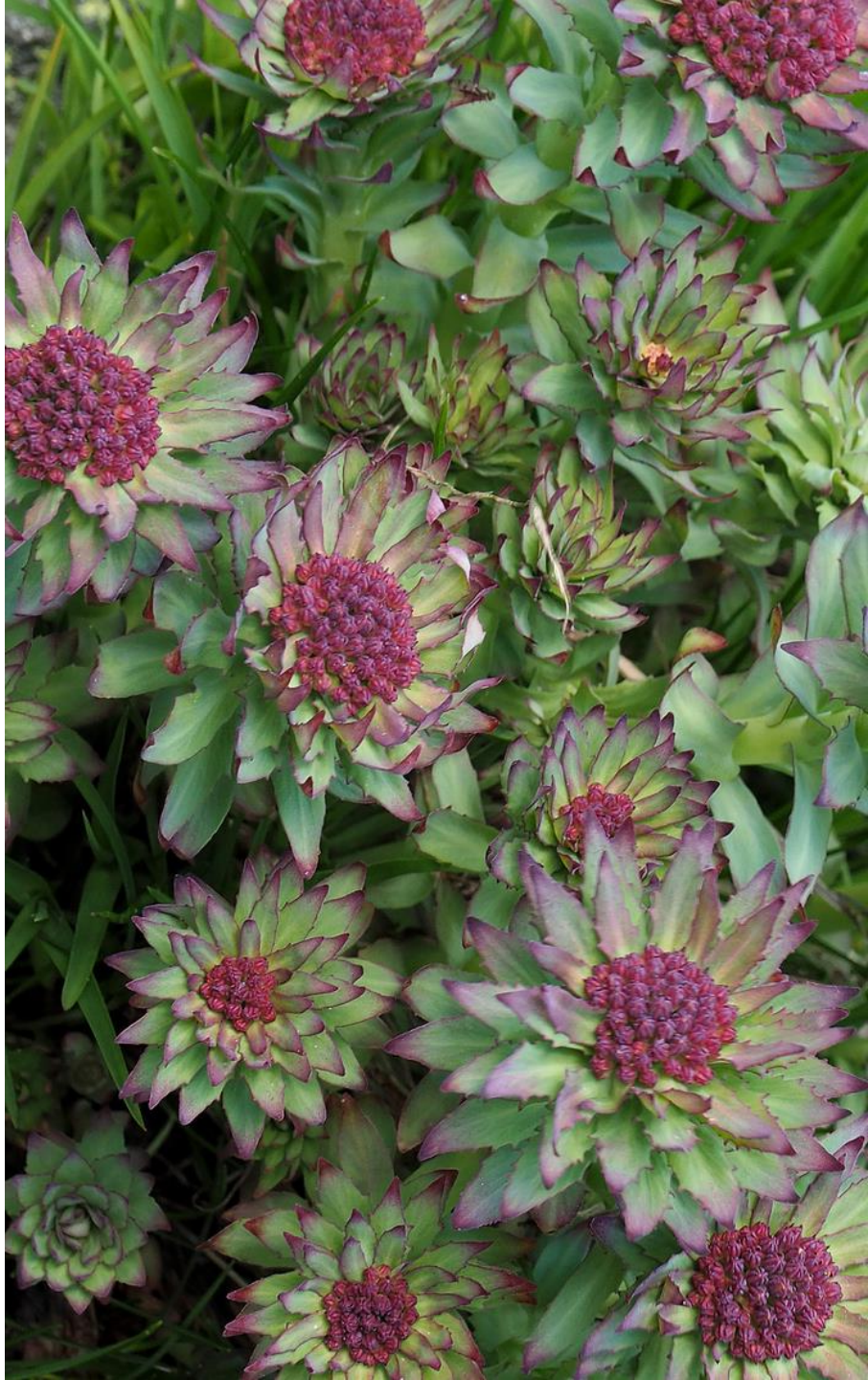
Medicinal Plants

Key Findings:

Impact of Climate Change on Medicinal Plants

Current Status of Medicinal Plants

- 25% of medications currently prescribed are derived from wild sources
- ~ 80% of people in developing countries totally depend on herbal medicine for their primary healthcare
- 50,000 – 80,000 plants are used as therapeutic agents worldwide - 15,000 species are faced with extinction
- Plant species loss is 100 to 1,000 x higher than the expected natural extinction rate
- Rare and endemic species, specialised reproduction – at highest risk
- Arctic and alpine medicinal plants at highest risk, island and rainforest plants more resilient to changes



Key Findings:

Impact of Climate Change on Medicinal Plants

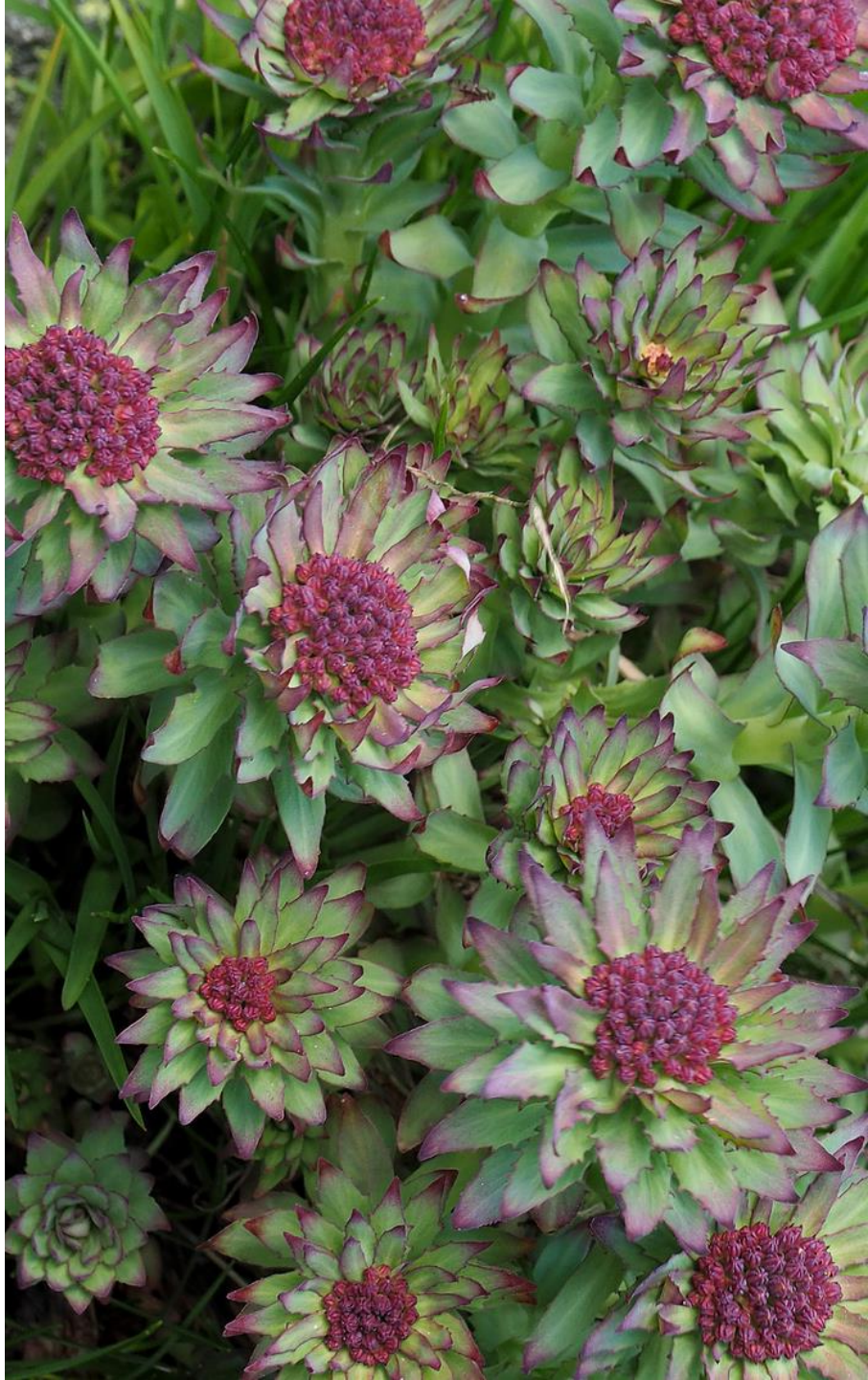
Major changes to endemic plants are being observed in Arctic and Alpine regions

- Have adapted to habitat, little competition
- Warming increases risk of new plant species, flooding, loss of favourable terrain

Examples:

- *Rhodiola rosea* grows along arctic shoreline of Asia, Europe and North America
- At risk of extinction through species invasion and flooding
- Conservation programs in place

- Cold-adapted alpine medicinal plants moving to higher altitudes e.g. *Saussurea laniceps* (snow lotus)
- At risk of extinction through loss of terrain
- Conservation attempts unsuccessful

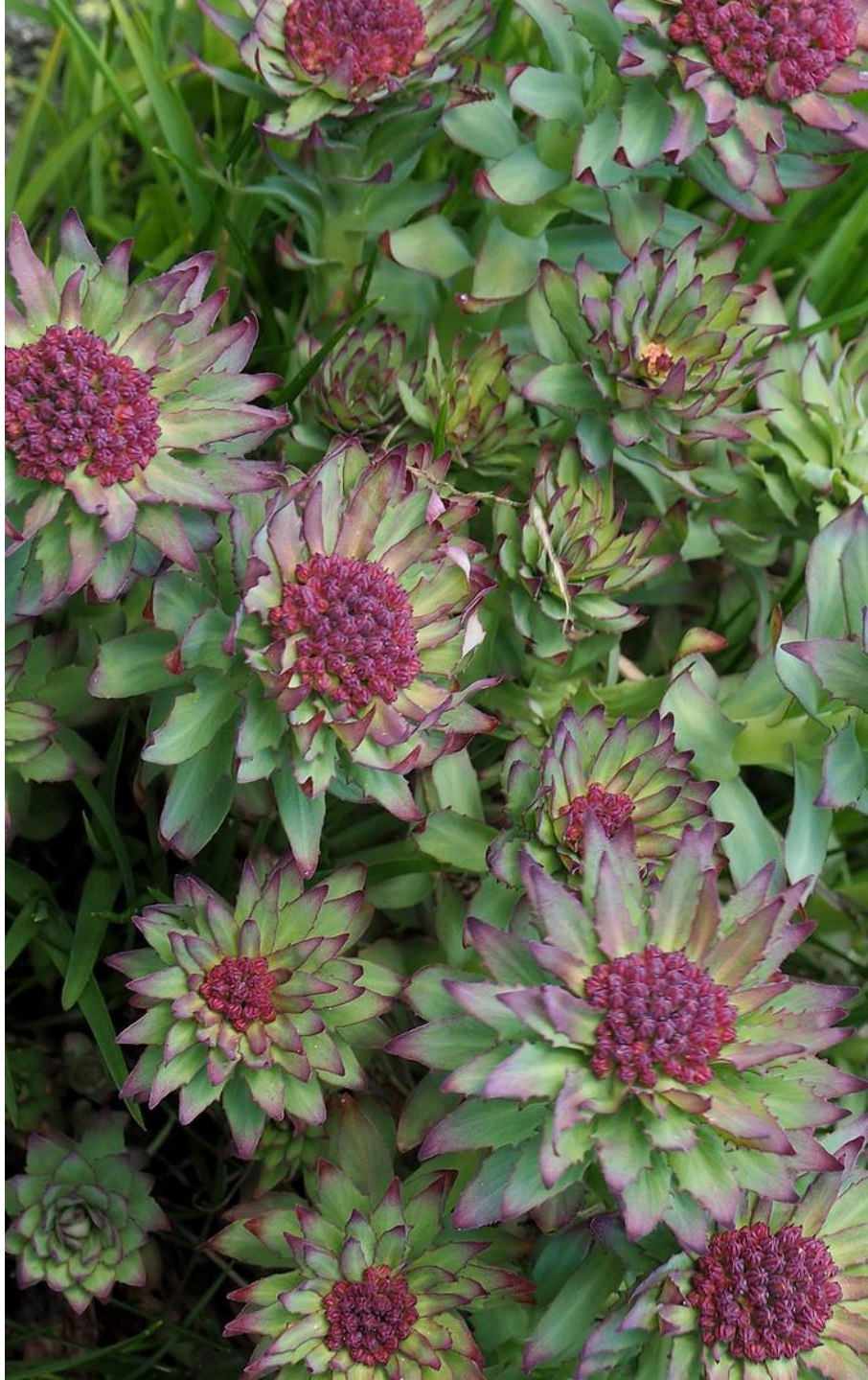


Proposed Solution:

Conservation and Sustainable Use of Medicinal Plants

Strategies for Conservation and Sustainable Harvesting

- In situ conservation (natural reserves, wild nurseries)
- Ex situ conservation (botanical gardens, seed banks)
- Good agricultural practises (GAP)
- Regenerative agriculture
- Good harvesting practises
    - Protection of slower growing plants
    - aerial parts vs roots, avoid whole plant harvesting

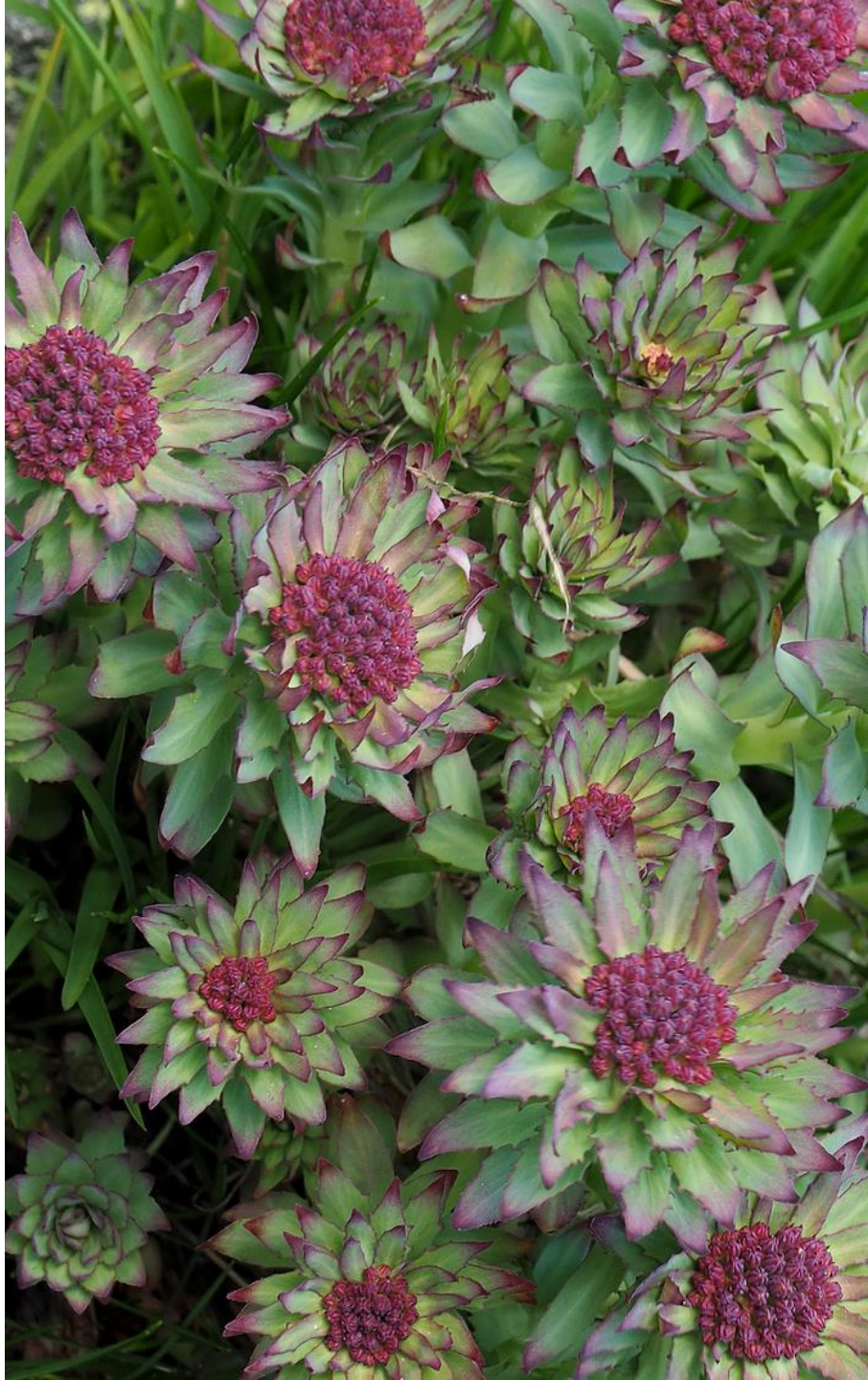


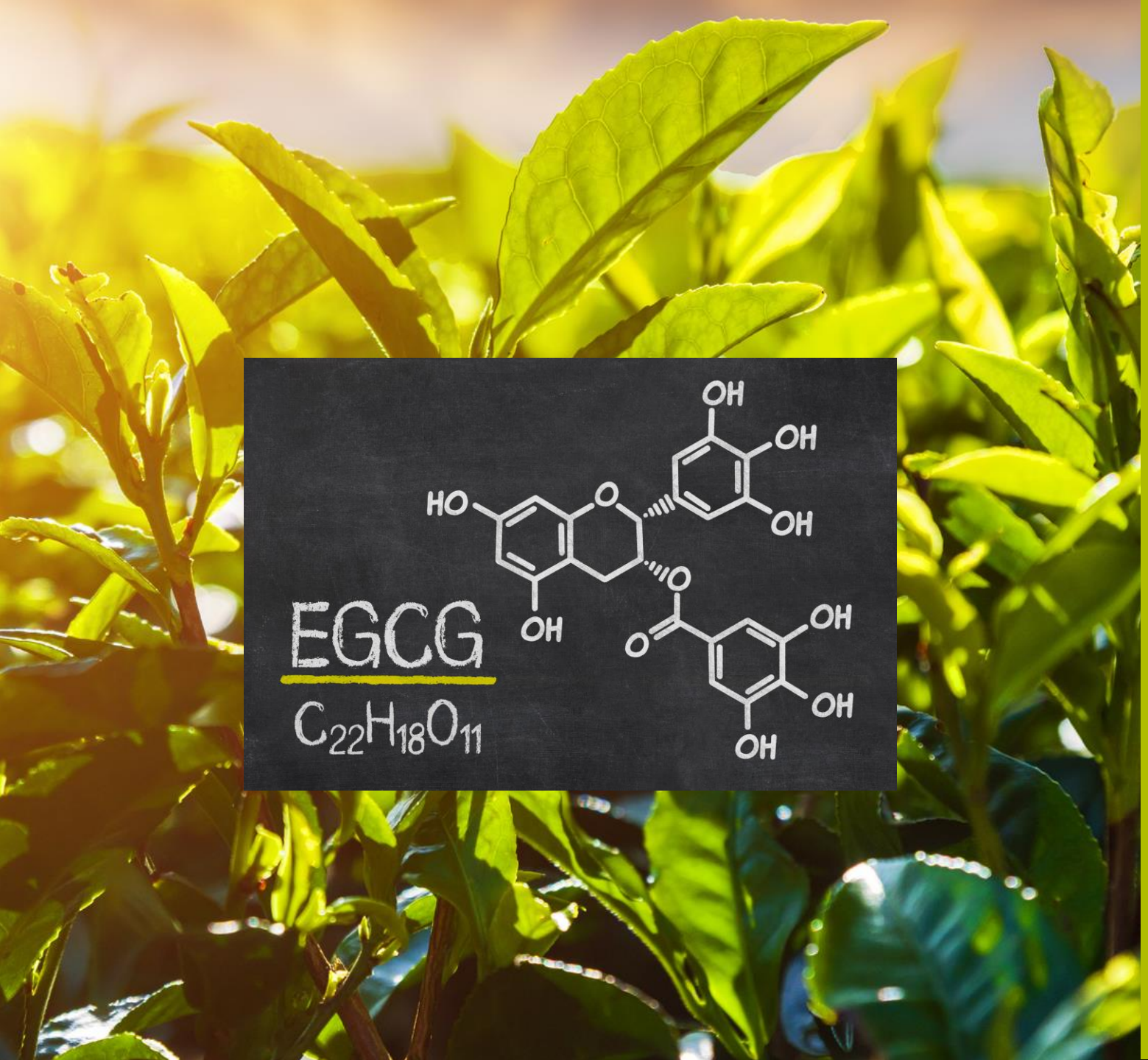
Proposed Solution:

Conservation and Sustainable Use of Medicinal Plants

Safe and sustainable sources of medicinal plants

- Fair Wild Standard and International Standard for the Sustainable Wild Collection of Medicinal and Aromatic Plants (ISSC-MAP) under CITES: The Fair Wild Standard was set up by the Fair Wild Foundation (Switzerland, 2008)
- Sustainable Herbs Program
- Botanic Gardens Conservation International (BCGI) Initiative (U.K. 1987)





Phytochemical Properties

of Medicinal Plants

Key Findings:

Impact on Phytochemical Properties of Medicinal Plants

‘Species survival of medicinal plants as a result of the impacts of climate change is only part of the story, we need to understand the effects on the phytochemical compounds that make them efficacious.’

The effects of elevated CO_2 on plant quality and secondary metabolites

Controlled environment studies – have shown beneficial effects of elevated CO_2 on productivity and quality of various products and constituents of medicinal plants

Key Findings:

Impact on Phytochemical Properties of Medicinal Plants

The effects of temperature on plant secondary metabolites

- The effects of temperature increase on secondary metabolite production in plants are not yet fully understood
- An increase in temperature might enhance all secondary metabolite production in all plant species → stress response
- Phytochemical changes will also impact on a plant's response to its environment
- Unknown whether or not secondary metabolite production will return to normal through adaptation
- Most likely impact on secondary metabolite potency and activity

Blackmores Group Sustainability Vision 2030

Healthy People, Healthy Planet:

Maurice Blackmore understood that you can't have healthy people without a healthy planet.

He long advocated the imperative to:

- Improve lives through better health and wellbeing
- Nurture the earth & use Nature's resources with respect
- Treat employees like family & owners of the business
- Give back to the community
- Partner with others to make a difference

The responsibility to act, and the capacity to influence

MITIGATION

Our actions to slow the acceleration of global warming including a reduction of emissions and lessening our impact of operations

ADAPTION

Building resilience into our business model and supply chain to adapt to the changing physical world and changing markets as a result of climate change and protection

OUR SUSTAINABILITY GOALS

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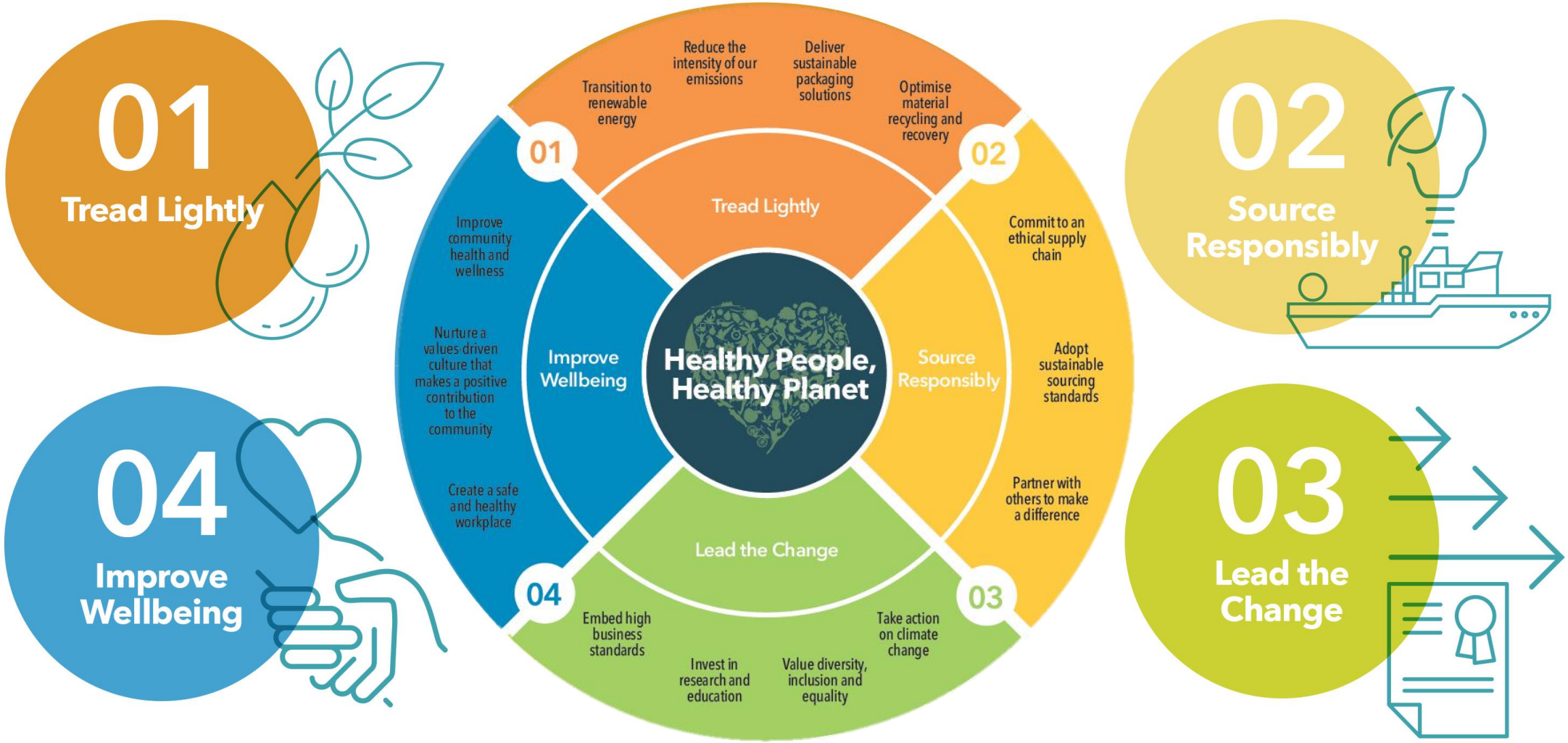

Industry action

Blackmores

- Adopted a clean energy strategy
- Agile working will support emissions reduction
- Focus on marine conservation and fishing initiatives
- Sustainable and ethical sourcing
- Partnering with farming organisations
- Divert more than 70% waste from landfill

BioCeuticals

- Herbal sourcing – only wild-crafted herbs in accordance with CITES, TRAFFIC, United Plant Savers, and the IUCN Red List of Threatened Species.

Emissions Reductions Targets

- Industry is becoming more responsible for their emissions
- Considering new strategies for carbon-offsetting
- Carbon reduction reporting

Blackmores sourcing team observing sustainable fishing practices

A farmer at BioCeuticals herbal production in Oregon